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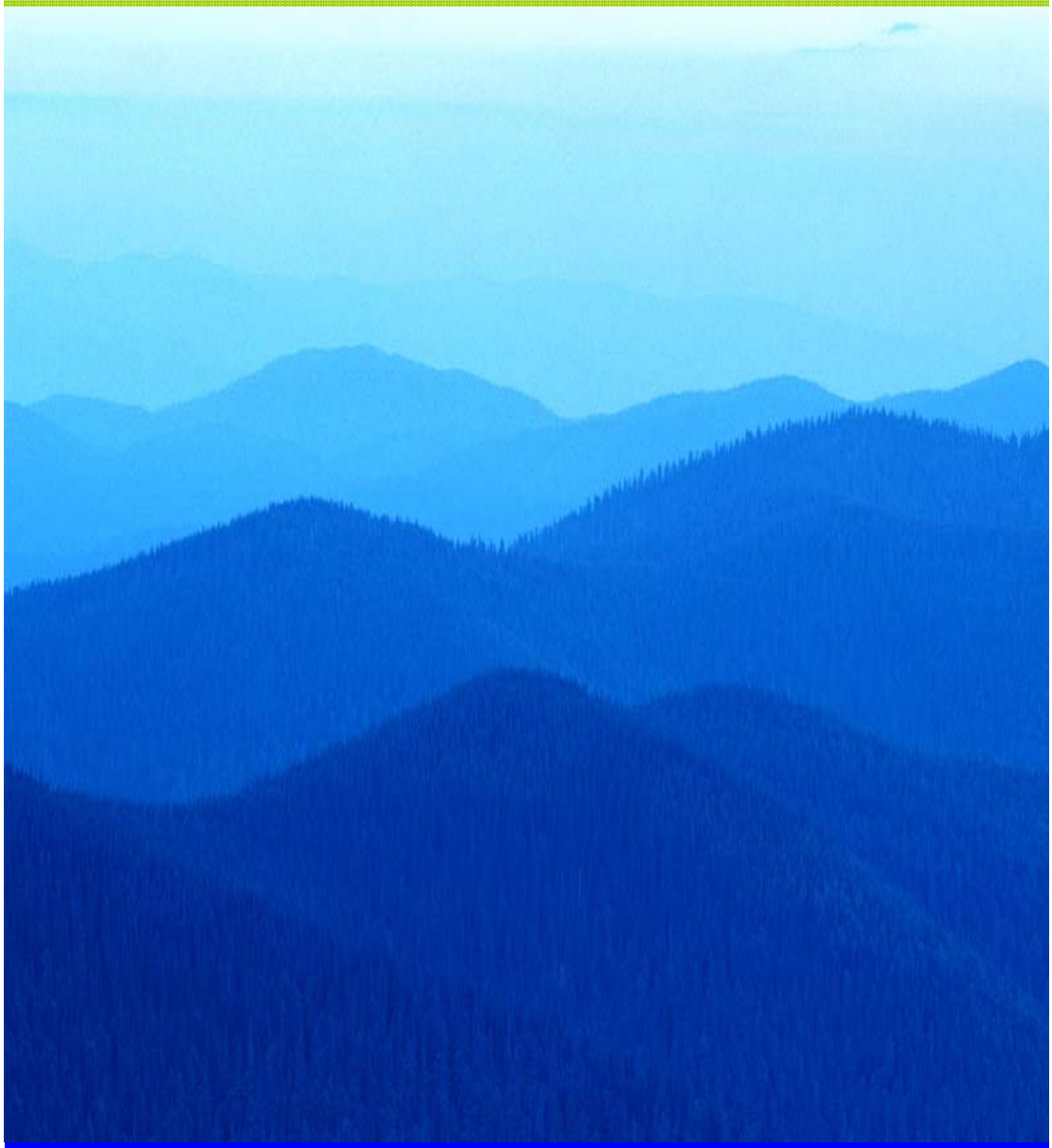

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The Journal of American Science

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CONTENTS

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Borges, the Quantum Theory and Parallel Universes

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Abstract: The "Whole" proto-theory and the "Tuner" metaphor, using the least phrasing and technical formulation as possible in order to draw the almost shocking relativist and quantum concepts near an educated population, yet, without a particular physical- mathematical background. The "Whole" is the basic permanent, omni-potential and may be one-dimensional continuous nature, where there is no proper time arrow. [The Journal of American Science. 2006;2(1):1-30].

Keywords: Borges; mathematics; physics; quantum theory; universe

Introduction

It took me almost four years to complete this essay, triggered after re-reading Borges´s story "El jardín de los senderos que bifurcan", (The Garden of the Bifurcating Paths), at the end of my career as an engineer.

This has not been Borges´s fault, but rather my intention of shaping, in an orderly way, a series of thoughts and existential considerations that have been building up in the mind of someone, as it is my case, who has been permanently dealing, as a professional, with so different subjects that range from chemistry to physics and mathematics, passing through human behavioral sciences, compelled, perhaps, by the ultimate goal of a chemistry engineer who has become an accidents-prevention and environmental sanitation specialist.

Through years of research, teaching and practical application of this knowledge, there appeared ideas and concepts that seem to contradict common sense or our purest ideas, especially on cosmology.

As things continuously change and due to the rhythm information moves through the web, this objective seems a never-ending story, and it becomes worse when trying to keep it up.

As you will see throughout this essay, this material does not have the purpose of a literary analysis of the fantasies of our great author; much has been written about it and undoubtedly much more will be written. I only try to give my opinion about the cosmological character of this story, which can be found as part of "Fictions", and expose also a metaphor which can be helpful for the better dissemination and understanding of theories such as the quantum or relativity ones, so new and hardly fought by common sense.

I do not qualify reasoning as "metaphysical" or "philosophical" although these words would perfectly fit in this context, agreeing with the feeling of discomfort the use of these meritorious and solemn terms sometimes provoke, according to Borges, when his objective was intellectual and aesthetic in his case, while mine is only of intellectual dissemination.

I do not agree with those who think that Borges´s ideas among others, about convergent, divergent and parallel times that *"cover every possibility and even then they are only a partial, incomplete, though not fake vision of the universe"* (Borges, 1941) are only the product of fortuity or a hypothetical accident (Alberto G. Rojo (www.lehman.cuny.edu/ciberletras/v1n1/crit_06.htm). I do think that he refers to the story, as he did in some other ones, in an unequivocal, cunning way when he says it is a detective story.

Borges knew what he was writing about, in the 4th decade of the 20th century, when he mentioned that Albert (Einstein?!) very busy with his infinite times and paths that would end with the (nuclear?) bombing attack to an homonymic English city in those years, portent of nazi intentions in a Germany, that was already widespread and notorious as the press reported, was already at the gateway of mastering the atom.

Of course I do not refer to a scientist´s physical-mathematical knowledge, but rather to the understanding of an informed and enlightened poet who read about Einstein´s relativity, Heissemberg´s uncertainty principle, Schröedinger´s experiences and other relevant thinkers whose ideas illuminated the 20th century daybreak.

Only a genius´s mind could glimpse the infinite realities that the quantum theory proposes, in the depths of a matter that becomes weird and elusive as we try to penetrate the boundaries of what is very small or unbelievably big…, the anguish of our ignorance coupled with the infiniteness of extremes.

After his long European experience and having read, in his mother tongue, among other books, most of the fantastic literature giants (he liked that name for what technicians today consider, almost mistakenly, "science fiction") - such us: H. P. Lovercraft, Olaff Stapleton, H. G. Well, among many others, not to mention the unending list that probably starts with the

ancient Greek classics and develops continually up to his contemporaries, both western and eastern - the polyglot Borges formed and set motion in 1941 to the germ of the *meme*, that would give birth, in turn, to the *parallel universes* and would catch today many important investigators´ attention.

More than a decade had to pass by before science would be interested in dealing with these ideas and give them a physical mathematical support, with Hugs Everett´s doctorate thesis (known as Many World Interpretation o M.W.I. by its acronym in English) in 1957, who eventually gave up scientific research and even his life, disappointed as he was because of the scant interest he arose and his collegues´ skepticism.

Now, it is really exciting and amazing to see that scientists like Stephen Hawking, Martin Rees, David Deutsch, Francis Crick and hundreds of others who, in spite of the scandal that these quantum conceptions produce, are sharing some of these opinions and working on the development of new concepts, which thousands of technologists are striving to concrete in new "realities" that amaze us day after day.

At their time it was Bruno, Spinoza, Galileo and other thinkers the ones who challenged the established Dogma with their revolutionary ideas about round worlds drifting in space that was not the axle of any celestial privilege and paid with their freedom, health and even life for the right to expose them to the big public. But others followed them until they convinced us that we are barely part of a minor planetary system that spins – maybe inconsequentially - in an obscure branch of an ordinary galaxy.

Many tyrants obstinately, systematically and recurrently insisted on keeping these hateful thoughts in silence, as they humiliated and denigrated ancient sacred ideas; but all bloodshed in the cause was useless as futile it is to try to cover the sun with a hand. This is how things are, and this is how our beliefs and knowledge develop, sometimes happily, sometime regretfully.

And what about computers´ calculation speed? Such devices did not exist at the time we were in high school, when we dirtied our fingers with stencil copies that today are easily obtained through photocopies. And, where is the proud expression that stated that a machine could never possibly defeat a champion at chess?

Scarcely more than one hundred years ago, humanity barely launched into the sky on fragile grotesque systems, while today we negotiate international agreements in the new frontier proposed by the space station.

We could go on mentioning an endless list of new realities that became concrete thanks to technology; "realities" that seemed mere fantasies or aberrant ideas about the nature of things. Holograms, fractals, tunnel-effect microscopes, scanners, magnetic resonance, nanotechnology, etc, etc are only some of the new concepts and devices –"realities" at last today- which are at hand everyday to improve our life quality.

In this essay it is not my intention to spend time on the description of this list that shows human intelligence evolution. Instead, conducted by the fabulous writer and also lying on the shoulders of the geniuses that inspired him, I do intend to expose to the reader´s consideration a simple argument about the quantum mechanism that nature employs to shape what we define as "reality" in order to reach, with the help of two metaphors (or more precisely, a pro-theory and an easily-understood metaphor): the "W*hole*" and the "*Tune*r", a new version of the subject-object relationship, that would let us understand better the world around us, to set up the possibility of "multiple realities" and overcome old antinomies, of the Materialism Vs Idealism and Dualism vs. Monism kind, which have confronted rational thinking for a longer time than we would have desired.

Words like quantum mechanics, decoherence, antimatter, emerging properties, teletransportation, etc., etc., intimidate us unjustifiably by their complexity, for the lack of a clear and simple explanation that would allow a conceptual approach to them and, although some of these revolutionary ideas are nearly centennial, most of the population does not grab their incredible entailments, neither are there attempts to make these concepts easier and understandable

May be two, among many, of the most incredible conclusions at which the quantum theory arrives are: on the first place, the revolutionary idea that the outer world "reality" - the environment that surround us – that we feel, watch or measure in everyday life, does not depend exclusively on itself; it is always and lastly related, directly or indirectly, to interactions with our brain—the tuner—and, on the second place, these interactions can give way to multiple experiences or versions of that everyday "reality", thus making what is known as the multiple worlds interpretation theory (MWI).

From this new focus or point of view posed by the Quantum Theory, the old and venerable human pretension to know the "essence" or the "being" of things or the thing in "itself" is simply a chimera, because for something to "be", "exist" or incorporate in our "reality" it is necessary that that thing or its constituting elements interact – demonstrate themselves – directly or indirectly with our senses. This condition is not fulfilled in any of the mentioned expressions as these refer specifically and emphatically to the interior or characteristic of the thing, conforming in all cases one of the many traps or paradoxes expected by our form of expression. That is to say, that we only know the direct or indirect interactions of things with our

brain through the different senses and functions of our body.

From this point there arose the difficulties faced by those who wanted to define reality´s intimate nature, since whatever the method used to detect it, it is always about interactions, that depend not only on the interacting local elements but also on the context in which they do it and on the particularities of the observation method and subject´s judgment.

In other words, for something to "exist", that is to say, for an object or thing to be, an interaction with another element or thing that would act as a subject and vice versa is necessary; if not, we would be facing what we define as nothingness, nothing.

It is just the Quantum Theory, with its uncertainty principle, its probability waves equation, the wave function collapse, and so on, the intellectual tool that lets us speculate with the possibility that there may exist different "realities" in nature—the whole—that reveal themselves only according to the characteristics of the interactions between the object from the environment and the subject (in this case our brain or tuner); all this, if we only speak about the recently known interaction levels.

Summarizing, my intention is to leave at hand of any person who asks himself/herself about his/her role in this open adventure life offers, another explanation of the brain's function, in particular the human brain which I think it is similar to a tuner, using this didactic metaphor with clear arguments linked to well-known elements, and also coherent and compatible with the ideas that great author gave us from the intellectual joy of his prose and poetry in line with the last advances of human knowledge.

Without neglecting other explanations, I think human brain functioning resembles—only as a parabola or an explanatory metaphor— the functioning of a radio or TV tuner, that instead of producing sounds or images, in this case it produces ideas, abstractions and consciousness knowledge and awareness, thus using this resemblance in the same way as the metaphoric term "Big Bang" could express so successfully our universe´s primigenial explosion (although it is only a mere approximation).

The idea or metaphor of thinking about the brain as a machine is not new as it is consciously or unconsciously used by the immense majority of scientific people who deal with neurosciences and medicine in general. What may have a feature of novelty is the idea of assimilating brain functioning to a tuner function and I have only found one similar reference in the case of the already centennial Swiss chemist, Dr. Albert Hofmann, inventor of the unfairly treated lysergic acid diethylamide (LSD), who in his book: "Interior Word, Outer World", pages 33 through 44 (Humanics New Age; 1989) he refers to the brain as acting like a tuner of reality, that produces consciousness and awareness.

Paraphrasing the legal lexicon, I could say that I will try to justify each concept used, by those explanations that constitute the "factual evidence", "proofs" or "traces" agreed upon by most present scientists. Moreover, it is not less important to add that these opinions concur on the fact that our present scientific knowledge is far from being a certainty in absolute terms and that it will surely be modified, enlarged and may be improved in the times to come.

Memes, purest ideas and concepts like time and space, so intimate and natural to our reasoning and daily experience, have suffered the assault of new theories and little is left of the primary common sense certainty, as a result of the dimensionality (macro- daily situation) in which our existence normally goes through and to which we have got used to, but not submitted.

Thus, we find that even relatively new explanations of the atom´s structure, like a mini planetary system, or about the origin and fate of the universe, such as the "Big Bang" and the "Big Crunch", are now being dramatically questioned, proposing unsuspected consequences. I firmly believe and assert in this essay, that it will be very difficult for science to give us all the answers about the nature of things, "reality" and our relationship with it, but I hope evolution will take us that way.

In this concise summary of "Borges, The Quantum Theory and Parallel Universes" essay, I want to highlight the explaining basement for both, the "Whole" proto-theory and the "Tuner" metaphor, using the least phrasing and technical formulation as possible in order to draw the almost shocking relativist and quantum concepts near an educated population, yet, without a particular physical- mathematical background.

The Whole and the Tuner
(A tale about us and "reality")
Eternity beats

In cosmology – the science or a group of sciences that study the general laws that govern the physical world of our universe considered as a unity-, when scientists refer to the origin of the universe using the illustrative and well-known "Big Bang" metaphor, in what is nowadays accepted as the "Standard Model" explanatory of reality and its structure, they generally use the following argument that reads like this:

"...going back in time farther than this singularity, when and where time or space did not exist at all. From this nothingness space- time emerged, and with it, everything else emerged,...", etc., etc.,

Most explanations suggest that there was nothing before the Big Bang or "Great Explosion", neither time nor space, and that these dimensions are created in that

initial moment sprung from that nothing. Following is how Peter W. Atkins, among others, explains it. He is a well-known chemistry-physics professor in Oxford, member of Lincoln College Council and author of the best-seller The Creation (1) who in chapter 5 (page 117, Biblioteca Científica Salvat, Ed. Salvat Editores S. A.) says:

"Let us go back in time now, farther than the moment of creation, when and where time or space did not exist at all. From this nothingness space-time emerged, and with it, everything else appeared.

In time, knowledge also emerged; and the universe, which at the beginning did not exist, became conscious.

Now, in the time before time there is nothing but extreme simplicity. In fact, there is nothing; but, in order to understand the nature of this nothingness, the mind needs some type of support. This means that, at least for the time being, we have to think of something. So, and no more, for the time being, we will think of almost nothing.

We will try to think, not of space-time in itself, but of space-time before being such. Although I can not say exactly what this means, I will try to point out how we can start to face it. The important thing to have in mind is that it is possible to think about a structureless space-time and that, after some consideration, it is possible to shape a mental image of that geometrically shapeless state.

Let us imagine that the entities that are about to be structured in space-time, and later, in elements and elephants, are like shapeless powder. Now, at the time we are considering, there is no space-time, only powder from which space-time will take shape. The lack of space-time and the lack of geometry only means that one can not say that this point is near or far from the other one; one can not even say that this thing comes before or after the other thing. In these circumstances, there is an absolute amorphous state. Later, we will have to sweep away even dust; but this, like every simplicity, will take care of itself…."

Other important thinkers, as well as Atkins, consider the beginning of the known universe from a singular event that everybody knows as the "Big Bang", before which time and space did not exist, as if everything had started from zero in that supposed beginning of all history.

From my point of view, that flash known as "Big Bang" is just – no more no less - that point or space-time singularity back to which we can project, with some rationality, the past (in fact, back to the moment 10 exposed to the minus 43 seconds, which corresponds, approximately to the 10 septillionth part of a second, Plank´s time) after that beginning, the application of our present knowledge about natural laws, the behavior and movement of matter and energy observed in the universe, especially in face of the stars expansion confirmed by the astronomer Hubble in 1929 and the coherent evolutionary process recorded in all the different manifestations of the universe, from the primigenium magma or plasma, through atoms and molecules to monkeys, fleas, men and the galaxies.

Nowadays, there is a precarious, relative and, surely transitory, general agreement among scientists as regards the "Big Bang" being the limit moment or situation or space-time singularity before which nothing can be scientifically stated; nor about time not even space, which is something completely different from accepting that before the Big Bang nothing existed or that our universe emerged from nothingness, like an unexpected miracle.

Scientists used to believe that the supernovas or the black holes were weird events in the universe and they even doubted about their existence; nowadays, we know that they happen everywhere in the cosmos. Likewise, there are many scientific speculations that consider numerous "Big Bangs" in every size that happen regularly in the relative infinitude of space, as Sean Caroll, a physics teacher in Chicago University, and the graduate Jennifer Chen assert, generating new and particular universes shaped from gravitational crises in the core of the frightening black holes through, maybe, the up-to-the-moment unknown and mysterious warm holes.

Also and from different disciplines, other authors agree with these brand new criteria. In his book "The infinite in the palm of the hand" Mathew Richard, a Buddhist monk of French origin with a scientific background in biology, together with Trinh Xuan Thuan, a Vietnamese astrophysics, tell us in their book, (Editorial Urano; 2001; pag.37):

"…The idea of the "beginning" is, no doubt, an essential worry of all religions and of science. The Big Bang theory, according to which the universe was created approximately fifteen thousand million years ago, together with time and space, is the best explanation of the visible world. Buddhism tackles this problem in a very different way: it asks itself if a "beginning" is really necessary and asks about the reality of what could have gained existence in such a way.

Is the physics' Big Bang a primordial explosion or the beginning of a certain cycle in a succession without opening or end of an incalculable number of universes?

Do our habitual concepts let us understand the ideas of origin and absence of origin? Doesn´t this idea reflect our tendency to consider all phenomena as things, i.e., to consider them things blessed with an intrinsic reality?…"

Following the order of this reasoning, and according to what I have said, I believe that we can define "nothing, nothingness" as the lack or absolute absence of elements that can interact directly or

indirectly with sensitive elements of our intellect (our brain, the tuner) in a certain and limited space-time region.

Of course, this is always something transitory and full of potentialities.

So, and beyond a possible religious interpretation, when we speak of nothing as a possible situation prior to the "Big Ban", we are evidently in the presence of a simple declaration of ignorance or a mistake, a wrong explanation, and we would have to think of a new conception of what nothing is as I propose above, as by definition, "nothing" contains nothing, nor time, nor space, not even any type of powder .

Even quantum fluctuations require something that fluctuates, whether real or virtual particles, beyond any word play.

Reasonably, and just to use what most of us consider the best method human beings have to interpret things from "reality" through statements based on logic and checked by experience empiric data, there seems to be only three possible states or situations previous to the moment of the hypothetical origin of this our known universe, or this particular "Big Bang":

- The futile and contradictory nothingness, which we have already discarded with enough logical arguments as the generator of any "reality";

- that there exists only something, which seems incomplete; I do not find a logical supporting argument, unless we take as valid the metaphor of the "Tuner" described below;

- Finally, the alternative of the "Whole" is left, for everything we can or we cannot even imagine nowadays; it seems not to have logical contradictions and it is justified within the framework of the "Tuner" metaphor , which completes and accompanies it from the perspective of human consciousness or awareness.

On my part, and within the framework of the explanatory coherence I pretend to support, I find it more logical, feasible, easy, reasonable and useful, to believe that our universe emerged as part or something (a cycle?) of a "Whole"- original, previous and permanent, made of the totality of the basic elements of nature and which , for the time being, lies greatly, "*beyond*" our present sensitivity and possibility of understanding, although not far from a certain amount of based argumentation.

From these particularities, new (though not necessarily unique or unedited) and different relationships—interactions—among some components of this permanent "Whole", there emerged and emerge, in each space time singularity known as "Big Bang", different elements with unlike characteristics that developed and develop in organisms of growing complexity, which perceive time and space, as for example, we in this our universe.

What do I refer to? What is this "Whole" made of? Why do I say that perceived "reality" is only one part of this permanent "Whole"? I will try an explanation:

Development of the theory of the "Whole" and the "Tuner" metaphor

First of all, and after overcoming the basic Cartesian doubt and the ecstasy produced by the fact of being aware and proving that there exists "something" instead of "nothing", I understand that even with language restrictions and limitations, we have to define certain elements in order to tackle coherently the data that experience gives us to answer questions such us:

What is that that "exists"? What is "reality" made of?

Most of us will surely agree on the fact that saying that reality is what it is or that things are what they are is a sovereign tautology that does not help us at all in the task of understanding nature, taking the latter as everything that surrounds us, even ourselves and the mutual relationships, according to the experiences that life poses.

Probably most people will also agree that every thing, element or individual has a nature of its own, particular, unique and distinct; that is to say, Perón was J.D. Perón, the Argentine president of the early fifties, Julius Caesar was the antique roman emperor in 50's BC, J.F. Kennedy was the American president who was murdered in Dallas, Texas, on 22 November 1963, Adolf Hitler was the German dictator who began the World War II, Chita was Edgar Rice Bourroghs´s Tarzan´s monkey, and Rin Tin-Tin was the most generous and intelligent dog that we remember on TV. Likewise, each one of their numerous homonym's or not of these characters, each atom, object, particle or individual that belongs to the known universe had, has or will have its own unique and particular identity or entity in time and space.

Well,... according to the Quantum Theory, all this may not be entirely true (or at least, it may constitute a partial version of the infinite nature of things). Let us see:

According to Bohr and Heissemberg´s *complementary principle*, also known as the duality wave/particle paradox, the subatomic elements which constitute the whole "reality" or known matter/energy, may be or behave: as a particle or as a wave. Moreover, according to the "*uncertainty principle*" (Heissemberg), these multifaceted freaks may be found at any point in space/time, not being able to establish simultaneously their precise position and movement.

Accepting the validity of these principles (as apparently science does), and considering that each element from "reality" is in the last instance the result of a subject/object interaction and vice versa, we inexorably have to admit that such element considered punctual in traditional space/time, accepts now (in the

light of the mentioned quantum principles), and also as a complement, a multiple interpretation, when taking the particle as a wave, and under that consideration, it will be a multi-interaction.

If at this point of the argument you are beginning to distrust this reasoning, neither feel bad about it nor think you are the only skeptical person: even Albert Einstein had always rejected these assumptions ("God does not play dice", he used to say) and he tried to rebuff them till the day he died…… unsuccessfully.

The Quantum Theory is the most successful and inclusive one of physical science reasoning and in it and by it, it is argued that there may not be only one "reality"; there may exist potentially infinite "realities" and identities, as many as there are elements, either object-subject or subject-objects which interact among each other.

Borges poetically expresses these doubts about the entity and identity of things, the impossible time return and its relationship with the being´s multiple consciousness, and he regrets about it in his essay: "New Time Refutation", written in 1946 and included in "Other Inquisitions" (1952):

"And yet, and yet... To deny time progression, to deny the I, to deny the astronomical universe, are apparent miseries and a secret relief.

Our destiny (different from Swedenborg´s hell and Tibetan mythology's inferno) is not horrifying for being unreal; it is horrifying because it is irreversible and made of iron.

Time is the substance which I´m made of.

Time is a river which carries me away, but I´m the river;

It´s a tiger that breaks me into pieces, but I´m the tiger;

It´s a fire that consumes me, but I´m the fire.

The world, unfortunately, is real;

I, am, unfortunately Borges"...

Also in "El jardín de los senderos que bifurcan" (The Garden of the Bifurcating Paths), through its characters, Borges tells us of his suspicions about the potential multiplicity of "reality":

"....In every fiction, every time a man faces different alternatives, he chooses one and discards the other ones; in the almost inextricable Ts´ui Pên´s, he decides – simultaneously - in favor of all of them. In this way, he creates diverse futures, various times, which also multiply and bifurcate. Here lies the novel´s contradictions. Fang, let us say, has a secret; an unknown man knocks at his door; Fang decides to kill him. Naturally, there are various possible outcomes: Fang can kill the intruder, this one can kill Fang, both of them can survive, both of them can die, etc. In Ts´ui Pên´s story, all the outcomes happen...."

With no delay I should state that in my opinion, there exists a basic permanent nature made up of something like a kind of a non differentiated element/wave or primordial dimension. Such is the case of the "one-dimensional resonators or oscillators of which the last physic-mathematical speculations speak about (see Crotti´s HYPERLINK http://www.geocities.com/macpetrol/Waves and Particles.html, among other Internet pages or sites, by Engineering M. Crotti, or may be the membranes of the hard working but prolific "M Theory" by Edward Witten, awarded the Fields Medal in 1990—equivalent to a Nobel Prize, in mathematics – and other renown thinkers that do not use to spend time foolishly). From this point or by it, through different types of interactions between each other, different phenomena, elements or dimensions give way, that in turn, when they evolve - new interactions at each level - they give place to the development (here I was tempted to add the word "final", but I think it is exaggeratedly anthropic) of new characteristics, among which are those individuals - like us - who have self-conscious properties, among other ones.

I call the "Whole" to that basic permanent, omni-potential and may be one-dimensional continuous nature, where there is no proper time arrow, what the prominent American physicist Richard Phillip Feynman (1918-1988) called "the sum of all stories".

We know by our own experience that there exists at least one universe – ours - which was formed in that singularity we know as "Big Bang" and which developed, among other emergencies, up to one of these types of phenomena with consciousness, awareness, and knowledge of one part of the "Whole" that we identify as human beings, homo Sapiens Sapiens, man, in the last instance, us, the "tuners" of the "Whole", which make up, among other things, something we define as "reality".

The "reality" we know, perceive and accept as such, the physical universe "reality", is experienced and recognized through various ways: we see something with our eyes; we hear something with our ears; we smell something with our nose; we touch something with our hands or the contact or graze of our skin. Afterwards, when these different signals or interactions with the outer world are processed somewhere and somehow by our brain, we decide that there is something, that we know or feel about "something"; summing up, we shape a "reality".

There is no scientific evidence about any other kind of interaction between our brain and the world that surrounds us; it has not been seriously verified, no matter how hard it has been searched for, the existence of any type of extra sensorial communication, telepathy or similar esoterism, that if they existed, they would also be interactions.

That is to say, scientifically speaking, it is only through our senses that we interact with some of the

elements of the outer world or environment, thus generating certain signals that are transmitted to our brain. Nevertheless, the only way to know or be conscious of those "things" or outer object is through the subsequent neural (or mental, if you prefer) processing of the signals in our brain/tuner.

It is worth remembering and stressing that although our senses receive different types of signals from the environment, such as light waves in our eyes, sound waves or air vibrations in our ears, vapors, gases or air suspensions in our nose, liquid solutions in our mouth and tongue or contacts of our skin with different bodies and surfaces, etc., etc., no part, "particle" or wave from these bodies, substances, objects, or external elements reach the brain directly in order to be interpreted, it is only a matter of interactions.

Thus, sounds, smells, tastes, colors, etc. etc. such as, and how, they are perceived, do not exist in the world outside us, they are perceptions and feelings that turn concrete and are recognized as such in our interior, in our consciousness, when waves/particles (air pressure waves, matter and/or energy radiations, different atoms and molecules, etc., etc.) of this world or outer environment interact with the corresponding nervous terminals of our senses. As stated more spiritually but with the same reasoning by the already mentioned and well known Swiss chemist from Sandoz Laboratories, Dr Albert Hoffman (almost accidental discoverer of LSD and explorer of what today is known as "consciousness altered states"): "… *We always have an external prompting, maybe chemical if we eat something, and this chemistry in my body produces an impulse that reaches my brain and in turn my mind says: "sweet, sweet…". Thus, all this connection between the material and the spiritual worlds takes place in our brain, in the different systems centers of the brain. Up to this point we can follow up the energetic waves that come from outside… but here starts the spiritual world because, for example, the sound does not exist in the outside world, there, only air vibrations exist, sound as perceived by us is spiritual, as tastes and images…"*

The nervous terminals in our senses are the ones in charge of picking up (as an antennae tuner would) and transmitting (as a tuner´s conductors would) the codified signals with the corresponding information from the object (the something or part of the external Whole) to different areas of the brain. This is done as electro-biochemical processes called nervous impulses (synapses, chemical potentials, electro-chemicals, neurotransmitters, etc), which are pretty well known processes, essentially based on electromagnetic interactions, somehow similar to electric currents in tuners´ wires. Lastly, in a third stage these interactions are processed inside the brain where they are transformed into consciousness, awareness and eventually, different actions like efferent manifestations, in a similar way, though far more complex, in which the invisible and electromagnetic waves in the "ether" turn into determined and precise air-pressure waves (radio sounds) or other kind of codified and visible luminance radiations (TV images) in the different types of tuners.

But nothing, absolutely anything from the outer world with respect to us, not waves nor particles, gets into or is processed or interacts *directly* with our brain or mind; it is just a matter of transmitting and processing specific codified electro-biochemical signals; these being very well-known signals, product of the interactions of our sensitive system (the tuner) with the outer world or environment (the something or part of the "Whole"), ... again, only interactions.

The knowledge of the first two stages of this process has reached to such an extent that nowadays cybernetics subjugates us with the possibilities of "virtual reality" that has little or nothing to do with concrete objects of our environment: They are simply artificial signals that imitate and substitute the natural process in those stages. Also, in some medical centers, cochlear implants are regular surgeries, where a bunch of electrodes are directly connected to the brain in order to produce "hearing" in certain types of deafness and similar efforts are being done to produce artificial sight or, in the efferent sense, to be able to move objects with the brain through electrical circuits directly connected to the brain or by a wireless connection between the brain and a robot, once the motion signals from the individual´s mind are codified.

Although, so far, nobody can tell for sure in what specific place in our brain/tuner such phenomena of the third stage we know as consciousness, knowledge and awareness take place, neither do we know the mechanisms which explain them, there is a general agreement—particularly based on the neurosciences field—that they are new ways or neuronal tracks that are created with every experience and recorded as we repeat them together with or as complement to the pre-existent connections in the brain/tuner of every species, according to their genetic pattern.

The researcher Dr. Fernando Cárdenas Parra, from the Psychobiology Department of San Pablo University, Brazil, asserts in his more than relevant Internet articles "Mental Representation and Awareness":

"Anatomy and physiology of brain representation

Million elements are grasped at every instant thanks to sensitivity systems, which acting out as filters, let in only an infinitesimal part of the outer world, that part which, along the evolutionary history of life on this planet became of crucial relevance for self-preservation of organisms.

Apart from not being related to the totality of the real world, this reflex of the different characteristics of matter, is decoded by the sensitive receptors in nervous

signals and as such is kept inside the biological system. Notwithstanding, later in time, it may be turned into "outputs" of movement, endocrine, exocrine, cognizant or verbal nature. When tracing the anatomophysiology of the different sensorial paths, a process of disintegration of the perceptual units into their minimum components is reached.

Initially, environmental information excites a group of receptors, which, in their connection with the "first end"(or more appropriately the initiations) of the nervous terminals decode that information into nervous activity in the shape of a local modification of the Na+ and K+ trans-membrane ionic cumulus. This modification moves through the axon at a speed ranging from 20 to 120 m/sec., ending at the other end of the nerve-cell with the relief of transmitting substances, which , in turn, act as a new stimulus for the nerve cells or other cells on which they make contact. This process, in the case of sensorial systems (except for the olfactory system) comes up to a series of neural aggregates or nucleus called altogether thalamus, with such a precise organization that it is possible to determine somatic, visual or auditory representation maps in the ventral, posterolateral, lateral geniculate and medial geniculate nucleuses, respectively. Such maps of the body, retina or cochlea are kept in the brain cortex with identical precision, once the impulses are transmitted from the thalamus.

Obviously, the information does not maintain a unique path in series, that is to say, the nervous impulses originated in certain receptors, apart from being transmitted to the brain cortex, are sent to other locations, (amygdala, hippocampus, superior and inferior colliculus, reticular formation, etc). This process shows an architectonical parallel organization, simultaneous with a series one, based on the principles of convergence and divergence of synaptic connectivity, thus conforming information processing nets or meshes. The recurrent activation of the same connection nodes establishes a process which is an unprecedented evolutionary gain, pillar for the development of animal biological systems: memory; initially by a simple electro-chemical facilitation for the work of certain synaptic connections (short-term memory), and lately, as a generator of new synaptic contacts, that is, physical modification of the structure itself (long-term or permanent memory)"…

And, among other considerations, he recommends taking the following with care:

"…Partial conclusions

Evidently, awareness in spite of being a brain process, can not be located specifically in any restricted area; thus, it corresponds more to a temporal work of the anatomic circuits excited externalyl and intrinsically; "…anatomy as a space and physiology as temporal dynamics" (Jaramillo, D., in printers)

One of the most shocking points that arise from all this makes reference to the fact that the physiological change produced to the system´s inside by the stimulation received is least (in activity rhythms, pulse patterns or evoked potential trains in certain neuronal populations both thalamic and cortical). This means that there is a back stage (the system´s spontaneous activity) on which the received information makes a little alteration. At least three important consequences can emerge from this statement:

a) minimum variations of the spontaneous activity lead to quite different subjective perceptions, with which the potential variability of different subjective situations is infinite, as it is the potential variability of different physiological states.

b) the subjective experience as such already exists in the system´s inside and the external sensorial information would only "polish" this experience, highlighting some traits and toning down others.

c) the difference between the subjective awareness experienced by organisms would only depend on the relative differentiation of their anatomo-physiological organization; however, the similarity of subjective states of awareness is immense, due to the genetic similarities of the organisms pertaining to the same species (same-species-organisms´ design). That means that our subjective worlds are much more alike than we wished, from this, we can share consensus or achieve empathy (assuming as taking the place of another person)

Relating the data obtained by Mountcastle, V. and Edelman, G. as regards the functional organization of the brain cortex in cortical columns or modules, with the concepts dealt with, it is possible to introduce certain ideas through which we can put together the experimentally and clinically found events and in turn find greater coherence in the conclusions mentioned in the previous paragraph…"

Therefore, I assert that the "reality" we know today may not be all that exists. There may be other elements of the "Whole" (for our present: year 2005 A.C.) that have not interacted with our senses yet, may be because they have not been needed by our evolutionary branch so far, and thus have not been incorporated into our present knowledge and speculations. For example, a possible candidate to emerge shortly, although only partially and only valid for our universe, is something which has been strongly outlined among astronomers, physicists and cosmologists in the last years: the enigma "dark matter and/or energy", which some estimations place in approximately 20-25 times the addition of all known matter and energy (baryonic) as factor and necessary value so that certain numbers of the so called "Standard Model" "fit".

I also state that man recognises only part of the "Whole", because it is obvious and evident that day by

day new things are incorporated to his "reality", to his consciousness his awareness and general knowledge, in an evolutionary process that – almost - nobody can deny nowadays, in spite of the doubts about its origin.

About this conceited permanent increase in our capability to understand the nature of "tuning" the "Whole", a curious, enigmatic or paradoxical consideration - among others - can be summarized in a remark that is contradictory at first sight:

It would seem that the more we know about the "Whole", the bigger is our ignorance; or in other words: for every answer to a question, many new questions arise; or another extreme form of saying the same: as the field of our knowledge broadens, unfortunately the horizon of our ignorance becomes larger…, from this point my doubt about what we can boast about.

Using an expression that belongs to our football slang or jargon, we could say, "evolution is permanently moving the goal away", and this is really scary.

In order to better understand how human consciousness, awareness and knowledge work, I appeal to a well-known literary image, a metaphor, and I propose the model or parabola of the "tuner", as an explanation about how a human being's body, especially its senses, brain and intellect, interacts with the "Whole", generating consciousness, knowledge, awareness, and, eventually, efferent actions.

At this point of development of this reasoning, and taking into account the confusion in most known languages with respect to the meaning of the words consciousness, awareness, self-consciousness, etc., etc., to the sole effect of using them in this summary of the essay "Borges, Teoría....", it may be worth making clear the terminology used:

1)When I use the word consciousness, I am referring to the capacity, that in greater or lesser degree, all living beings have to grasp the environment or outer world around them and to act accordingly. For example to escape or defend themselves from hazards and dangers, get the necessary sustenance, etc., etc..

Instead, when I use the word awareness, I want to refer to the capacity that almost exclusively - and thus can be expressed - in greater or lesser degree, human beings mentally developed and sane have in their interaction with the environment when they are awake and attentive.

Of course in both cases, consciousness and awareness, it is possible to consider different degrees of attention, concentration and other circumstances that can blur the limits of the definition given, but, almost undoubtedly - at least in the neurosciences consideration – it is always about "properties emerging" from the interaction of every individual's CNS, particularly its brain, with the surrounding world, generating in first instance a certain type of mental representation and also different types of eventual internal "abstractions" conformed or produced by the consequent neuronal activity.

Apparently there is a specific neural processing that it is supposed to be produced redundant and comparatively only in men's extended frontal lobules, the responsible for the emergence of awareness, qualia and other manifestations exclusive of human beings.

Most of the work being done on this subject, can be visualised or appreciated in any Internet search engine (browser). For example if we look for "Awareness vs. Consciousness " or Self-Awareness vs. Consciousness in Google we can find more than one million four hundred thousand (1,400,000) ("variopintas")entries in English and approximately six hundred and fifty (650) entries if we prefer the Spanish language for: "Conciencia vs. Consciencia", with (also "variopintos") articles referred to this subject.

In those articles we can see that both, in English and in Spanish, these two words: "awareness or consciousness" in English and "conciencia o consciencia" in Spanish, are practically synonyms and that it is necessary to undergo a deep and wise lucubration to establish subtle but, for some analyses, major differences of interpretation, as for example to consider or not mental representation in one case, qualias, self-awareness or self-consciousness in others, etc. etc.

In my case, by this means, I try to clearly establish a difference that dictionaries in both languages do not show or reflect and that the undeniable evolution process has established between brain/mind/human tuner functioning and the corresponding functioning of the rest of the living beings.

As it can be seen, the limitations sometimes imposed by language can be overcome if we previously agree upon, delimit and state clearly the phraseology to be used; something that seem to be easy at first, but that in practice esotericism and certain cases of recalcitrant fundamentalisms, are in charge of denying.

There are still those who emphatically reject the evolution process or Darwinism, among other reasons, because they have not yet found the perfect "lost link", when really there are thousands of fossils and other elements found from our ancestors, such as tools, ornaments, etc. that duly dated and classified, render non contrastable proofs of an almost routine evolution process, as the saying: "there is no worse blind that the one who does not want to see".

On the other hand:

2) We believe and say that there "exist" different types of things, but in a first instance we could classify everything into two big groups:

a - concrete things: they can be detected directly (or also indirectly through instruments) by our senses and they have locations and dimensions that can be defined

in time and space; for example: water, an apple, fire, a stone, air, the sun, planets, a tree, radiations, a book, animals, atoms, etc.

b - abstract or ideal things: produced by cerebral or mental activity; for example, fashion, God, beauty, truth, good and evil, the devil, angels, desire, love, numbers, time and space, the soul, ideas, that is to say memes, general concepts and processes that have no defined space-time dimensions.

There is much more that could be added about the nature and characteristics of things, both concrete and abstract; at least, we can say the following:

- Back to the beginning of times, and still today, the amount of things that "exist" has been constantly increasing, the concrete ones - only since the appearance of awareness - as well as the abstract ones.

-Until recently, concrete things seemed to have certain degree of independence from the observer; this is still valid for macroscopic objects, but the situation changes dramatically since we have had access to the quantum or subatomic or microscopic level; instead, abstract things keep a kind of "personal touch" within their subjectivity, which every individual defines on his own.

-All concrete things may be conceptualized and symbolized, thus turning into abstract ones, but not all abstract things can have their corresponding concrete ones.

-We should also say that both types of things are bound to a permanent change of "status" and attributes; in this way, atoms, electrons, etc., were only abstractions or speculations in scientists´ mind/brain/tuners, while nowadays science and technology allow to manipulate such objects both in time and space, with the same or more precision than Maradona mastering a football. Likewise, but in the opposite direction, those same concrete elements until a few years ago, now vanish in a mass of indeterminations and uncertainties when their intimate structure at the light of the scarce believable principles of the quantum theory are to be explained.

This process is what we call cognizant evolution and although we do not know every detail yet, we believe that it follows some intelligible rules. For example, quarks, electrons, positrons, radiations, pulsars and galaxies that are real and concrete things today, at least for the science man, surely did not belong to any human being´s "reality" or "existence" in the Middle Ages, not even in the most esoteric fantasies at those times, still less in Paleolitic times. Nevertheless, we know now that these concrete things were there as they are today, they belonged to them and accompanied them like silent, indifferent and unknown venture-mates, in the same way as today we can have no idea about other things that surround us or that are our constituents but that they will "exist" or become real in the year, let ´s say, 3050, supposing that there will still be conscience and awareness to detect them.

Repeating this reasoning, one could argue that the above mentioned elements are just mere and new combinations of the existent and known matter, but this is not so. What was that known matter that already "existed" for our ancestors?

As far as we know, the ancient Greek thought the world was made up of elementary and indivisible particles that Democritus called atoms, these proceeding from four basic types of matter: water, earth, fire and air and from which combination they gave place to all the other objects of the "reality" . Later on, in the course of the 17th, 18th and 19th centuries, there appeared the approximately one hundred chemical elements that integrate the periodic table today. Different radiations also irrupted in the 19th Century and it was on the past century that the antimatter was incorporated to everyday "reality", just to mention some of the last elements that "emerged" to humanity's knowledge, consciousness and awareness.

Something similar occurred, and still happens, with abstract things, ideas or memes: they have also increased in number, developed, at last, they have also evolved and evolve, at phylogenic as well as at ontogenetic level in every individual

Undoubtedly the frontier –if there is such a thing— that separates concrete from abstract things is blurred, elusive and voluble for human beings. Nobody questions today that a chip or a computer are things that belong to the concrete "reality", but some time ago, they were only mere abstractions or scientific speculations. It is only due to our need to categorize things for a better understanding and grasping through language, that is the tool that we, human beings, use to understand among each others, thus dividing natural from artificial things as if they were different, but it is also possible to consider them as a simple - or complex if you prefer - evolutionary continuum.

So we see there is a close relationship between what "exists" and our awareness, as bishop G. Berkeley used to say far in the 18th. Century: "to be is to perceive"…, which is not at all the same to say that we perceive" everything" that exists.

Let me make clear what my agreements and discrepancies are with respect to this idealist position. In his Treaty on Human Knowledge Principles, G. Berkeley says:

"There are some truths that lie so near the mind and are so obvious for it, that a man only needs to open his eyes to see them. From these, there is one which is utmost important, namely: that everything in the sky and on the earth, or, in one word, all those bodies that make the powerful structure of the world lack an independent substance from the mind, and their being consists of being perceived or known; consequently, as long as they

are not perceived by me or do not exist in my mind, or in any created spirit´s, either they will not have any existence at all or if they do, they will have to survive in some eternal spirit´s mind. Attributing any part of those things an independent existence from a spirit, would be completely unintelligible and would entail the absurdity of an abstraction".

Or also as Borges says:

Curios about shade
And frightened by the threat of daybreak
I revived the tremendous conjecture
By Schopenhauer and Berkeley
That declares that the world
Is an activity of our minds,
A dream of our souls

With no base, or purpose, or volume" J. L. BORGES, "Fervor de Buenos Aires", (1923)

I agree with the bishop in that we say or define that something "exists" to everything that is perceived directly or indirectly by our senses, transmitted by our CNS and processed by our brain (tuner).

I disagree with him when he denies any kind of "existence" to everything which is not perceived (direct or indirectly) by our senses; it is surely another type of "existence", which we could very well define as potential or as everything that has not yet interacted (directly or indirectly) with our brain/tuner .

To support my disagreement, I propose to analyse what nowadays is accepted as the detailed description of the phenomenon called "perception", responsible for the conformation of what we know as "reality", at the light of the last scientific knowledge which, of course, the Irish bishop did not have on those days:

Perception is the interaction between the outer world and our brain/mind through different senses that make up the structure of our Central Nervous System (CNS).

Different stages can be identified in the perception process:

1 - Arrival, contact or interaction of the external signal (electromagnetic radiation, variable pressure wave, chemical substance, etc.) with the corresponding nervous terminals of the CNS;

2 – Generation/ transduction and transmission by electromagnetic interactions of the corresponding electro-biochemical codified signal by means of the CNS neuronal system(s) which operate in each case (synapses, neurotransmitters, etc.);

3 – De-codification and interpretation of the signal received in the different brain information-processing centers.

Although the details described in the first two stages of the perceptive process are very well studied and understood, it is the third stage – where human knowledge, consciousness awareness are believed to reside- the one that presents the greater proportion of doubts for present neurobiological science .

This is considered neurosciences´ hard problem: Which, how and where is the process that generates the sense of "I", of our personality and individuality, the site and essence of self-knowledge and awareness produced?

I dare think of neural mechanisms being similar to those that generate other kinds of elemental feelings/sensations such as pain, pleasure, anger, fear in animals consciousness, which evolution has taken to process in a more complex way and redundantly in the case of hominids, specifically in the new areas of human brain, as the frontal lobules, neocortex, etc, generating new sensations and unrest which did not affect our animal ancestors as for example: intellectual values (as regards this, I recommend reading Lewis Munford´s The Machine´s Myth or Elkhonon Goldberg´s "The Executive Brain" or Johnjoe Mc Fadden´s Quantum Evolution)

Different research on the study of certain pathologies and brain strokes or injuries (accidents) which alter the normal functioning of the information-processing areas, such is the case of different kinds of agnosias - aphasia, amnesia, etc. - has allowed to establish in certain individuals, that in spite of receiving clear signals from the outer world that conform the first stage in perception, as well as operating the sensitive/transmitter/ transductor process described in the second stage correctly, a deficiency in the third and critical stage of human interpretation produces the subject's unconsciousness and ignorance of the variables affected. That is to say, that "reality" disappears from his mind; that "reality" does not "exist" for him; he will not recognize it in front of his wide open eyes and it is likely that he will even mock those who think otherwise. (See The Man Who Mistook His Wife for a Hat by Oliver Sacks; Editorial Gerald Duckworth & Co.; London; 1985).

I deeply believe that something similar happens naturally in the rest of the animal species: as they lack the redundant processing of the third stage, which is exclusive of human beings, all of them have - in a lesser or grater degree according to their sensitivity - a similar image, an equivalent consciousness of the surrounding reality, that is to say a similar – and even better and more complete in some cases – interaction experience between their senses and the outer environment, but none of them can process that information in their respective brains to produce awareness properly. That is to say, they know, but they do not know they do; or in other words, they are conscious of and in that "reality" but they are not aware of it; they lack a brain mechanism with the size – proportionally speaking - and complexity of our brain cortex, neocortex or frontal

lobules, that asks or compares redundantly the other neural functions.

In the same way as our children, adolescents and certain senile or sick personalities, they also have the same "reality" we have (the sound and well culturally and intellectually developed adults, with all the exceptions this conception may imply) in front them, but they lack the necessary intellectual capacity to interpret it in our way; we could say, comparatively, that they undergo different types of associative agnosia.

We could also state that while the adult, healthy human being knows that he/she knows, for the time being, that human being ignores how he/she knows it.

I keep inside a cruel suspicion that could also be called secret illusion: Which and how many natural and innate agnosias of the human species may there be?

On the one hand, I feel anguished to know or al least suspect, about the existence of other worlds, universes or dimensions - the infinite configurations of the Whole—that I can not perceive directly because of that innate hypothetical incapacity. But, on the other hand, those fears are limited and my hope encouraged because I know or infer that we can reach them and their different "realities", maybe indirectly – not through the direct interaction with our senses – in some cases for the better others not so much, through the evolution of our intelligence, creativity, imagination, and, why not, the creasiest fantasy, that led to the artistic expressions of Rembrandt, Mozart, Verdi, Picasso, Proust, Borges, the genialities or scientific intuitions of a Leonardo Da Vinci, Newton, Maxwell, Planck, Julio Verne, Einstein, etc. but also to the foolishness of a Hitler in Germany or a Pol Pot in Cambodia, just to mention some deplorable events in the past century.

ccording to some authors we are dreaming machines, infinite story makers, creators of myths, gods and religions; from the freedom of our fantastic imagination to the technological wonders only limited by our scientific knowledge; all of them new interactions , capable of creating new "realities"—from art, faith, science, etc. —which exceed the perceptive "reality".

This mindset drives me to think that, in the last instance, the "WHOLE" exists, as the sum of the universe we perceive today and of what it is – may be just for the moment - *beyond* our senses and knowledge.

This means that there "exists" a growing "reality" that we identify directly or indirectly by the interaction of our senses with the outer world as part of or something of a "Whole", which is fundamental, continuous, basic and permanent of which we grasp partial aspects as a "tuner" does, though our body, mainly the CNS and the brain, where a complex and so far not very well known neural mechanism finally produces what is known as consciousness, knowledge, awareness, and eventual efferent actions.

It is evident that everyday, with no hints of exceptions in the known story, we are constantly broadening that "reality" by interacting, in some way tuning, with some of the other elements of the "Whole", that lie beyond the immediate perception.

Those who believe that there is nothing beyond our senses and knowledge, should have in mind the following:

- In the same way as a given "tuner" is not capable of processing every different wave that reaches it, our senses do not "grasp" all the range of phenomena they are supposed to; for example, our sight only detects a very small fraction of electromagnetic waves; our ears are incapable of hearing infra or ultra sounds not at reach of our sensitivity, etc. This shows that a big part of "reality" is out of reach of our direct perception.

- With the development of neurosciences certain pathologies and accidents can be detected, where neural systems are injured, producing what in medicine is known as agnosia, aphasias, amnesias and other similar disorders which cause "loss" of reality. Thus, it is admissible to assume the possibility of other potential interactions unknown for the time being.

In order to better grasp this concept of the mentioned interaction between the "Whole" and our body in the production of knowledge, consciousness, awareness and efferent actions, I propose the "tuner" metaphor that I will explain later and moreover, I believe that this new activity - what is mental , the abstract thinking with self-knowledge - had a start in our known universe with the brain development—the tuner—and the appearance in it of those early redundant functions, some million years ago in the primates, modern men´s ancestors.

How things and ideas developed up to the quantum mechanics

All concrete things are made up of what at first were thought to be indivisible elemental particles, something like matter balls, identifiable in time and space, as for example, Democrito´s atoms.

It was not until the beginning of the last century that Rutheford, Bohr and other researchers proposed a new atom model according to which it was no longer an indivisible ball as the Greek thinker originally thought, but it had a central massive nucleus with positive charge around which smaller and lighter particles with negative charge, the electrons, revolved at different distances from each other.

This miniature solar-system like scheme worked very well as an explanation of the atom according to the classic or Newtonian mechanics principles, we could add, almost keeping with common sense; but, unfortunately, some complain all this scheme began to crack almost simultaneously with the new relativist

concepts and it collapsed with the amazing and hard to believe Quantum Theory. This theory proposed the almost utter disappearance of matter continuity, displacing it by the discrete properties of elementary "particles" (tiny subatomic elements) that included probability waves and other similar, more diffuse and less precisely located – in time and space - lively things. That is to say, the nucleus itself was no longer a small solid and indivisible ball but was in turn made up of "particles" or smaller wave-packets: protons and neutrons that were neither indivisible as the other smaller and less defined or concrete entities in turn integrated them.

Let us put it clearly: the universe, concrete things, kept being externally the same that have always been to our senses, but now these interacted (generally indirectly, through devices and instruments and sophisticated devices such as particle accelerators/ colliders in the case of subatomic or super-radio-telescopes for big cosmic bodies) and our brain also processed other levels of the external "reality". We had penetrated in a world of dimensions or magnitudes so different to everyday experience, where it was logical to expect things and behaviors different from the ones we were used to.

Let us remember that good man or indigenous if you prefer, who belonged to a country or tribe who believed they were the only ones in the world and that by a strange accident they found themselves immersed in another planet, country and culture unknown by them, how do you think they might have felt?… at least, confused and bewildered.

I think this is the situation of the Homo Sapiens Sapiens and some of his nearest ancestors: a continuous amazement and bewilderment before new things; but, as soon as the first doubts and fears were over, their growing intellectual background came into play and the inertia of evolution continues its way.

Those who believe in Darwinian or natural evolution, think this is a good, though precarious explanation - the only one available at present - of the long run since our "Big Bang". We also think that awareness as well as abstract knowledge are unedited emerging elements, product of the activity of a new and bigger brain, let us say the last evolution development, in the same way other emerging properties were, as life, intelligence, homeostatic equilibrium, consciousness, etc., in the known history of nature.

This was how, thanks to the relativities of what is immensely big, we lost deep concepts as absolute times, the flat earth, simultaneousness (see M. Crotti) and there appeared other exiting concepts as curved spaces, black holes, quasars, galaxies and similar spatial wonders our forefathers did not even dream of and which propose us trips to new universes or dimensions through exotic worm holes.

In the other end, in what is immensely small, the shocking Quantum Theory eliminated some years later, the image of the electron as a planet revolving around its star, and it replaced it by a cloud of juxtaposed (entangled) probabilities that could be placed almost anywhere in the universe, giving place, among other weird things, to the possibility of meeting infinite parallel universes (David Deutsch, in : "The Fabric of Reality", Penguin Books, London, 1997), as we will see later.

Eventually, ….again, the anguish of our ignorance joined in the infiniteness of extremes.

A similar evolution phenomenon may be considered for abstract things, but in this case, the amount of present knowledge about the intimate nature of these kinds of things is even more limited.

Paradigm changes that the new "reality" proposes

The duality wave/particle as fundamental constituent of what is concrete is nowadays accepted, almost without blushing, as the same subatomic element can manifest itself in discernible particles or waves, according to the mechanism or device used to observe it, as it happens in the well known experiments on optical interferences of grids.

What happened? Maybe "Reality" has changed? Yes and no.

What happens is that, when we change the observation scale, as science went into the subatomic world, we face new things or "realities", which although they have always been there, behaving in the same way, they were inaccessible to our ancestors´ brains – or "tuners"— to their consciousness, awareness and knowledge; therefore, those things did not "exist", did not take part in any "reality".

Nowadays, we can assume that those "particles" that interact among concrete things of the outer world and our senses are the quarks, electrons, muons, and other fundamental products which lie on the borderline of what are the smallest ones, according to the latest science communications. On my part, I prefer to suspect that other still smaller incredible creatures lie, as Russian dolls, in the deep inside and *beyond* the "reality", that is known today, such as other constituents of the "Whole", with which we have not interacted yet, either under a consciousness or an awareness fashion, and that will surely come to light as we develop our "tuners", rendering new and not even today imaginable amazements.

I would like to point out that when I refer to the word "particle" these inverted commas are justified because in the quantum scale (subatomic), what we know as concrete matter or "reality": electrons, quarks, etc. lose or transform their characteristics before us, appearing like waves also, depending on the use of devices, either to detect or to measure them, thus losing

their space/time specificity and their location is best expressed in those cases as a probability function or wave equation (Schrödinger).

Moreover, from theoretical developments by Einstein, Plank and others, it was demonstrated that matter and energy (everything we know) were different manifestations of the same elemental thing.

Following this, luminescence radiation waves can be interpreted as "particles": the photon or wave packets or quantum, according to the work of scientists such as Plank, Heisemberg, Schrödinger, Dirac, among others. Also, a "particle" as an electron may be described as a kind of wave, which loses or changes its specific characteristics, according to the approach method used.

For the first time in history — apart from G Berkeley´s and his followers' idealism— it is being admitted that the "reality" which is observed and measured, may be made of or defined by the object as well as by the subject…and that is, in the last instance, an interaction.

All this has been proved and checked by innumerable lab experiences and technological applications that take part in our everyday life and made a deep change in the object-subject relationship mandatory, at least in the subatomic level, taking to the surface of our knowledge the fact that the observer, the subject, can determine a specific "reality" among maybe infinite "realities" or possible alternatives of the "existence" of the object.

This has been almost ironically immortalized by the well-known experience of Schrodinger´s cat. In it, the Austrian physicist described a hypothetical experiment where a macroscopic element—a cat enclosed in a box with a poison which was occasionally activated by a radioactive source —could be considered to lie in a "limbo" of infinite states of "existence" between life and death, including both of them, until a spectator defined one of the infinite and possible versions of it with his act of observing.

About interactions in the quantum level and "emerging properties"

Leaving what is immensely big as it is not point of this essay, I will concentrate on developing the concept that links what is extremely small as a conceptually fit element to make up the "Whole" as the sum of what "exists" in nature and which we can reach gradually and progressively through the evolution process, according to the development of our "tuner" or awareness. Let us make clear, once more, that what is big and small, time and space are abstractions or subjectivities extremely useful for our existence, products of our brain activity but which interrelationship and intimate nature are, for the time being, away from our reach or understanding.

In the known universe, every concrete thing and its "particles" or constituents manifests itself through its interactions through any/some of the four elemental forces: electromagnetic, gravity and the two types of nuclear forces (strong and weak) with other concrete things and their "particles" or constituents, either when the elements of the outer world interact between each other, as it has been occurring from the "Big Bang" up to date, and also when these elements interact directly or indirectly with our senses, following an evolutionary scheme which we can simplify in the following graph:

Previous to Big Bang (¿?)
I
I
Big Bang (do you consider it as the starting point of everything?, I do not)
I
Primordial Plasma or Magma
I
Radiant Energy
I
Matter (subatomic, atomic particles, basic light elements)
I
Matter aggregates (molecules, celestial bodies, planets)
I
Life (replicate elements , organisms)
I
Consciousness (animal brains, intelligence)
I
Self-consciousness/language, Awareness (front lobules)
I
(do you think this is the closing point? I do not)

Although we do not always stop to think of it, practically everything that makes up our "reality" is, in the first instance, product of these interactions, forces or relationships among elementary "particles" from nature, from concrete things such as water, an apple, fire, a stone, air, the sun, the planets, a tree, a book, computers, an animal, atoms, quarks, etc., etc., and we assume, up to abstract things such as fashion, God, beauty, truth, good and evil, the devil, angels, lust, love, numbers, time and space, etc., although in these cases we do not yet have the adequate verification, apart from incipient experiences – through magnetic resonance – that allow us to relate our thoughts with certain electro-biochemical processes, such as the nervous impulses transmission or neuronal communications through synapsis, neurotransmitters, their later cortical processing, etc., etc.

According to present information, all scientific disciplines related to the study of our past, let us say cosmology, geology, paleontology, archeology, anthropology, molecular biology, genetics, history in

general, clearly show an evolutionary process where, from the primitive magma or plasma expansion on, the interaction of each level´s elementary "waves/particles" gives way to the appearance or emergence of different structures, thus gaining at each step different elements of growing complexity and capabilities. Each with characteristics or properties of their own, which are different from the original elements that gave place to them which we define as "emerging" properties. For example, the formation of the first water molecule in nature can be explained by the electromagnetic force or interaction between two hydrogen atoms and an oxygen atom, which gave way to the appearance or "emergence" of a new compound: the water molecule, with characteristics of its own, different from the two constituent elements, the original oxygen and hydrogen atoms, which, in turn, had been previously created by another process, as we have seen, in which some of the nuclear forces in the primitive magma or plasma – hydrogen – or in the interior of the stars – oxygen - had intervened or interacted at different degrees.

Likewise, from the later interactions among certain and different molecules those with self-replicant characteristics emerged, and in turn, from the interactions among these ones, the first cells emerged, which gave place to the first organisms by interacting among themselves, in increasingly complex processes, which have not been explained yet.

What do we mean when we say that elements or things "interact"?

We mean that every thing or element is affected by another one (and vice versa or reciprocally), when its structure and/or behavior, and/or any parameter that defines or identifies it as such, changes in or by contact or proximity to the elements of the other.

Summarizing, the interaction between particles/waves under certain conditions results in the appearance of different behaviors or properties – emerging ones - from the original particles/waves, considered individually or altogether.

This interaction is always produced in the same way and proportion in our known universe, conforming nature´s laws and constants; these relationships or regularities are the ones which science studies and technology applies.

As we know, at the most elemental level and according to our present knowledge these interactions are produced or manifested in our known universe only through gravity, electromagnetic and nuclear (strong and weak) forces, which act more directly.

It is worth mentioning that in recent years, these forces have been physico-mathematically interpreted or tried to be interpreted as the product of a sub-particles/waves interchange between the acting elements in the relationship or interaction, working with very innovative and complex ideas, such as the string, superstrings theory, etc. However, I will stick to the word "forces" because I consider it conceptually and traditionally more comprehensible than the action of sub-particles, such as "gluons" or dimensional cords, which is more difficult to grasp.

Anyway, I think we can reproduce, and it is worth reproducing, the concept of "elementary particle" from the Greek thinking up to present time.

As we saw, the first renowned human being who thought that reality was made up of small indivisible particles was Democritus and for over 2000 years this conception was not questioned. It was by the end of the 19th century that there arouse the suspicion that there might be something else inside the atom. This was confirmed during the first years of the 20th century by Rutherford's and Bohr´s experiences and the speculations of researchers like Plank, Einstein, Heissemberg, Schröedinger, Dirac and others, which ended up in the unbelievable and contra intuitive Quantum Theory, with its group of subatomic particles. At about the middle of the century the growingly powerful particles accelerators allowed the determination of the existence of new elements in the guts of matter itself and of limits never conceived by human mind before.

Of course, all this development and evolution of concepts and new "realities" require a coherent physico-mathematical support, which is being strongly discussed and agreed upon in the scientific community today.

To this respect, one should mention the efforts of enlightened minds like Einstein among others, who worked to reach the unifying theory (Theory of the Unified Field) of relativistic and quantum concepts, which would link gravity to electro-magnetic and sub-nuclear forces, thus defining certain entelechies as gravitons, gravitational waves, branes, etc… evidently not an easy task..

Very frequently, we tend to consider evolution of scientific thinking as almost automatic or that this evolution directly does not exit, when in fact, it is a long hard road. Let us see a couple of paragraphs about these efforts and hope, written by the possibly future candidate to the Nobel Prize, the American researcher about the string or superstring theory, Brian Green (author of the book on scientific disclosure, "The Elegant Universe"") in an interview edited and directed by Peter Tyson, chief editor of Nova online (Translation for Astroseti org.)

NOVA: Is it an exciting time to be a string theorist?

Greene: It's an amazing time to be a string theorist. The last few years have witnessed a tremendous amount of progress, so much so that I think no one in their wildest dreams would have imagined that we'd have gotten as far as we have.

NOVA: Do you think string theory will ever be accepted as widely as, say, the theory of general relativity? What would it take for that to happen?

Greene: Well, the real reason why general relativity is widely accepted is because it made predictions that were borne out by experimental observations. The primary one that put general relativity on the map was its prediction of the bending of starlight by the sun, which in 1919 was confirmed by observation during a solar eclipse. That was the moment when general relativity emerged from the realm of theory and entered the realm of being a piece of reality as we know it.

For string theory to have the kind of acceptance of general relativity, it's got to do the same thing. It's got to make a prediction that is borne out by some experiment. And as yet, we haven't quite gotten to the stage where we can make definitive predictions which, if they're found, the theory was right, and if they're not found, the theory was wrong.

But we have gotten to the stage where we can make some rough predictions for things that might happen at the future accelerators that are now being built, in particular one in Geneva, Switzerland, called the Large Hadron Collider, which should be ready about 2007 or 2008. If some of the predictions that string theory says might happen are borne out through experiment at that accelerator, then I think it's quite possible that string theory would be as accepted as general relativity.

NOVA: Can you give an example of a prediction that might be experimentally verified in coming years?

Greene: Sure. One of the strangest features of string theory is that it requires more than the three spatial dimensions that we see directly in the world around us. That sounds like science fiction, but it is an indisputable outcome of the mathematics of string theory. So the question is, where are these extra dimensions? One suggestion is that they're all around us, but they're small relative to the dimensions that we directly see and therefore are more difficult to detect.

What the theory also predicts—not necessarily but possibly—is that energy can escape from our known dimensions and leak into these extra dimensions under appropriate circumstances. Those appropriate circumstances might be generated in high-energy collisions that will take place at the new atom smasher, the Large Hadron Collider.

So it's possible that through these high-energy collisions we will find that there is less energy at the end of the collision than there was at the start. If the energy loss is of just the right sort, it could be very strong evidence that the energy has seeped off into these extra dimensions. If that were true, if that were the best explanation we could find, that would be strong evidence that the extra dimensions are real, and that in turn would be strong evidence that the framework of string theory is correct. ...

... NOVA: Have you ever had doubts about string theory?

Greene: All the time! I mean, it is a very strange research career, in a way. So far I've spent something like 17 years working on a theory for which there is essentially no direct experimental support. It's a very precarious way to live and to work.

The funny thing is, I sometimes get the impression that some people outside of the field think that there's some element of security that we have in working on a theory that hasn't made any predictions that can be proven false. In a sense, we're working on something unfalsifiable. And there sometimes is a sense that we're happy about that. But let me state categorically, if the theory is wrong, I'd like to know it today so I wouldn't waste my time on it any longer.

We will have no certainty that it's right until the experiments show that it's right. However, I should say that in my mind there is a strong circumstantial case already that it's correct, because it puts together general relativity and quantum mechanics, and each of those theories has already received a fantastic amount of experimental support. String theory is the most developed theory with the capacity to unite general relativity and quantum mechanics in a consistent manner. I do believe the universe is consistent, and therefore I do believe that general relativity and quantum mechanics should be put together in a manner that makes sense. That's what string theory does, and to me, that's pretty convincing.

Limits to understanding

NOVA: Is there any way you can make people who know little about mathematics understand the supreme elegance of string theory?

Greene: I think so. You know, when we talk about theories of physics being elegant, what we often mean is that a theory is able to explain a wide range of phenomena using a very small number of powerful ideas. The elegance comes from the tremendous reach of these few simple ideas.

"No matter how hard you try to teach your cat general relativity, you're going to fail."

And that really is a core characteristic of string theory. We have this idea that the basic constituents of nature are these vibrating strings, that their vibrational patterns dictate the properties of particles, and they dictate the kinds of forces at work in the world. If the theory is right, that simple notion will perhaps be able to explain, in principle, every physical phenomenon. That powerful reach is where the elegance resides.

... NOVA: Do you think there are limits to how much we can know about the universe?

Greene: I don't know. I'd like to think that there aren't, but I suspect that's a little optimistic. An analogy that's used in the NOVA program that I'm quite fond of is: We are certainly aware of intelligent beings on this planet whose capacity to understand the deep laws of the universe is limited. No matter how hard you try to teach your cat general relativity, you're going to fail. There we have an example of an intelligent living being that will never know this kind of truth about the way the world is put together. Why in the world should we be any different? We can certainly go further than cats, but why should it be that our brains are somehow so suited to the universe that our brains will be able to understand the deepest workings?

..... NOVA: Well, for example, most people have trouble envisioning a fourth spatial dimension. Can you?

Greene: No. I cannot envision anything beyond three dimensions. What I can do is I can make use of mathematics that describe those extra dimensions, and then I can try to translate what the mathematics tells me into lower dimensional analogies that help me gain a picture of what the math has told me. But the picture is certainly inadequate to the task of fully describing what's going on, because it's in lower dimensions, and in higher dimensions, things are definitely different.

To tell you the truth, I've never met anybody who can envision more than three dimensions. There are some who claim they can, and maybe they can; it's hard to say. But it's very hard, when your brain is involved in a world that appears to have three dimensions and is well suited to envisioning that world, to go beyond that and imagine more dimensions.

... NOVA: What advice would you have for an aspiring string theorist? Go for it, or for God's sake stay away?

Greene: I think ultimately you've got to follow your heart in these matters, and if these are the kinds of ideas and questions that are burning within you, and you just can't imagine not having them at the forefront of what you do in day-to-day work, then yeah, you've got to go for it. On the other hand, this is a very speculative field, and it could turn out to all be wrong. And if that's the case, and you would feel, after putting years of research into the subject, that those years were wasted because the theory was wrong, then it's probably not the right field for you.

I and many others, however, would not feel it had been a waste of time if the theory turns out to be wrong, because we've developed a lot of important mathematics. We've developed connections to other, more well established areas of physics, which I think will be important in their own right. We will have done some very valuable work. To me, if the theory turns out to be right, that will be tremendously thick and tasty icing on the cake, but without that icing, to me the work will still have been incredibly interesting and useful.

NOVA: You're just finishing up a new book. What's that about?

Greene: That book is about space and time. The Elegant Universe was about the search for the unified theory, and space and time were supporting characters in that story. In this new book, space and time are the main characters. It's really a discussion of our ever-changing grasp of what these seemingly simple notions of space and time actually are.

NOVA: You mentioned unified field theory. If string theory does lead to the so-called "theory of everything"—I know you don't like that term much—where would theoretical physicists go from there?

Greene: Well, I think an analogy that I believe Richard Feynman once used is probably the best one to explain where we would be. If you are learning the game of chess, the first thing you have to do is learn the rules. But after you've learned the rules, the game of chess for you is not over. It's just beginning, because now you can apply those rules to play all sorts of wonderful games that involve all kinds of strategy and allow you to explore the richness of that universe.

"A unified theory would put us at the doorstep of a vast universe of things that we could finally explore with precision."

Similarly, if we did finally have the unified theory, if we did finally have the deep laws of the universe in hand, that in a very real sense would also be a beginning. It would be the beginning of our quest to use that deep understanding to fully explore this universe, to fully understand black holes and stars and galaxies and even the big bang, to fully understand how things got to be the way they are. So in many ways, it would just be the start. A unified theory would put us at the doorstep of a vast universe of things that we could finally explore with precision.

As we have seen in this partial expression of thoughts of a scientist specialized in superstrings and super symmetries, there is nothing that assures us we are in the correct way to find the answers we are looking for, neither that these will come up tomorrow product of a miracle, but that is no obstacle, absolutely, to give up trying. There is too much work, effort, time and money spent on these activities maybe because historical experience shows that only through these speculations, trials, errors, refutations and confirmations known to be temporary, human knowledge progresses.

Let us remember something about these primary and fundamental forces:

Gravitational force: it is the force generated between particles/waves masses; although it is generally positive (attraction), there are suspicions about the existence of negative cases (repulsion, maybe responsible for the expansionist acceleration recently observed in our universe). Its reach is practically infinite, instant and proportional to the masses in consideration, but its power decreases as the distance between particles grows. Because of these characteristics, this is clearly shown between big bodies like planets, stars, galaxies, but it is almost neglectful in the subatomic or quantum level, in front of the high value of the nuclear forces present in those levels.

Electromagnetic force: it is the one generated by the particles´ electric charges: when they have the same charge they repel each other and when they have different charges, they attract each other, with magnitudes which are inversely proportional to the distance between them. They are significant in the subatomic, atomic and molecular levels, although their effects can be also considered in the macro level, especially in the case of magnetism. The movements of electrically charged particles, which generate magnetic fields and vice versa are equally important.

Weak Nuclear Force (or Fermi´s): These forces are responsible for certain interactions among elemental particles, such as neutrinos and matter, in certain nuclear reactions like the ones that take place in the sun and in radioactive processes. They have a limited scope: 10 to the power of minus 15 meters (one ten billionth centimeter approximately),

Strong Nuclear Force: it is responsible for keeping particles with the same electric charge together, as in the case of protons in the atomic nuclei. Its absolute value is high in terms of energy, but, like the other nuclear force, its range is only approximately some billionths part of a centimeter.

As I mentioned before, there is no scientific evidence of any other kind of basic interaction among elements of different nature from the four forces described or the ones derived from them, from electric transmission to love;

For almost a century, scientists have thought that there is a joining element among these basic forces of nature and they have been looking for it earnestly, in what is known as the theory of the unified field, or theory of the whole. In the same way, in 1868, Maxwell found the relationship between forces, charges and magnetic and electric fields; something so simple and practical like the fabulous relationship discovered by Einstein in the almost magic formula $E = m.c^2$, that relates mass and energy; but this wished relationship has not been attained so far.

A matter of numbers

When interaction takes place among a few elemental "particles", the results of putting or taking or moving some of them from their habitual locations do not imply major surprises; this is studied with a high degree of certainty in the particles´ accelerators and colliders, where the work is done with incredible precision. This takes a dramatic turn when we speak of interactions at macro or everyday scale, where every real life experience means in every case, the interaction of millions and millions particles that intervene practically simultaneously and new "emerging" properties appear as product of myriads of interactions and combined geometries.

To this respect, we could remember with wonder that a simple water drop contains something like a thousand trillion water molecules.

With this, I want to emphasize maybe that the interaction of a pair of thousands or millions of "particles", atoms or molecules with one another, will almost surely be unnoted in every respect in the macroscopic world of daily life and it would hardly be considered a conscious or conscious aware experience or one that is somewhat part of the "reality" of our knowledge.

In other words, our everyday experience, no matter how specific the considered event may be, is the result of multiple interactions and I think it is not yet clear the role that they play in this multiple experience that conforms our consciousness and awareness, the big numbers theory, chaos, the progressive complexity increase with the consequent appearance of unexpected emerging properties in each step and even the evolution or Darwinian machines, especially in the interaction with the over one hundred thousand million neurons in our brain. (see: The Society of Mind by Marven Minsky, 1987)

Not until recent years, with greater knowledge about atomic and subatomic structures, coupled with greater and better possibilities of handling them through nanometric-scale techniques, chemistry seems to work on preconceived strategies, not by accident or chance, as it occurred , for example with the first alloys or, in other times, with rubber vulcanization.

Still, we do not know the ultimate reasons for most changes or "emerging properties" we see in nature, for example, why a thermal treatment and, maybe the adding of certain metallic salts, transforms some opaque and dull sand and silicates into a wonderful lump of colorful, glassy reflections? Or, moving in the evolution scale we ask ourselves about the consequences or derivations of those first interactions among the elemental forces mentioned (gravitational, electromagnetism and nuclear) with the subsequent appearance of new and growingly complex attraction/repulsion forces, moving from the unknown interactions of the elemental components of the whole

among each other, to the waves/particles interactions at the subatomic level, to the following level of atomic interactions, then to the molecular level, etc., etc., up to the macro and every day level where the physico-chemical and electromagnetic affinity in general trigger the emergence of: surface tension, capillarity, osmosis phenomena, conductivity, the synaptic potentials, neurotransmitters, etc., that in turn give place to the more abstract or complex interactions in living beings where the homeostatic mechanisms appear, those that regulate thirst, hunger, sexual desire, love, hate, up to the feelings and thoughts of human beings that when they interact between each other and their environment, develop cultural guidelines that give place to ethic and moral values, etc., that according to popular a saying they "move mountains" or "pull harder than a pair-bullock carriage "

We do know, instead, that every interaction between concrete things is, in the last instance, a manifestation of the action of any of the four elemental natural forces already mentioned: gravitational, electromagnetic, strong and weak nuclear ones and we also know, that this interaction has to have a certain number or "particles" in order to reach our knowledge or awareness, something like a critical mass or minimum interaction quantum, necessary to produce the wave function collapse, decoherence or conscious and awareness experience.

This way, we can study the case of a piece of charcoal in the open air, that apart from being exposed to the influence of the whole world gravitational forces and of the different radiations of the earth atmosphere like, for example, the photoelectric effect of solar radiations will remain unaltered (for our senses at least) as far as the surrounding energetic conditions do not change drastically. In turn, if we put enough energy on a spot of its surface, like a match flame or heat by the concentration of solar radiations through a magnifying glass, we can obtain the interaction between the external charcoal atoms electrons with their corresponding ones from the oxygen of the air surrounding it, in what we know to be a combustion phenomenon or process that can be self-kept and which will be over when most of or every part of the solid charcoal turns into gaseous carbon oxide.

Leaving aside certain technical details, that may be important in other analysis, we can say that we are facing a case where the basic characters of this change are electromagnetic and nuclear forces, as the main evidences are the result of an oxide reduction reaction, with energy relief, change of state, etc.

As we may remember, combustion reactions as described above are known in chemistry with the name oxide reduction and they are clear examples of the process through which some of the most external electrons belonging to the different intervening atoms, adopt specific behaviors that confer certain properties to the resulting compounds. The same as with the water molecule above mentioned, in this case there are also new elements as final result, "emerging" elements: oxide or gaseous carbon dioxide molecules and the appearance , relief or transformation of an energy which turns from its potential shape in its original chemical state (the different energy contents in carbon and oxygen electrons according to their orbits) to a kinetic or dynamic state (heat and light radiation), and totally different properties in the newly formed products, at least for our sensitiveness, to the ones in the compounds that originated them.

As we have already said in every elemental interaction the four forces mentioned (electromagnetic, gravitational and the two nuclear ones) will always be present, but the participation or supremacy of one over the others is variable and depends on each interaction considered, for example, in the case of interaction among elemental "particles" of the surrounding concrete things and their sensitive manifestations. Although in our analysis the electromagnetic force is preponderant, the other forces that are always present and may be relevant in other type of analysis or consideration should not be forgotten.

As far as we know, most of the known things that make up our concrete and everyday "reality" are predominantly created by some kind of electromagnetic interaction between atoms and molecules, as it is the case with the above mentioned examples within the framework of an always present and practically invariable gravity, and as such, its presence seems almost unnoticed in face of the noticeable changes produced by electromagnetic interactions. On the other hand, at cosmic scale, gravity becomes preponderant to our attention, and the weak nuclear force will be the one which determines radioactive degradation; and at subnuclear level, the most outstanding interaction role corresponds to the strong nuclear forces.

In order to have an idea of the relative magnitude of these forces, let us consider a scale of intensity of the different acting forces of an atom's constituting elements, where we assume that gravity has magnitude 1. Comparatively, in this case the weak nuclear force would be 10^{+34} (10 to the 34th power, that is 1 followed by 34 zeros) times, electromagnetic force would be 10^{+37} (1 followed by 37 zeros) times and the strong nuclear force, 10^{+39} (1 followed by 39 zeros) times.

Let us think that a difference of only two zeros in the order of magnitude, like weight (for example from 10^{o} a 10^{+2}) means the difference between lifting 1 and 100 kilograms.

Here I want to highlight that in our daily experience, the one of common sense, lunar gravity attraction, for example, exists at every moment, but it is negligible compared to other experiences, let us say,

salt flavor, how we see an image or we hear the sound of a car passing by or the way we smell the scent of a flower. However, it is not unnoticed with respect to big water masses as it is the case of tides. Likewise, although in everyday life we do not appreciate the changes in the atoms nucleuses with which we interact (strong nuclear force), those changes do exist almost unnoticeably in our environment, or can "exist" according to the level we want to analyse. Such is the case of the thermonuclear reactions with which our star, the sun, gives us life with its photons imbrue and which is also responsible for the derived and subsequent energy and forces interchange that generate storms and climate disasters that, in other circumstances, takes life away or, with not that seriousness, burns our skin in a foolish day at the beach and even other ionizing radiations that play a extremely important role in the evolutionary change process are assumed.

To better understand the world of big numbers and the possibilities and probabilities of fulfillment of a determined event – vital to understand the scheme proposed for the emergence of consciousness and "reality" – I propose reading the best-seller "Origins" (Shapiro R., 1986) by the renowned researcher in biochemistry Robert Shapiro, professor at the University of New York who in his Chapter 5 proposes his very practical allegory or metaphor of the "tower of numbers" that is very didactical to understand part of the phenomenon of big numbers and how the improbability of getting a number drawn in the lottery, turns probable for a lucky person every day.

As we see, the "reality" of the concrete things we want to take into account depends on the level of analysis we may or are willing to undertake.

Our ancestors did not have the possibility to know the subatomic "reality"; their tuners and the knowledge they conveyed were not enough. It may be appropriate to clarify in this respect that it is highly probable that the antennae - the senses- of our ancestors´ tuners as well as the tuners of some contemporary animal species have been and are superior than ours; for example, lynxes´ or flacon's sight, hyenas´ or sharks´ smell, a spider´s touch, the geomagnetic orientation of certain migratory birds, etc., a Cromagnon's sense of smell or sight, etc., etc., probably giving a greater or better consciousness level -signal profit-. But the fundamental difference from our perspective is given by the demodulator/integrator equipment of the human tuner - our bigger brain with its pre-frontal new cortex and its redundant functions - that produces an emerging property: awareness, which our ancestors lacked and still today our cousin animals lack.

However, if you asked me if having these new redundant functions and their consequent "awareness" is a big evolutionary advantage, something that would make us feel superior or a cause for pride, I would answer that that is something we still have to see (without too much fuss, cockroaches and a lot other bugs could survive many more years than the, sometimes, miserable and cruel time human beings take on the face of the earth). Moreover, there are those who think- it is not precisely my case - according to their faith or luck, and seeing human experience, that all this is a real poisoned gift.

Not reaching such extremes, in more than one opportunity most of us use to agree with the novelist Milan Kundera (Czech Republic, 1929), on how right the title of his awarded book was: "The Unbearable Lightness of Being"

The processes that shape awareness, consciousness and knowledge

As I pointed out before, the "emerging" properties of awareness, consciousness and knowledge spring from the interaction (which can be direct or indirect) and at every level, of the basic elements from the "Whole" between each other, and with the sensitive elements from our body –or the other way round, if you prefer- since the moment of each human being´s conception, following patterns that evolution has been characterizing in the genotype, in permanent relationship with the environment.

According to some investigations and present conclusions of neurobiological sciences, it seems that though the rest of living beings in general have what we call consciouness in different levels corresponding to each individual´s cerebral and sensitive schemes; some of them with attributes and potentialities unknown or even superior to those of man. Only some superior primates show some hints of consciousness and it is only the human being the one that has developed so complex manifestations as language, abstract thinking and self-knowledge or awareness, that have permitted artistic prodigies, as "The Gioconda", scientific prodigies, as differential calculus and technological prodigies, as the international space station.

Apparently, as neurobiologists say, these properties are characterized by the activity of certain parts of our brain mainly in the last neural developments of superior primates which are, among others, the qualitative/quantitative details of the pre-frontal lobules and the neo-cortex related to senses (for more information about brain functioning, I suggest reading interesting neurobiology investigation works, like The executive brain, by Elkhonon Goldberg, which has a Spanish translation, Editorial Crítica, Barcelona, 2002)

Remembering the well-known case of the American Hellen Keller, who turned blind and deaf and who, in spite of her disabilities could achieve a remarkable social and cultural development thanks to her own effort and the help of her teacher Anne Sullivan, we appreciate the incredible flexibility of the

brain/tuner to develop new circuits of knowledge and awareness in spite of the limitations or alterations of some of its original neuronal conducts of the sensitive elements of our body and we understand the permanent malleability and growth –evolution in the last instance—of the "tuner" in face of the obstacles posed by the environment.

With this basic reference to our senses, I only wanted to highlight that all our knowledge, consciousness and awareness are basically formed, at a first level, by electromagnetic and nuclear interactions among electronic structures of the concrete things around us and the corresponding electrical structures of our senses. This is performed in a similar way as in every living being, generating what we call consciousness and growing knowledge according to the evolution scale in the phylogenetic and ontogenetic developments of each individual of every species.

It is only with the recent qualitative and quantitative development of animal brains, in particular the pre-frontal cortex of big anthropoid primates and hominids, which seems to act as a redundant element of the ancestral limbic system, there comes the gradual advent of the last "emerging property" of the known evolution: our awareness. This means that there appears a new "tuner" model which, apart from grasping "reality" it produces unedited abstractions as well: the self, not self, language and self knowledge in the individual together with culture and the accumulation of knowledge in individuals communities.

For the time being, there seems to be consensus in neurobiology sciences in the following questions: the brain´s (tuner´s) growth, the appearance of consciousness, awareness and knowledge in every individual is the product of interactions, inter-relationships and interconnections, synapsis, etc., among the neural cells or neurons of the CNS, as of the origin of that individual, between each other or with the environment. If this were also true onto and phylogenetically speaking, we would be facing a mechanism that would very well explain the development of, among other things, the cultural manifestations as sciences, art, and also humanity´s religions.

Analysing the development of great knowledge landmarks in man´s history, we see that, in general, any significant advance in human potentialities has been the product of observations and thinking that required suitable brains ("tuners") fit to grasp the "reality" before their eyes at that time.

It´s hard to imagine a Neanderthal understanding God´s word or monotheist religions, or an Egyptian in pharaoh's times grabbing infinitesimal calculation, or a citizen at revolutionary France discussing the general relativity theory. In no case were the "tuners" ready for such challenge: nor they harbored the concepts, memories or knowledge of such "interactions". It was necessary that our brains/tuners developed phylogenetically until they could elaborate abstractions and symbols that permitted the emergence of the essential physico-mathematical concepts to work coherently on the sensible reality.

In this sense, first language, then writing, were Copernican landmarks; no other alive or known species has achieved this so far.

Some conservative thinkers believe that there has been no trace of evolution in man in recent years and this may be true as regards their external corporal physical aspect, but this criterion is evidently very limited and chauvinist as, leaving aside the evident changes that took place and were reported in the aspect of our Australopithecus cousins, following the latest anthropological researches (Wiquipedia Encyclopedia on the Internet), we can see the changes produced in a "single" bone as it is the sphenoid and its suspected relationship with human evolution:

- 60 million years ago the prosimians had a horizontal and flat sphenoid as the immense majority of the other animals with a brain.

- 40 million year ago, in simians the sphenoid had a first downwards inclination what allowed an increase in the encephalic capacity, the occipital lobules got more room and thus the perfection of stereoscopic sight and maybe visual memory were attained.

- Less than 12 million years ago, a new downwards inclination is produced, this in the evolution line that would originate the anthropoids, that would imply a brain even bigger in proportion to the rest of the body.

- 6 million years ago, with the Australopithecus, the sphenoid inclination is again accentuated, and thus, the neurocranial capacity is increased again.

- 2 million years ago, a new downwards inclination of the sphenoid is produced, what coincides with c total bipedism, such bipedism has required a voluminous brain and with complex neuronal nets in order to keep this position opposed to gravity; it is also likely that that new sphenoid position had allowed a rudimentary speech which phonemes were click/cluck noises and guttural tones.

- Between 200.000 and 160.000 years ago the sphenoid gets the inclination that it has in the Homo Sapiens Sapiens, it coincides with the increase in brain capacity (specially of the frontal lobules), accompanied by a greater blood irrigation to the brain.

On the other hand, the most interesting aspect of human evolution is its intellectual development and in this sense it is evident that day by day there are growing records in the memories of our brains/"tuners", through new interactions that bring about the emergence of unedited knowledge and this seems to be the most important evolution process. This way, we have new

melodies, new cultural guidelines, new fashions, customs and also, why not? new scientific and religious paradigms.

Still not knowing if this will be for better or for worse, we are sure that brains/"tuners" developed and go on developing thanks to rules that are in force in our universe: rules of the attractor type, according to Illa Prigogine, or morphogenetic fields, in the eyes of more esoteric authors, or the "intelligent project" according to some religions to such an extent that there are those who consider that if Newton, Michelangelo, Einstein or other similar geniuses had not existed, others would have surely and equally reached to the same conclusions and productions, or similar ones, some decades after or before.

This becomes more evident in the technological field, where similar devices are attempted to be patented or developed simultaneously—leaving aside cases of ill will—in different places not related between each other. Such is also the case of some monotheistic religions, which present a singular origin similitude, in place and time, as well.

According to what I explained above, if the connection between brain and "reality" were true and, without leaving aside other developments, will there be anything more promising to humanity than to study brain functions? Both, from the cost/benefit point of view, and, from the possible results that would affect every filed of thinking.

Or also, will it be possible or convenient to look for the improvement and acceleration of synapses, neuro-transmitters and other brain/neural processes?

Parallel Universes

Coming back to the wave/particle duality, you may ask yourself: what is the difference between considering "reality" made up of waves and not particles?: …. Well, when ceasing to consider elementary "particles" as specific elements, individual small matter or energy balls and assuming every interaction experience as the only possibility of making a determined and concrete "reality", the Quantum Theory, with its clouds of infinite and indeterminate probabilities – waves, strings, entangles - that replace every specific "particle", proposes a change for every opportunity, every synapsis if you prefer, every interaction of elementary particles/waves/strings between each other at every moment, an infinite number of interactions or simultaneous "realities", thus conforming the hypothetical "parallel universes" of which Everett, De Witt, Paul Davies, Tagmark, David Deutsch speak, among other renown physicists

This may sound rather strange at the first moment, but it is not so much if we remember isomers phenomena in chemistry.

Isomers are compounds, generally molecules, which are integrated by similar quantities and proportion of determined atoms; for this reason, one could expect to find similarities in their characteristics and properties.

However, as their configuration or geometry – the way atoms are linked between each other - is different, their behavior differs dramatically.

Such is the case, among many other examples, of Cis and Trans isomers of unsaturated fat acids. Their differences in terms of interaction produce dramatic consequences is cholesterolemia in human beings, which not until recent years have been addressed by nutritionists and which are alike only in their spatial structures, their geometry, though not in their composition as seen in their respective formulas:

(For a detailed study of this founded speculation or argumentation, I recommend "Quantum Evolution" written by my colleague, John Joe McFadden or to visit his website).

So, there exists the possibility that every brain, every self-conscious mind or a mind with awareness or in other words, every conscious individual can build up in his/her mind (perhaps with/in the new neural sectors of the prefrontal cortex and its connections, in the cortical and/or subcortical brain regions) numerous and different interactions –geometries—with the same signals conveyed by senses. This will provide what will be different, multiple, may be infinite "realities", which will have nothing to do with other versions of the same trunk, from which it separates in every bifurcation or interaction of its "tuner" – he/she himself/herself - with the (waves/"particles" of) the "Whole".

One will have to think, then, that from the transformation of the specific "particles" (electrons, quarks, etc) into clouds of probabilities (waves/strings), what we understand as a unique and definite "reality" is rather a cloud of interactions and consequent "realities", each one of these with the potential of "collapsing" – to "decohere" according to physicists— into different independent universes, or not causality -related : the "Parallel Universes".

I think we are facing an obvious and inevitable conclusion.

Inexorably, only future developments on the study of the brain and awareness will confirm or not these assumptions and I believe that the "whole" proto theory

and the "tuner" metaphor are quite appropriate to work on the comprehension and disclosure of this line of research.

Let us quote again the interesting article written by Dr. Fernando Cardenas Parras: "Anatomy and physiology of mental representation"

"A controversy between two positions has recently appeared: a classical one, according to which the spatial topographic representation would be enough to explain awareness processes, and a contemporary one according to which this topographic representation is not enough in itself and has to be complemented by a temporal analysis. This second position is top ranked nowadays in research and has given rise to the concept of binding that can be translated into Spanish as integration (Llinás, R,., personal communication; Horgan, J., 1994) or coherence (Cibilis, D., Lorenzo, J., and González, N., 1995). *Anatomically speaking, the circuits responsible for this process have been described long time ago (for example in 1968, Krieg, E. They correspond, basically, to thalamus-cortex type projections, similar to the ones related to sensitive relief, but in this case it is not a specific projection bound to a certain modality, instead, it is bound to a spontaneous-type work of other neuronal populations related to the ascendant activator reticular system. Therefore, they are circuits highly parallel to vigilance and attention activity. Spontaneity should be understood as the process organized in space-time, in such a way that the spatial level establishes contacts with certain cortical dendrites branches (mostly in the superficial layers) throughout the cortex. Likewise, there exists a temporal functioning sequence that can be macroscopically understood as a sweeping away effect of the cortical state of activation, performed in the face-caudal direction at a very high speed (one every 12,5 milliseconds, approximately). Taking into account the momentary state of cortical activation, these circuits would allow the creation of a comparison continuum between the previous state (s) and the present one (s), process that would correspond, according to some authors, to the awareness phenomenon in itself. There are some experimental data that support this hypothesis; the most convincing ones of all are perhaps, the ones that belong to Urs Ribary and his group from the University of New York: in his typical experiments, he asks a person to listen to a sound, binaurally presented, and say if it is presented in one or two ticks. Simultaneously, a magneto encephalographic register is being taken in the temporal lobule. Originally, there existed psycho-physics reports, mainly as a result of Kristoffersen´s work, which could infer that there is a minimum time for the perception to be established. However, not until Ribary´s work, a neurophysiological correlate of the responsible mechanism could be established. According to the data obtained, if two clicks are presented temporarily separated by 12,5 ms or more, the stimulus perceived will be heard as two sounds; but, if the temporal distance between the two clicks is less than 12,5 ms, the perceived stimulus will be judged as only one sound. In other words, the brain makes a reading of temporal quantum of 12,5 ms; all the information (translated as cortical activity dots) presented in each one of these temporal sweeps will be compiled as only one "cognizant image", which will integrate itself with the next period of 12,5 ms, giving way to a topographic space-time representation. This hypothesis is in the frontier between the brain topographical representation and the mental representation, backing late 19th century William James´s intuitions, who considered awareness as a flowing or progressing course. However, it is clear that this hypothesis only takes us to another level in the process of clarifying this phenomenon, but it gives us the possibility of disentangling the subjective world´s mystery."...*

It is also worth mentioning that in our universe not all the interactions among quantum elements are possible and that certain configurations of matter—quantum or not—are vetoed in such a way that, for example among a number of chemical elements as in Pauli´s exclusion principle, are impossible, or that only a few and determined variable values (never continuous) are feasible, as in the case of the photoelectric effect, that, when a photon come in contact with or is freed from an atom electronic structure, the detected electrons energy levels take perfectly defined but not continued values and it is always like this in the universe we perceive.

Isn´t it striking that only certain values of those variables can be observed and measured? Where are the mysterious and logically necessary intermediate values? Why is it that we can never detect the infinite intermediate values?

My appreciation about this incapacity, the fact that present sensitivity of our measurement and exploration instruments (our extended senses, the antennas of our tuners at last), beyond the marvelous scientific breakthroughs, is not yet enough to highlight or detect those "particles" and consequent interactions that, due to their smaller size or other characteristic, maybe typical or natural of our species, as it would be the case of a supposed agnosia derived from the lack or faulty interaction between our senses or brain/tuners with that set or area still unknown and for the time being inaccessible of the "whole".

So far, the most precise instrument to study or visualize the subatomic reality is the electronic microscope, which, in spite of its amazing power to grasp matter´s inside, its sensitivity is limited by the size of the photons or electrons it uses as "scalpel" or measurement tool. Therefore, this will be its utmost

definition capability. Any particle, element, or set of elements smaller than a photon or an electron, will not be assessed by this device and that is just our present limit…further, there is only our imagination and intellect which keep us amused, for example, with the speculations of this essay.

Is it possible, then, to imagine thousands of other elementary particles—existent in the "whole", perhaps the continuum—with special characteristics, with which we have not interacted yet, but that may make up or do make up infinite different universes, perhaps overlapped to our or other space-time as Bruno, Berkeley, Heisemberg, Borges, Everett and many others suspected in the past and that today De Witt, Davies, Deusch, Rees and other outstanding contemporary thinkers support with different shades of meaning?

¿Could there be the "mirror neurons" responsible for the redundant processing that produces the "I" phenomenon, in the way that Platon suspected that the shadows reflected on the walls of the cavern represented the true "reality"?

Since almost time immemorial, the concept of the "THE WHOLE, EVERYTHING" has a more than interesting background in conscious or unconscious allusions in the minds of different thinkers like Spinoza, Bruno, and, in general, of those who have speculated with infinite´s meme and mirrors, as Borges does in some lines of his fantastic story "The garden of bifurcating paths" that belongs to Fictions (1941):

"the garden of bifurcating paths is an incomplete, yet not false, image of the universe…"

Is Borges perhaps suggesting that there is a universal entity, more comprehensive and complete than the known or even imagined universe? … or,

"does that fabric of times to come (that come close to each other), that split, are interrupted or are secularly ignored, comprise all the probabilities…"

Different times that are ignored? … that do not interact?…To comprise all the probabilities… Could Borges have imagined something like a WHOLE? … or,

"time bifurcates everlastingly towards innumerable futures…"

Perpetuity, eternity, to be for ever in *every* possibility? … or,

"the damp garden that surrounded the house was saturated to the infinite with invisible persons…"

Saturation of the infinite, ¿the "Whole" again, the continuum?

Poets, literates, pintores, plásticos y artistas en general, teólogos "chamanes" (religious people), prophets, gurus and other intellectuals who, from different points of view, propose diverse connections between "reality" and fantasy, the concrete and the abstract, synthesizing between the outer world or environment and our brain/tuner, agree, though using unlike methods and interpretations, with men of science when they dive *beyond* into the "Whole"´s depth.

As I mentioned before, the above description poses some objections by those who say that it has been impossible to see the other remaining elemental "particles" from the "whole", even less their interactions with our or with other living beings of the known universe.

This objection reminds us of the situation ancestors lived in the world previous to the development of electromagnetic radiations´ knowledge: all of them were immersed in a sea of radiations, but no one was conscious of it; consequently, that universe did not "exist". It was enough that Marconi and others developed/explained the interacting elements between them and our senses — the brains/"tuners" — for that "reality" to change.

So we see that there is a direct relationship between what we are likely to acknowledge that "exists" and what we would be able to "decohere", according to our circumstantial data derived from our tuner´s capacity.

According to this interpretation, awareness and knowledge—as any other concept or element of the known "reality"—are products from the natural evolution of things, products, in this, our universe. Summarizing, "reality" changes and apparently will keep on changing at the same rhythm of the interactions of our brains/tuners with the environment and the own neural interactions – memories, knowledge – derived from them.

Attentive to this evolution changes, some thinkers as the informatics expert Ray Kurzweil ("The era of spiritual machines", 1999), dare forecast that the manipulation of elemental waves/particles will allow, maybe in a not far future, to imagine true "chosen from a menu/customized" realities according to the wish of those individuals that can create and re-create their existence at their will on the artificial structures that remedy our present organisms, brain/tuner included.

As that almost mythological character of the universal literature said referring to his adventure mate: "Sancho, you will see things that you won't believe" ("Don Quijote", Miguel de Cervantes Saavedra, first 1605 or second 1615 version – ¿apocryphal?)

Decoherence and awareness

The word *decoherence* in modern physics refers to the interaction phenomenon between quantum, elemental "particles" in nature – the "reality" exterior to us – and the terminals – also quantum – of our senses by which only one of the infinite and mixed ("entangled") states of the matter are "crystallized", thus it is a process that turns the world imprecise and overlapped of possibilities of the quantum universe in a unique and palpable "reality" for our senses, at least for our version of "reality".

This process is precisely studied through appropriate instruments as would be the particles accelerators/colliders. Through this device the only one of the likely and infinite overlapped – entangled – estates in which, according to Heisemberg's uncertainty principle, all the subatomic elements that constitute the known nature in this, our universe are, will "collapse" or become concrete for our consciousness, awareness and knowledge with also only of the likely and infinite overlapped states at subatomic level of our sensitive element or sense (nervous terminals in eyes, ears, skin, etc., etc.,) transmitting a determined signal through a kind of "snapshot", "imprint", "trajectory" or "trace" in our brain of every event. In turn, this event, according to its duration and intensity can be recorded as a conscious experience or not by our body, at least in one of the likely and infinite versions of such.

In the model I am trying to describe, awareness is an "emerging" concept, derived in the first instance or stage from the interactions (relationships and decoherence) between the elemental quantum components or nervous terminals of an organism (the sense, that is, the brain/tuner´s antennae) and the external environment quantum components , thus generating an hypothetical second stage or instance in the chain of events, relationships, electro-biochemical interactions (neurons circuits, synapses, neurotransmitters, etc. that is to say the tuner's conductors) already in the nervous central system, that finally reach the brain. There, by means of different mechanisms and ways - not yet elucidated although there are speculations of serial, parallel and holographic processes - they produce a "plaque" or own and exclusive print of the event that will be available as a kind of data base or memory, that processed in what we know as mental activity, will generate knowledge, consciousness, efferent actions and in human beings also awareness.

Moreover – though not less important and insisting on this aspect – it is worth remembering that "waves/particles" should not be considered to behave individually, except when interact among each other; as from that first relationship new emerging properties appear, different from their aggregates, not suspected in the original components, which keep on gaining complexity in the evolutional diversity that commands Darwinian's machine "natural selection" mechanism, acting over million unities or individuals.

In other words, although we can see the interaction between a few individual particles through particles accelerators and their accessories, in everyday life, what we see, and know as an exclusive and specific experience with our senses interacting with the environment, is in fact, a multitude of connections in which it is liable to suppose a vast series of intermediate emerging properties, hard to imagine in their original elements. (Marvin L. Minsky)

There is an extraordinary impressive difference between nature´s macro and micro scales and we are beginning to appreciate them through the realities proposed by the Quantum Theory.

Thus, we can attempt to describe a new evolution scale, as follows:

1º- Cyclic or periodic situation in the "Whole" which originates the "Big Bang" (one-dimension oscillators/resonators? or may be black holes that collapse—develop—into "white holes" through "warm holes")

2º- "Big Bang" that generates energy quantum, elemental particles/waves/strings that interact between each other (themselves) –evolve - to give:

3º- Subatomic components/radiations/nucleotides (forces, quarks, electrons, protons, neutrinos, photons, etc) that interact between each other – evolve - to give:

4º- Light atoms or elements (hydrogen, helium, etc,) that interact between each other - evolve - to give:

5º- Gases and cosmic powder, that interact between each other — evolve — to give:

6º- Agglomerated bodies: stars, galaxies, cumulus, etc, which interact between each other - evolve - to give:

7º- Heavier elements: oxygen, carbon, iron, etc), that interact between each other– evolve – to give:

8º- Molecules of increasing complexity that interact between each other - evolve - to give:

9º - Self-replicant molecules that interact between each other - evolve - to give:

10º - Life, cells, that interact among each other – evolve – to give:

11º- elemental organisms that interact between each other - evolve - to give:

12º- Organisms with CNS and brain (intelligence, consciousness animals, etc.) which interact between each other – evolve - to give:

13º- Men, minds, awareness, abstractions, ideas, memes, knowledge, etc. that interact between each other– evolve - to give:

14º- societies, cultures, etc, that interact between each other — evolve — to give:

… for the time being only God, or someone or something with his capacity, knows.

In this brief and concise summary of the evolution process, open on both ends, we should include the concepts belonging to D. Hofstadter, A. Damasio, P. Davies and many other intelligent thinkers, on the cumulative or increasing complexity produced in each evolution stage or level, each supplementary "meaningful layer" that is added by the "emergence" of new unexpected properties, which lead us to assert that, although it is true that a man (just to give a scale

example) is a set of atoms, it is also true that a man is not "only" a set of atoms.

In order to give a definition of man, it would not be enough to describe what the composing atoms or molecules look like or how they behave as for example, any living being - a cell - has properties such as self-replication that does not exist in any of the atoms, molecules or basic inert inorganic elements composing it.

It is the interaction among elements from each level of complexity the one that produces the "emergence" of new unedited and unexpected properties. Sometimes we see that anything added or the set of original components in a given level produce significant changes in the behavior of that agglomerate of elements that expresses itself in a new type of relationship with the environment, in a species of growing complexity scale, …. but always level by level.

In this way, atoms by themselves will never be able to make up cells, not to mention organisms, without first going through the molecules level and exploring the different types of interactions among them. Likewise, molecules alone could never give way to organs or living organisms without going through the cell level before and thus, going on in the complexity scale.

In living beings, the "reality" acquisition process and the consequent consciousness emergence is always produced very slowly in every individual from the moment of conception, that is, from the same and own conformation of the protobeing, according to time and manner established by the evolutionary process for each species. Practically, in an automatic natural or non-voluntary way - and little by little - as progressing ontogenetically and philogenetically in the – supposed by us - evolution scale other attributes or emerging properties start to appear additionally and gradually until awareness is finally obtained as a further step, product not only just from elemental "particles" or quantum interaction but also by its aggregates that are turning to be more complex from the atoms to the first molecules, then from these cells towards organs and organisms, until the ultimate known evolution products: individuals who, when interacting among each other and with the surrounding environment, in turn create emerging properties such as social and cultural behavior – which in turn are emergent properties of previous stages – in an ontogenetically and philogenetically brain growing and maturing process. In the case of human species and considering from the moment of conception, it is estimated that in every individual it requires around twenty-five years approximately to be completely developed. (There is a recent death by accident statistics that justify higher rates of brains immaturity in young people – under twenty-five years old)

Let us consider for a while a five or six year-old child. We can observe that, during waking hours, this child is well-structured and aware, with clear control of his/her movements and reasoning in response to the alternatives presented by the environment. This child lacks and adult's amplitude, accuracy, complexity and competence, thus clearly showing that both his/her entire body and his/her brain are in a developing stage, they are not complete and that it will take an intellectual as well as physical maturity process in time an manner, the characteristics of which science is rendering more knowledge every day.

Rituals and customs that define the different stages and responsibilities according to the constituent's age, from their childhood, through adolescence, until adulthood are thus produced in the different human cultures

So, we can then say that throughout a long period of our life, though we are conscious, we are not necessarily and completely aware of it and this is so because of our brain´s state and the different capacities during its evolution both onto and phylogenic. This capacity is also affected by accidents and illnesses, and it also declines, sometimes, during old age; not taking into account one third of every day in our life that we spend sleeping.

In other words, if we consider the moment of every human being´s conception as the moment the female ovule and the male spermatozoid join together, we can think about a very well known process that tells us that, in fact, the true origin can be traced back to the famous "Big Bang" and be marveled with those minute "particles" content and their interaction, where thousand millions years of evolution are represented – to name only what is known - and also potential and almost infinite futures are encoded, according to the interactions that are produced, at each step, among elemental components, to give way to determined groups with differentiated inside/outside and these, again also interact with their environment, during the development of things and beings. Nowhere in this process can we talk seriously about a homunculus being, "fleshless" entity or a supernatural will that guides it.

There are no real or scientifically proved experiences nowadays about the existence of any spirit roaming independently in the body or brain in time and/or space.

Instead we do have more than enough reasons—though nor certainties—to think of processes that, moving in accordance with natural mechanisms and rules in our universe, produce these new "emerging properties".

With this I mean and I want to emphasize that there is no connection between evolution, behavior, awareness and knowledge with respect to the will or

presence of a homunculus, a spirit, or a supernatural soul that guide the events of our lives.

Any appeal to supernatural mechanisms or miracles to explain or support these human beings´ characteristics belongs to the sphere of faith and here, there are as many explanations as religions in the world, each one with arguments that do not require any coherence and which are alien to scientific activity . This does not mean that the religious experience in itself can not be considered as an inherent part of the brain´s normal activity and studied from different fields of the neurological, psychiatric and psychological research.

We are what our brain/tuner naturally interacting let us be: we are born, grow up, become old and die with our brain; there are no personal experiences out of or independent from our brain. We are our brain, body and what they generate.

"We are our memory—Borges wrote—*we are that fantastic museum of fluctuating shapes, that pile of broken mirrors",* in that beautiful elliptical and poetic way he used to refer to abstract concepts, so elusive as mental representations and their neuronal registers can be.

Anyway, I want to beg may pardon to believers as well as agnostics for not carrying out any value analysis on the supposed "intelligence" of what is known as the "Intelligent Design" theory.

I understand that any action to that respect would offend feelings of any of the parts, and this is not my purpose.

Past, now and future, finally, time: is just an illusion?

Another intriguing aspect of the vital process and awareness is that it always happens in real time; no matter if this activity is bonded to the information stored as memory (the past) and that it is also connected to those parts of the brain that define expectations (the future), reasoning, thoughts or value judgment with the existing information or records, etc., etc., as a simply marvelous task. What is true is that awareness of what is going on - in a healthy not altered brain—is only produced in what everybody knows as "the now", in only one of the infinite and possible trajectories of the "Whole", in the way a "tuner" would do, with the infinite and diverse electromagnetic radiations that reach its antennae; they are all there……but only one manifests itself at a time.

I should not incur in any delay in making clear that I use the image of a "tuner", just as a parabola, metaphor or analogy that lets me shape awareness phenomenon referring to something already known. Before receiving justified criticism on an involuntary reductionist "in extremis" position, I must say that just as a radio tuner has got a series of necessary intermediate elements such as the antennae or waves receptor, a conductor, a demodulator, a transducer, diaphragms, loud-speakers and so on, and, of course, a source of power to transform the waves or electromagnetic signals from space into vibrations that produce pressure waves in the air or sound, in the case of an audio equipment - and other more complex elements, in the case of image transmission and emission - TV - in the same, though substantially more complex way, a series of mechanisms, intermediate steps or processes in between space/time points or singularities are needed in the CNS of a living organism. Here this relationship, a contact, a detection, in the end, a "decoherence" or a "wave collapse" takes place among parts/ waves/particles or quantum or strings of external information and the receptor (sensorial organ or "antennae") of the body's nervous system that, through the brain mental process it finally shapes knowledge, consciousness and, in our case, awareness.

Have you ever thought that the *now, this present moment* I am writing these lines is conceptually the same, but literally different from the *now* when you are reading them, and from this *now* of this very last word?

There appears a confusion as regards the multiple use of the word "*now*".

It is always possible to think about the past and also the future but always and only from the present of this *now* that is ephemeral and not able to be grasped.

In every space/time singularity that you may consider as fleeting and intangible *now*, you only have "in your hands" (your awareness or aware thinking) the information that is arriving and being processed in real time, through the interaction of your senses (in fact your whole body, including memories, homeostatic answers and so on) with the signs coming from the external "Whole", in that instant without extension we call *now* and which wonderful neural processing by the more than complex central nervous system follows in a more than intricate and still inexplicit labyrinth of activations and inhibitions where many mechanisms are involved-conscious or not - such as memories, future expectations, reasoning, etc. coupled with our body homeostatic reactions associated with our body, that some people imagine in series, in parallel or even holographically and that evolution added and adds so natural and permanently to human background in a process which origins are lost in the night of times

From this conception of time and consciousness it is possible to think that all the elements that belong to our reality, and our ancestors—all our past-, also our descendants—all our future—exist, are, in so different as individual conduits of interactions among the elemental particles from the "whole" and they only become concrete for each of us, each version of the multi-universe, in every instant of our present, in those events of real time we call consciousness and

awareness making up the now, through the interactions/relationships or decoherence of our bodies´ elemental parts - generally our central nervous system senses - with the corresponding elemental parts of the "Whole". This is performed in a similar way a "tuner" would do to catch radio or TV waves and give as outputs sounds and images through the processing of such in their demodulating guts.

All "realities" – interactions/decoherences - are possible in the "Whole", but for you, the version or versions being read at this moment, this piece of writing becomes alive now, and it is that probability the one that "collapses" in this singularity of space/time, according to the structure of the reader's consciousness or "tuner", making up this only "reality" that we share from so different and own nows.

As Borges would say in the mentioned story dedicated to his friend Victoria Ocampo:

"... then I considered that that everything happens to one, precisely now. Centuries and centuries and only in the present is when facts happen..." (El Jardín de senderos que bifurcan, 1941).

We only exist and are aware of it, in the present, the only and permanent now of any of us, yes, it is this same now I am writing and you are reading and, of course, also that other now when an unknown and remote reader is reading these words, may be with the smile of someone who now knows something we are ignoring now.

Prospects

One can ask oneself: where do the new elements and "emerging" concepts come from? Is evolution process over? Is everything already discovered? Will the infinite parallel universes of which men like Borges, Everett, De Witt, Davis, and more recently, Davies, David Deutsch, Martín Rees, Max Tegmark and many others spoke about be "waiting for us" round the decade or the century? What other new emerging elements or concepts will be added today, tomorrow or next week to the "known reality"? Where do you thing they will come from? … I do not believe it is crazy to think about the "Whole" and the "tuner"…

If we consider the exponential growth in the amount of new events, concepts, things and individuals included –by invention, discovery, emergence, birth—to everyday "reality" along the time of the known history of humanity, it seems reasonable to suppose that the number of unknown elements, unimaginable today, that are still inside the "Whole" is to a large extent bigger than we can imagine. And all this thinking only in a simple extrapolation, keeping away from the enigmatic world of chaos and complexity, full of surprises that make our precarious certainties and predictions slip and stumble.

There are recent glances into that still concealed world, like the ones proposed by the new theories on chaos and complexity. In this respect, we can read Ian Stewart´s (Editorial Crítica, Barcelona, 2001), "Is God playing dice?" It is the product of theoretical research about nature´s regularities –or irregularities - as from the beats of our heart to meteorological changes, accurately confirmed by coherent concrete practical applications like the production of sensitive metallurgic elements. These ideas tore into pieces the old determinist precise paradigm that ruled the universe and they seem to illustrate that it is inherently not scientific to make absolute certainty long-term predictions about our long-term future by simple extrapolation of our present knowledge and experiences.

Yes, obviously, everything seems a little weird, but is like this in this strange world of modern physics and quantum mechanics…strange, but it works, not only in the tunnel-effect microscopes but also in the medical-diagnosis devices, where improbable and "virtual" particles become concrete under the spell of technology or in hundreds of other technological applications which only basement or explanations are, at least for the time being, the apparent incongruence to our common sense that the extraordinary quantum theory proposes.

Once Heisemberg´s uncertainty principle was established and accepted, it was then Schrödinger who developed the corresponding wave function that allowed overcoming doubts.

That is to say, quantum physics turned a great amount of our certainties on nature´s structure or "reality" into a world of probabilities eventually measurable. If we remember the old mathematics principles, any probability which measure is different from zero, will finally be factual in a finite time, or, if you prefer it, in the eternity (the "Whole"?) the Creator has established farsightedly for these cases.

As D.R. Hofstadter puts it: What other esoteric questions and astonishing answers will hit our naïve and never-ending surprise?

Clues? At this moment, the greatest intellectual efforts in the world are focused on finding mechanisms and gadgets that would let us study "the quantum reality" from our macroscopic world, without distorting it.

In this respect, there is an important progress in quantum optics that allows to encode messages safely. In quantum computer science, there is the emergence of a new information unit, equivalent to the bit in classical digital computers (binary notation with only two possible values: zero or one): the qubit , which represents the decoherence of the infinite entangled states from their quantum world to the macroscopic collapse of our "reality" and consciousness.

Accepting that the formation of a remembrance, knowledge or an aware experience – our "reality" at last

– is as it is allowed to speculate from the Quantum Theory, a result of a limited but victorious multi-interaction in the Darwinian selection process that forms our particular and own version of our awareness, it is worth asking ourselves about the destiny of the resting and minority – in our version – interactions of every case or opportunity. May other knowledge, "realities" or coincidences participate in hypothetical parallel universes?

In order to answer these questions or hypothesis, I think that it will be necessary to wait for a greater development of very promising theories as the ones already mentioned on quantum computation, string theory, super-symmetries, up to new reasoning instruments as fuzzy logic, that allow to attain answers that will surely complement our present mathematical tools with greater precision.

Other fields of research where the quantum world is being focused, like nanotechnology, waves/particles teletransportation, the continuous antimatter production, etc., etc, allow to assure that evolution has not stopped and that, on the contrary, "tuners'" task (our brain that produces our awareness and knowledge) seem to speed up, diving into the "Whole"´s infinite reservoir.

Those who have been working from mathematics and physics on the last scientific developments such as the superstrings theory, "M" theory, Higg´ boson, etc. as the important physicist Stephen Hawking or hundreds of renown mathematicians from the Internet, speak about strings, branes, and up to hypothetical "one-dimensional oscillators" as the possible nature´s or and hypothetic "Whole" possible basic components.

Finally, we can say that the "Whole" is the sum of what exists, either we perceive it or not (again, "the sum of all histories" according to R.P.Feynman); it is the place of every possible configuration of the true "elemental particles" conforming elephants, fleas and monkeys, brains, atoms and electrons, stars, planets and galaxies, etc. Some of them interact and they produce phenomena we can interpret as movement, time, space, life, intelligence, knowledge, consciousness, awareness and other things we can not even dream of.

That "whole" can be imagined as an infinite plane or volume – just to think about familiar dimensions - in which its constituent elements are related (Bohm, David, La totalidad y el orden implicado Ed. Kairós, Barcelona, 1988), each one is and conform part of multiple, maybe infinite, configurations which are arranged according to their interactions established among them. These interactions occur in the fashion of a snapshot or a cartoon in a magazine, recorded in a CD or a familiar video tape or film: they are seen from the perspective of their own dimension or dimensions; they can not abandon their singularity and space-time dimensionality; every picture, every bit, every case, every experience has a sole present an only now and in such way they will remain for ever, in their respective chapter, only accessible as a set to a hypothetical external observer, who is irrelevant to the limiting dimension of the magazine, CD or video-tape or individual consciousness.

Is it possible to imagine other beings or self-consciousness configurations with a different and bigger sensitive dimension than us, in the immensity of the "Whole"?

There are people who suppose that intelligence evolution can drive us to "Matrix"- like realities, and even that perhaps our present existence is in the end something similar to the one shown on the screen by the Wachowsky brothers, while others, like the clergyman Theillard de Chardin visualise a future conjunction between man and nature and its creator in an omniscient Omega point.

We must admit we know very little about the "ultimate nature" of concrete things, let alone about abstract things and their interactions in order to assert undoubtedly that any of the fashionable interpretations of "reality" is more or less concrete than the other.

There is something about which there is little discrepancy today and that is that knowledge about reality evolves in any unexpected direction, with characteristics that appear in the complex and chaotic processes, like the emergence of new and unedited theories, in such a way that what we know today or our ideas about the world change every time more quickly, reaching the paradox to think that the only permanent thing is change and there we go with our dreams, hopes or maybe, only the illusion of being the owners of our fate…(Illya Prigogine. Cuadernos Infimos Nº111, Tusquets Editorial, Barcelona, 1983)

"Patience, in the blue of the sky", is what the well-known Canadian researcher on nucleosynthesis (the process of creating new atomic nuclei in the stars) and Research Director in the National Center for Scientific Research in France, Huber Reeves, asks for, author, among other books of the best seller Cosmic Evolution (Granica, Juan. Colección plural Nº 2, Ediciones S.A 1982)

There seems that ends are open to any destiny we could attain and we would do well if we keep our "tuners" alert to understand and, why not, make a better world.

Like any other known species, I think that may be even us, the Sapiens Sapiens, would disappear from the earth some day and I hope our children—not the sexual ones but born from our intelligence—will be the ones to take nature´s evolutionary (infinite, circular?) post.

After all, and if the reasoning exposed above proves being correct, sooner rather than later we shall understand that our freewill has always an open end as the only possible choice.

I close my analysis or technical summary of the book about "Borges, Teoría cuántica y universos paralelos" where I intend to deal with the proto-theory of the "Whole" and the "tuner" metaphor as an expression or model about the nature of the relationship between "reality" and our awareness, with a poem or couplet that in a wonderful evidence of science and fantasy having a common fortune, delights us and summarizes in ten lines what would take whole bookshelves of judicious rational elucidation to explain, something so elusive as "reality" and human knowledge:

Caminante son tus huellas
el camino y nada más;
caminante, no hay camino:
se hace camino al andar.

Al andar se hace camino,
y al volver la vista atrás
se ve la senda que nunca
se ha de volver a pisar.

Caminante, no hay camino,
sino estelas en la mar...

Which would go something like:

Walker, your footprints are your path and nothing else; walker there is no path: the path is made as you walk.

When you walk you draw your path and when you look backwards you can see the path you will never tread on again.

Walker there is no path, but trails in the sea

(famous couplet by the Andalusian poet Antonio Machado, that could be translated or understood as something like: "Reality", "what exists" is so solid and concrete, fleeting and ungraspable as life itself).

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Mankind May Be Impossible to Manufacture out Any Artificial Real Gravitational Black Hole (BH) Forever

---- Part 3 of "New Concepts to Big Bang and Black Holes" [6][7]----

----A incidental comment to BBC News about artificial BH on 3/17 /2005----

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Abstract: Recently, many scientists in different countries did some alarmist talks to "artificial black holes". Probably, those scientists only depended upon their unreal image to talk about "artificial black hole". They might not conscientiously study the characteristics of a real gravitational BH, and not calculated out the exact values of various parameter of a real gravitational BH in detail. Most scientists hankered after new modern theories, such as string theory, but almost neglect to apply classical theories, such as Hawking's formulas about BHs in calculations of BHs. However, BH is the product of classical theories, it can be correctly explained only by classical theories. Some experimental scientists probably made up news about manufacturing artificial BHs for their special purpose. Thus, they did not apply the suitable formulas to calculate out correct value of every parameter of a real gravitational BH so that they might consciously or unconsciously obscured the principal differences between a real gravitational BH and non-BH with specious arguments. The calculated fundamental formulas in this article originate from GTR and Hawking about theory of BH, through qualitatively analyses and detailed calculations to various parameters of different real BHs, this article will show that, any "artificial BH " will have no possibility to be manufactured out by mankind forever. [The Journal of American Science. 2006;2(1):31-37].

Keywords: artificial black hole; real gravitational black holes; calculations to various parameters of black hole

Introduction

Previously, some Russian scientists had advertised to produce artificial bombs of mini BHs or so-called Otone, mass of 1 Otone = mass of 40 atoms = $40\times1.67\times10^{-24}$g $\approx10^{-22}$g. Russian scientist Alexander Trofeimonko pointed out that, mini black holes could be manufactured out in laboratory as a "bomb of black hole", which could kill billion people. They said, it will be the century of "Otone" after 50 ~60yrs. They also advocated that, mini BHs inside earth would ignite volcanic eruption, and mini BHs would lead to spontaneous combustion in human body, etc.[1] In January 2001, English theoretical physicist Wolf Leonhart declared that he with his colleagues would make a black hole in a laboratory.[1]

On 3/17/2005, BBS reported that in RHIC—Relative Heavy Ion Collider sited at the Brookhaven National Laboratory in New York, "fire ball" caused by the collision of two gold-nuclei, which speed of smashing collision approached light speed, was striking similar with a micro black hole.[2][3][4] When the gold nuclei smashed into each other, they were broken down into particles called quarks and gluons. They formed a ball of plasma about 300 times hotter than the surface of the Sun.[2][3][4] The maker of "fire ball", Prof. Horatiu Nastase of Brown University in Providence of Rhode Island wrote: "We calculate the soliton (black hole) temperature, and get 175.76MeV, compared to the experimental value of the "fireball" ` freeze-out` of about 176 MeV, its lifetime is about 10^{-24}s. "[2][3][4] He said: "There is something unusual about it. Ten times as many jets were being absorbed by the fireball as were predicted by calculations."[2][3][4]

English famous cosmologist, Martin Reez predicted in his book <The Last Century> that, the first one of 10 greatest catastrophes on earth in future would be "artificial black hole".[2]

Some Greek and Russian Scientists proposed in 2003 that countless short-lived micro BHs were produced from the collision of the universal rays with high energy to particles or molecules of our atmosphere, its mass was about 10×10^{-6}g, its lifetime was about 10^{-27}s. In addition, they pointed out that the new Super Hardon Collider of European Particle-physical Laboratory will work in 2007, and will have strong power enough to manufacture out about ten thousand micro BHs every day.[5]

1. Black hole (BH) and formulas for calculating various parameters of BH

According to the definition of GTR (general theory of relativity), black holes were objects, in which light would be bound by the extremely curved time-space and could not escaped out. Hawking discovered Hawking's radiation emitted out from BH and got formulas to calculate Hawking's radiation. Those theories and formulas are the calculated foundations in this article.

Only Schwarzchild's BHs (no charges, no rotating and spherical symmetry), which are real gravitational BHs, will be studied in this article.

In my former article "New Concepts to Big Bang and Black holes —Part two",[6] author pointed out clearly that, BH would be the simplest object in nature, the relationships between its various parameters are simple and single value, once the value of a parameter is given, the values of all other parameters would be solely decided with the first one. In that article, author further demonstrated that, any BH had no possibility to exist in nature, if its mass was less than 10^{-5}g.[6][7]

For a formed real gravitational BH, the formulas of its various parameters are below, if M_b —mass of a BH, R_b—its Schwarzchild's radius, T_b--temperature on Event Horizon, $_b$ --density on Event Horizon, G--gravitational constant, κ-- Boltzmann's constant, h—Plank's constant, M_θ--mass of sun ≈ 2×10^{33}g, C—light speed. According to the definition of GTR and Hawking's theory about BH, to a real gravitational black hole, formulas (1a), (1b), (1c) and (1d) below should not be violated.

$R_b=2GM_b/C^2$ or $C^2=2GM_b/R_b$ [6][7][8] (1a)

(1a) is the necessary condition for existence of any real gravitational BH.

According to Hawking's formula about BH,

$T_b = (C^3/4GM_b)\times(h/2\pi\kappa) \approx 0.4\times10^{-6}M_\theta/M_b \approx 10^{27}/M_b$ [6][7][8] (1b)

According to Hawking's another formula about BH, the lifetime of a BH is decided by the energy emitting out Hawking's radiation from BH in unit time,

$\tau_b \approx 10^{-27} M_b^3$ (s) [6][7][8] (1c)

It can be seen from (1a), (1b) and (1c), $\tau_b \propto 1/T_b^3$.

Particle and radiation at extremely high temperature (energy) would have three forms of energy (E_1, E_2, E_3), in some special states or conditions, they might be identical and transform between each other.

$E_1 = m_pC^2$, $E_2 = \kappa T$, $E_3 = Ch/\lambda$ (1d)

$M_b = 4\pi\rho_bR_b^3/3$ (1e)

It can be seen that, R_b, T_b, τ_b, $_b$, are all simple and single functions of M_b.

For convenient calculation, formula (1a) can be altered to

$M_b/R_b=C^2/2G\approx0.675\times10^{28}g/cm\approx10^{28}$g/cm (1aa)

Formulas (1a)×(1b) is equal to

$T_b\times R_b = (C^3/4GM_b)(h/2\pi\kappa)(2GM_b/C^2) = Ch/4\pi\kappa \approx 0.1154$ cmk (1ba)

2. The collision of two gold-nucleons with approaching light speed in RHIC of New York cannot become a real gravitational micro BH at all

(A). To a particle m_o of speed v, its total energy E can be expressed as below, m_o—static mass of a particle,

$E = m_ov^2/2 + m_oC^2$ [9] (2a)

Suppose 2 gold-nucleons (Au) had formed a "fireball" in the collision in RHIC with speed v, v approached to light speed C, M_{oau}—mass of a Au:

$2M_{oau}$ = 197 H×2 = $2\times197\times1.66\times10^{-24}$g = 6.58×10^{-22}g

From (2a), the total energy-matters E_{au} of the formed "fireball" gotten from RHIC would be,

$E_{au} = 2M_{oau}v^2/2 + 2M_{oau}C^2 \approx 3M_{oau}C^2 = 1.5\times6.58\times10^{-22}\times(3\times10^{10})^2 = 0.89$erg $= 6.242\times10^{11}\times0.89$eV $= 555$GeV $= 555\times10^9\times4.46\times10^{-26}$kW*h $= 2.5\times10^{-14}$kW*h (2b)

In ideal state, the highest temperature T_{au} of "fireball", $T_{au} = E_{au}/\kappa \approx 10^{17}$k (2c)

E_r—energy expended by RHIC for collision of 2 gold-nucleons (i.e. for 6.58×10^{-22}g),

$E_r=E_{au}/3 \approx 185$GeV $= 0.8\times10^{-14}$kWh (2d)

It shows that**, if mankind could successively manufacture a BH of mass = m_o with collision of particles on a Colliders, mankind should expend energy $E_r \approx m_oC^2/3$,terrible costs!**

$E_r \approx m_oC^2/3$ **(2e)** (2

Thus, if M_{bau} was a new formed real gravitational BH, its values of various parameters should be:

$M_{bau} = 3M_{oau} = 3\times197\times1.67\times10^{-24}g = 9.87\times10^{-22}$g,

From(1aa), $R_{bau}=M_{bau}/0.675\times10^{28}=1.5\times10^{-49}$cm,

From (1ba), $T_{bau} = 0.1154/R_{bau} = 0.77\times10^{48}$k, (1a)

From (1c), $\tau_{bau} \approx 10^{-27} M_{bau}^3$(s) $= 10^{-27}\times(9.87\times10^{-22})^3 \approx 10^{-90}$s

From (1d), $E_{bau}=\kappa T=1.38\times10^{-16}\times0.77\times10^{48}=10^{32}$erg

From (1e), $\rho_{bau} = 3M_{bau}/(4\pi R_{bau}^3) \approx 0.7\times10^{125}$g/cm^3

It can be seen that, above values of R_{bau}, T_{bau}, E_{bau} and τ_{bau} as a real gravitational micro BH had no possibility to appear in nature, because above values greatly exceed the beginning values of Plank's Era (Plank's mass $m_p = 10^{-5}$g, Plank's time $t_p = (Gh/2\pi C^5)^{1/2} = 0.539\times10^{-43}$s, Plank's length $l_p=t_p\times C=(Gh/2\pi C^3)^{1/2} = 1.6\times10^{-33}$cm,).[7] The deep interior of Plank's Era might not be known and not detected by mankind at all forever.

Assume "fireball" made in RHIC was still a BH after absorbing 10 times jets of particles as called by Prof. Nastase, values of various parameters of such BH (M_{10}) are respectively changed into different values below.

$M_{10} = 10M_{oau} = 10\times9.87\times10^{-22}g = 9.87\times10^{-21}$g, $R_{10} = 1.5\times10^{-48}$cm, $T_{10} = 0.77\times10^{47}$k, $\tau_{10} \approx 10^{-87}$s.

It can be seen that practical values of "fireball" detected by Prof. Nastase is still too far away from a real gravitational BH.

(B). The almost same temperature value of that "fireball" or so-called BH calculated out and got from experiment by Prof. Horatiu Nastase was 176MeV, its lifetime was about 10^{-24}s, the surface temperature of "fireball" was about T_{sur} = 300 ×5,800 (surface temperature of Sun) ≈1.74×10^6k. They are far away from values of a real gravitational micro BH above. Thus, "**fireball" was not a real gravitational BH at all**.

First, lifetime 10^{-24}s of "fireball" in RHIC showed that "fireball" is not a real gravitational BH at all. To a real gravitational BH, if its lifetime is 10^{-24}s, correspondingly, its mass M_{-24} should be about 10g, because according to (1c), $10^{-24} \approx 10^{-27}\times M_{-24}^3$, $\therefore M_{-24} \approx 10$g.

Then, what does lifetime 10^{-24}s of "fireball" mean? It may mean that, gold nuclei after collision rapidly formed a "fireball" and instantly decomposed into particles other than integrating a real BH, because the disappearance of a BH would be bound to follow a burst of strong explosion and to emit γ-rays of extremely high energy. The relatively quiet disappearance of "fireball" express that, the energy of "fireball" is not so high to become a real BH needed by the same mass.

If distance $d_{au} = 10^{-24}$C (light speed) $= 10^{-24} \times 3\times10^{10} \approx 3\times10^{-14}$cm, hence, $d_{au} = 3\times10^{-14}$cm may be approximately considered as the distance of the closest protons in gold-nuclei, or the distance of two closest gold-nuclei jetted from RHIC with approaching light speed, thus, lifetime 10^{-24} of "fireball" only shows the time from the beginning collision of the first pair of gold-nuclei to second pair of gold-nuclei, and to other 10 times gold-nuclei non-stop jetted from RHIC. That process is complete difference with a real micro BH to engulf energy-matters from outside. The existence of "fireball" could keep in 10^{-24}s only due to more gold-nuclei continuously jetted by RHIC. Therefore, lifetime 10^{-24} of "fireball" just indicate that "fireball" is not a real micro gravitational BH.

Second, what does 176MeV of soliton (black hole called by Prof. Nastase) got in experiment and calculated by Prof. Nastase mean? Let E_{pk} is the kinetic energy of a proton in gold nuclei, and $E_{pk} = m_{pro}v^2/2 < m_{pro}C^2/2 = 1.67\times10^{-24}\times (3\times10^{10})^2/2 = 7.5\times10^{-4}$erg $= 7.5\times10^{-4}\times6.242\times10^{11}$eV $= 47\times10^7$eV $= 470$MeV,

$\therefore E_{pk} < 470$MeV.

After collision, E_{pk} would not be completely altered into heat energy, greater part of E_{pk} transformed into other energies, such as radiation, so, **176MeV measured by Prof. Nastase are just heat energy transformed from partial kinetic energy of every particle in collision.** The process of manufacturing real BH should accumulate most energy-matters, however, greater part of energy has to lose in collision in RHIC. If "fireball " was a real BH, heat energy of 176MeV could not be measured by Prof. Nastase. **A real gravitational BH should have no way to be detected. A detected object is not a real BH.** It has conversely proved that "fireball" is not a real BH at all. Temperature T_{pro} corresponding to heat energy 176MeV should be: $T_{pro} = 176\text{MeV}/\kappa = 176\times10^6\times1.602\times10^{-12}/(1.38\times10^{-16}) = 2\times10^{12}$k

Third, what does the surface temperature ($T_{sur} = 1.74\times10^6$k) of "fireball" mean? Temperature on the surface of our Sun is about 5,800k, so, $T_{sur} = 1.74\times10^6$k was temperature on the surface of "fireball". It shows that, before or after collision of protons, interactions between protons or gold- nuclei exerted heat movement and formed a ball of blazing gas, i.e."fireball", because the practical collision was a process, **all protons in gold-nuclei of two sides had no way to participate in collision at the exact same time,** its wave length

$\lambda_{sur} = Ch/\kappa T_{sur} = 3\times10^{10}\times6.63\times10^{-27}/(1.38\times10^{-16}\times 1.74\times10^6) = 8\times10^{-7}$cm.

According to $\lambda_{sur} = 8\times10^{-7}$cm, "fireball" should emit x-rays and become a real "fire ball".

Fourth, assume "fireball" were a real BH, it could not endanger anything as well as mankind, because its lifetime was just 10^{-90}s, if it could move with light speed C, it only went 10^{-80}cm. However, the real lifetime of "fireball" was 10^{-24}s as Prof. Nastase's said, it could only move 10^{-14}cm with light speed C, 10^{-14}cm is just the distance between two closest nucleons in any atom.

In a word, object produced by the collision of 2 gold-nuclei (Au) in RHIC was not a real gravitational micro BH at all, but just a "fireball" of mixed quarks and gluons, because a real BH could have no visibility and not be detected except Hawking's radiation, besides, the death of a real BH should have a burst of very strong explosion and emit γ-ray bursts with high frequency. However, visibility, very long lifetime and quiet disappearance of "fireball" have proved that, "fireball" produced by Prof. Nastase in RHIC had no any similar with a real gravitational BH.

(C). It can be known with the same reasons and calculations that, micro BH Otone advocated by Russian scientists would have more impossibility to be manufactured out by mankind forever, because mass of Otone is equal to mass of 40 atoms $\approx 1/10M_{bau}$. It is said, assume Otone is a real BH, its temperature would be higher and its lifetime shorter than above collision of gold-nuclei in RHIC.

(D). It can be seen from (2b), assume a bomb of artificial BH had been made out, its explosive total energy was E_{au}, but the expended energy in laboratory was $2M_{oau}v^2/2 \approx 1/3E_{au}$, it was the worst business for producer of BH.

(E). About energy of RHIC: It can be seen from above calculation, the energy of RHIC for the collision of 2 gold-nucleon is $1/3E_{au} \approx 1/3\times0.89$erg ≈ 0.3erg $\approx 0.3\times6.242\times10^{11}$eV $\approx 1.87\times10^{11}$eV ≈ 187GeV. It is rather high to RHIC.

(F). Assume M_{bau} became a real micro BH, could it exist in a long time? From above calculation, its lifetime was just 10^{-90}s, only if it could engulf energy-matters from its surrounding within time of 10^{-90}s, it would vanished certainly. $10^{-93}\times C = 3\times10^{-80}$cm, it is said, if energy-matters depart from M_{bau} beyond 3×10^{-80}cm,

M_{bau} would have no way to grow up and vanish instantly.

(G). Could BH $M_{bu} = 10^{-5}$g,[7] (i.e. 10×10^{-6}g), which is equal to BHs at the genesis of our universe, be manufactured artificially by the new Super Hardon Collider (SHC) of European Particle-physical Laboratory in 2007 or exist in atmosphere of our earth? No way, SHC will only manufacture a little bigger and more "fireballs" than RHIC. Short-lived micro BHs had no way to appear in our atmosphere, even if the energy of universal particle was high to 10^{11}GeV[11], but it only became a little bigger "fireball", because its mass is still too small.

From (2c), if energy E_{bu} is needed by artificially manufacturing a $M_{bu} = 10^{-5}$g, as a result, $R_{bu}=10^{-33}$ cm, $T_{bu} = 10^{32}$k, that state has been on the border of Plank's Era. $E_{bu} \approx 10^{-5}C^2/2 = 4{,}5\times10^{15}$erg $=3\times10^{18}$GeV.

(H). Mankind can't triumph over nature

"Fireball" made in RHIC by Prof. Nastase had no possibility to become a real gravitational BH. Mankind would have no way to attain energy of every particle high to (3×10^{18}GeV), which only appeared at the genesis of our universe forever. Such high energy was the result of gravitational collapse of our whole universe in its past life or could be considered as a God's masterwork.

Assume above micro BH of $M_{bau} = 9.87\times10^{-22}$g was a real BH, its temperature T_{bau} would attain $0{,}77\times10^{48}$k, however, the highest temperature of our Universe at its genesis was 10^{32}k.[7] Mankind has no way to restrain the energy emission of BH.

3. The necessary condition of existence and growth for a new-born micro BH, as assuming that an artificial real gravitational BH had been manufactured out

(A). A new-born micro BH, whether it is an artificial or a natural, always had too much high temperature and too much shorter lifetime, hence, the necessary condition of growth for a new-born micro BH (its mass = M_{b1}) is that, in its lifetime, its gravity at least could reach to energy-matters of its surrounding. τ_b—lifetime of BH, C—light speed, d_{bp} —distance from new-born micro BH to particles outside BH, then,

$$\tau_b C > d_{bp} \qquad (3a)$$

From (1c), $M_{b1}>10^9 (d_{bp}/C)^{1/3}$, or, $M_{b1} >3.2\times10^5 d_{bp}^{1/3}$ (3

Assume an artificial BH M_{b1} has been successfully manufactured in a laboratory, mass of M_{b1} is heavy enough and d_{bp} is short enough for increase in mass of M_{b1}. It is said, assume new-born M_{b1} instantly shoot or fall into some object, (such as atoms, white dwarf or neutron star in form 1) in which the distance d_p between two closest particles must be less or equal to d_{bp}. For comparison, three different objects will be offered. E_{eV}, E_{kwh}—energy needed by manufacturing a corresponding artificial BH.

Form 1

Objects	**ρ_o (g/cm^3),**	**$d_p \le d_{bp}$ (cm),**	**M_{b1} (g),**	**τ_b (s),**	**R_b (cm),**	**E_{eV} (eV),**	**E_{kWh}** (kWh)
Atoms	10^1	10^{-8}	700	3.43×10^{-19}	10^{-25}	2×10^{26}GeV	9×10^9
White dwarf	10^6	10^{-10}	150	3.38×10^{-21}	2.25×10^{-26}	4×10^{25}GeV	1.7×10^9
Neutron star	10^{15}	10^{-13}	15	3.38×10^{-24}	2.25×10^{-27}	4×10^{24}GeV	1.7×10^8

Values of M_{b1} calculated from formula (3a) or (3b) on above form 1 were just a fictitious necessary condition for a new-born BH to have a possibility to engulf some energy-matters from outside in its lifetime. However**, Energy-matters of outside just felt the gravity of the new-born BH but had no more time to be surely engulfed, besides, the new-born micro BH was rapidly losing its energy-matters with Hawking's radiation.** Therefore, **M_{b1} were all still too small, their lifetime were all too short.**

Furthermore, the energy E_{eV} needed by Colliders for producing new-born BH is too much great. Now, energy of the strongest accelerator in the world is just less than 10^4GeV, but the energy of micro BH of mass = 10^{-5}g (i.e. single particle) at the genesis of our universe was 10^{19}GeV,[7] which might not be attained by mankind forever. The ability of mankind to manufacture a micro "artificial BH" would not exceed God's will at all.

(B). The real speed V_p of a particle of object under the gravitational effect to lash at new-born BH M_{b2} has no possibility to attain light speed C, hence, M_{b2} must much heavier than M_{b1}, and then might engulfed some particles from outside, (3a) should be modified as below,

$$\tau_b V_p > d_{bp} \qquad (3c)$$

According to laws in physics, if a new-born BH shoot into an object, distance S—between particle of object and BH of M_{b2}, $a = GM_{b2}/d_{bp}^2$, a--· Accelerating speed, G—gravitational constant, from (1c) and

$$V_p^2 = 2aS \approx 2ad_{bp} \text{ and } S = at^2/2 \text{ [9]} \qquad (3d)$$

$$\text{So, } M_{b2}^{7/2} > 10^{27}\times d_{bp}^{3/2}/(2G)^{1/2} \qquad (3e)$$

For example, let $d_{bp} = 10^{-8}$cm = distance of atoms, **$M_{b2}\approx1.8\times10^5$g, so, M_{b2}** >>(M_{b1} = 700g) (on form 1), because $V_p \approx (2ad_{bp})^{1/2} \approx 1.6\times10^3$cm, V_p<<C. Thus, **L_{eV}** needed by Colliders for producing new-born bigger BH would be increased about 1,000 times than L_{eV} (form 1).

In case $M_{b2} \approx1.8\times10^5$g, its $\tau_b \approx 10^{-27} M_b^3 = 10^{-27}\times(1.8\times10^5)^3 = 5.8\times10^{-12}$s. If object has much matters enough for being absorbed by M_{b2}, how much matters are absorbed in the whole lifetime of M_{b2}? From (3d), $S = at^2/2 = (GM_b/S^2)\times(\tau_b)^2/2$, S = 0.58×10^{-8}cm, if density

of object $\rho_o = 10g/cm^3$, M_o is mass of object absorbed by M_{b2}, hence,

$M_o = 4\pi\rho_o S^3/3 = 0.8\times10^{-23}g$.

As a result, $M_o << M_{b2}$, if M_{b2} shot into an big object, only its partial mass of ($M_o = 0.8\times10^{-23}g$) is engulfed by M_{b2}. So, M_{b2} has still no way to grow up, but just can prolong its lifetime a very little. In reality, $M_o = 0.8\times10^{-23}g$ is more than mass engulfed really by M_{b2}, because M_{b2} is gradually decrease in its mass with emitting Hawking's radiation.

In case M_{b2} was shot in a neutron star, its density is $10^{15}g/cm^3$, so, $M_o < 10^{-8}g$. M_{b2} could not grow up yet.

(C). For the growth of a new-born BH, it needs more strict condition, the energy-matters engulfed by BH from outside object must be more than the energy-matters emitted by BH in the same time.

Assume a new-born BH M_{b3} is formed, its lifetime $\tau_b = 10^{-27}M_{b3}^3$, $d\tau_b = 10^{-27}\times3M_{b3}^2\, dM_{b3}$,

$dM_{b3}/d\tau_b = 10^{27}/(3M_{b3}^2)$ (3f)

Assume outside object $M_o = 4\pi\rho_o R_o^3/3$, let ρ_o = constant = density of M_o, R_o—radius of M_o,

$dM_o/dt = 4\pi\rho_o R_o^2 dR_o/dt$ (3g)

Growing condition of new-born BH (M_{b3}) must be:

$$\mathbf{d\,M_{b3}/d\tau_b < dM_o/dt} \quad \textbf{(3h)}$$

So, $10^{27}/(3M_{b3}^2) < 4\pi\rho_o R_o^2\, dR_o/dt$ (3i)

To find out dR_o/dt, from (3d), $S = at^2/2$, $S^{1/2} = (GM_b/2S^2)^{1/2}t$, suppose M_{b3}= constant (really $M_{b3} \neq$ constant, so, M_{b3} should be bigger),

$S^{3/2} = (GM_b/2)^{1/2}t$, $3S^{1/2}dS/2 = (GM_{b3}/2)^{1/2}dt$, hence, $dS/dt = (GM_{b3}/2)^{1/2}2/(3S^{1/2})$ (3j)

dR_o/dt of (3i) may be considered to be equal to dS/dt of (3j), so, from(3i) and (3j),

$10^{27}/(3M_{b3}^2) < 4\pi\rho_o R_o^2(GM_b/2)^{1/2}2/(3R_o^{1/2})$, after simplifying,

$M_{b3}^{5/2} > 10^{27}/[8\pi\rho_o R_o^{3/2}(G/2)^{1/2}]$ (3k)

Let $R_o = 100cm$, $\rho_o = 10g/cm^3$, hence,

$$\mathbf{M_{b3} >> 1.366\times10^{10}g}.$$

Above calculations may indicate that, if a formed new-born BH of $M_{b3} > 1.366\times10^{10}g$ could be shot into a metal ball M_o of radius $R_o = 100cm$, and its density $\rho_o = 10g/cm^3$, M_{b3} would become bigger and prolong its lifetime τ_b until all mass of metal ball absorbed by M_{b3}, because energy-matters emitted from M_{b3} were less than matters of M_o absorbed from the metal ball.

Let's check up the result below.

Let $\mathbf{M_{b3} = 2\times10^{10}g > 1.366\times10^{10}g}$ below.

In case $\mathbf{M_{b3} = 2\times10^{10}g}$, its lifetime $\tau_b = 10^{-27}M_{b3}^3 = 8{,}000s$, its Schwarzchild's radius $R_b = M_{b3}/0.675\times10^{28} = 2.96\times10^{-18}cm$, absorbed mass of metal ball $M_o = 4\pi\rho_o R_o^3/3 = 4.2\times10^7g$, time t is needed by BH to absorb metal ball, $R_o = at^2/2$, $a = GM_{b3}/R_o^2$, so, $t = 0.387\times10^2s = 38.7s$.

However, $\tau_b - t = 8{,}000 - 38.7 = 7961.3s$, the rest mass M_{br} of M_{b3} corresponding to the rest lifetime ($\tau_b - t$) is $7961.3 = 10^{-27}M_{br}^3$, so, $M_{br} = 1.997\times10^{10}g$, if M_{bd} is the decreased mass of BH in the period t = 38.7s, hence,

$M_{bd} = M_{b3} - M_{br} = 2\times10^{10} - 1.997\times10^{10} = 3\times10^7g$, as a result, M_{bd} (3×10^7g) < M_o (4.2×10^7g).

If M_o is bigger than 4.2×10^7g, it can be completely engulfed by M_{b3} within longer time.

All above calculation are approximate, they may be considered as estimated calculations and qualitative analyses, because the state and structure of BHs have almost be unknown.

(D). Assume a new-born BH M_{b4} has been manufactured by a collider or an accelerator, what conditions could ensure the growth of M_{b4}? **For the growth of M_{b4}, matters continuously shot in a row by a accelerator should be more than energy-matters emitted from M_{b4} at the same time.**

From (3f), $dM_{b4}/d\tau_b = 10^{27}/(3M_{b4}^2)$ (3l)

Suppose M_o —mass shot by a accelerator, m_p —mass of a particle in M_o, n—total numbers of shot particles, l_p—distance between two closest particles, l—length of n particle in a row, hence,

$M_o = m_p n$, $dM_o = m_p dn = (m_p/l_p)dl$

$\therefore dM_o/dt = (m_p/l_p)dl/dt$

let $dl/dt \approx$ light speed C, so,

$dM_o/dt \approx C\, m_p/l_p$ (3m)

For the growth of M_{b4}, $dM_{b4}/d\tau_b < dM_o/dt$, as a result, $10^{27}/(3M_{b4}^2) < C\, m_p/l_p$ (3n)

Let $m_p = 3.29\times10^{-22}g$ (mass of a gold-nucleon), $l_p \approx 10^{-13}cm$, $\therefore$ **$M_{b4} > 0.18\times10^{13}g$.** (3o)

4. Analyses and conclusions

Different real gravitational BHs, bigger or smaller, are calculated on above paragraphs, they are: $M_{bau} = 9.87\times10^{-22}g$, $M_{bu} = 10^{-5}g$, $M_{b1} = 15\sim700g$, $M_{b2} \approx 1.8\times10^5g$, $M_{b3} = 2\times10^{10}g$, $M_{b4} > 0.18\times10^{13}g$, but no one can be artificially manufactured out in future. Why? Analyses and demonstrations are seen below.

(A). All calculations in this article are on the basis of formulas (1a), (1b) and (1c), which originate from GTR and Hawking's theory about BH as well as the application of thermodynamics, author had got already many principal conclusions on the past article—"New Concepts to Big Bang and Black holes, Both had No Singularity at All". [6][7] Some important conclusions can be accurately applied in this article to solve greatly difficult problems about artificial BHs.

First, the relationships between each other of various parameters of a BH are single and sole correspondence. It is said, **to a real gravitational BH, whether it is natural or artificial, if a certain value of a parameter has been determined, such as its mass M_b, the sole and certain values of all other parameters are respectively and solely determined by M_b from formulas (1a), (1b) and (1c). There would be no any**

two different BHs, which could have the same value of only one parameter, but have the different value of all other parameters.

Second, owing to that, lights in BH could not shake off the very strongly gravitational trammel of BH, a real gravitational BH had no way to emit out any information, which could be directly detected by external world. Of course, BH emits Hawking's radiation, but right now, it cannot be detected yet. Therefore, if any so-called "BH" included artificial BH was advocated by some people either in the past or in future to have been directly detected, it would not be a real gravitational BH at all.

Third, real micro gravitational BHs of (mass = 10^{-5}g = M_{bu}) formed our new-born Universe at its genesis. **M_{bu}= 10^{-5}g was, and still will be, the heaviest particle and the minimum BH in our universe.**[7][6] Energy E_{bu} of every M_{bu}, E_{bu} = 10^{19}GeV, [7] it was the greatest energy for a particle (BH) in our universe, and cannot be reached by mankind forever. It is said, mankind will absolutely have no way forever to reach energy >10^{19}GeV in one collision to manufacture out an artificial BH (particle), which mass ≥ 10^{-5}g.

Could mankind manufacture out any smaller artificial BH, which mass < 10^{-5}g) in future with smaller energy than E_{bu} (i.e. < 10^{19}GeV)? No way, according to formula (1b), for a BH of mass < 10^{-5}g, its temperature must be > 10^{32}k. On the contrary, suppose its E_{bu} < 10^{19}GeV, i.e. its really temperature = E_{bu}/κ < 10^{32}k. Thus, the created particle of (mass < 10^{-5}g) would not be a real gravitational BH at all. It's really a pity that many modern scientists are still attempting to manufacture out micro BHs of (mass <<10^{-5}g) with strong collider according to such incorrigible idea.

Fourth, theories of BH are built up on the foundations of gravity and stability of protons (quarks). It is said, in a real gravitational BH, its composition and state are protons and accordance with GTR as well as Hawing's theory. In a BH of M_{bu} = 10^{-5}g, its R_{bu} = 10^{-33}cm, T_{bu} = 10^{32}k, τ_{bu} = 10^{-43}s. Those states are at the border of Plank's Era,[7][11] which is the limit of our real physical world. As assuming that, a real gravitational artificial BH of (mass < 10^{-5}g) could be manufactured, its temperature > 10^{32}k, its Schwarzchild's radius < 10^{-33}cm, its lifetime < 10^{-43}s. It shows that, **in a BH of mass < 10^{-5}g, its physical states has entered a complete Plank's Era,[11] i.e. Plank's quantum states, it is another unknown physical world. In that world, protons (quarks) have not existed, the present gravitational theory may have lost its some important effects, can some present important theories and formulas about BH be applied? That world has neither been detected nor demonstrated by a correct theory of common sense, thus, any real gravitational BH of (mass < 10^{-5}g) might not appear and exist in Plank's Era (another physical world) at all. In string theory, the size of strings are smaller than 10^{-33}cm, so, the researched object and foundation of string theory are Plank's physical world, but not our real world of (BH's size > 10^{-33}cm), thus, those scientists hankered after new modern theories seem to write out the insufficient prescriptions for solve problems of BH of our physical world**. Whether in the past or in future, if any formed particle (its mass << 10^{-5}g) with high energy (temperature) is a detected collision on collider (for example, on RHIC), values of its parameters would have no possibility to accord with formulas (1a), (1b) and (1c), because its temperature had no way higher, and its Schwarzchild's radius had no way smaller than what a real gravitational BH should have. Therefore, the greater collider of higher energy in future can only manufacture out greater or more "fireball", but not a real gravitational BH at all.

Now that any smaller real BHs of (mass < 10^{-5}g) could not be manufactured out by any Collider in future, it would only be a small "fireball" and be impossible to become a bigger BHs of (mass > 10^{-5}g) with sustained jetting particles in a collider, because the lifetime of "fireball" was still too short, even if "fireball" could become a little bigger, it would not have enough gravity inside to become a real BH at all, just because "fireball" was not a real BH, particles in "fireball" after collision would be instantly ejected back and dispersed each other, and the caused "fireball" must be immediately disintegrated.

Fifth, furthermore, even if at the collision of 2 gold-nuclei in RHIC, all protons in gold-nuclei of each side **did not collide at the exactly same time**, hence, lifetime 10^{-24}s of a formed "fireball" in RHIC might really only reflect the time of sustained collision of protons in 2 gold-nuclei, but
not be the lifetime of a real gravitational BH

(B). It may be a fundamental principle that, the collision produced by objects of any two non-BHs
would have no possibility to become a real gravitational BH. **No matter whether a star-formed BH or any much smaller BH, their most common characteristic is that, plasma in BH would have extremely high density,** on the layer of radius of same curvature, the heat pressure should keep balance with gravity. However, gravity is a very even central force, the heat state of extremely high density on every layer should be even and approximately ideal state. Thus, any BH could only be formed by the gravitational collapse of a large amount of matters in nature, but not by the collision of two objects with high speed, just as the collision of two bodies of movement with high speed could not form an even body.

In a word, the process of forming a real BH is an accumulative process of energy-matters, but any collision of particles with the highest speed can only

let accumulated energy-matters before collision to be instantly diffused after collision, thus, manufacturing a real BH with any collision of the highest speed is principally impossible.

(C). For getting an artificial BH, the sole way for scientists may be to put very high circular pressure to original materials as to be able to attain the extremely high density needed by an artificial BH in its Schwarzchild's radius. Can mankind overcome all difficulties to do so?

Assume high pressure to manufacture a real gravitational BH could be reached. Might mankind probably expend smaller energy to get bigger BH? How can the limit of high pressure be got by mankind in remote future?

$$P = n\kappa T = \rho\kappa T/m_p \text{ [6][9]} \quad (4a)$$

$$E_p \approx M_b \times GM_b/R_b = M_b \times C^2/2 \quad (4b)$$

In above formula (4a),T—temperature on Ev Horizon, n—numbers of particles in unit volume, Boltzmann's constant, ρ--density, m_p —mass of parti in BH, let m_p = mass of a proton = 1.66×10^{-24}g, E expanded energy, C—light speed.

Pressures P (atm) are calculated by different BHs its Event Horizon (Border) on form 2.

The pressure in the core of our sun is ab 3×10^{11}atm,[10] so, mankind may have no way manufacture any artificial BHs with high press needed in form 2 in remote future.

Form 2

Mass of M_b(g)	R_b (cm)	T_b (k)	τ_b(s)	ρ_b (g/cm^3)	P (atm)	E_p (eV)	E_p (kwh)
$M_{bau} = 10^{-21}$?	10^{-49}?	10^{48}?	10^{-90}?	10^{125} ?	10^{175} ?	10^{2}G ?	10^{-15}?
$M_{bu} = 10^{-5}$,	10^{-33}	10^{32}	10^{-43}	10^{94}	10^{128}	10^{18}G	10
$M_{b1} = 15$,	10^{-27}	10^{26}	10^{-24}	10^{80}	10^{108}	10^{24}G	10^{7}
$M_{b2} = 10^{3}$	10^{-23}	10^{22}	10^{-12}	10^{74}	10^{98}	10^{28}G	10^{11}
$M_{b3} = 10^{10}$	10^{-18}	10^{17}	10^{3}	10^{64}	10^{83}	10^{33}G	10^{16}
$M_{b4} = 10^{15}$ **,	10^{-13}	10^{12}	10^{18}(10^{10}yrs)	10^{53}	10^{67}	10^{38}G	10^{21}

* M_{bau} made in RHIC was a "fireball" and had no way to attain above various values needed by a fictiti gravitational BH. All values are hypothetical and just for reference.

** Energy for manufacturing any M_b with high pressure ≈ total energy emitted by sun in 3 minutes.

(D). Even if an micro artificial BH could be manufactured by mankind in future, how might it be controlled? For example, assume that, an artificial BH of $M_{bu} = 10^{-5}$g or $M_{b1} = 15$g had been successfully manufactured out, how could its short-lived lifetime τ_b and very high temperature T_b be controlled? It is said, such short-lived micro BHs have no way to exist and to grow up. For bigger BHs, such as M_{b3} or M_{b4}, they might have possibility to grow up, but their needed energy might not be reached by any collider forever.

Black holes (BH) were produced from gravitational collapse of massive mass in nature, they had no possibility to be produced from collision of particles with extremely high speed in collider or produced in machines of extremely high pressure. Therefore, mankind may not be able to manufacture out any artificial BHs at all. All declarations or propaganda about artificial BH were alarmist talks in the past and must not be trusted in future.

If theories, formulas, demonstrations and calculations used in this article have no theoretically mistakes and can be passed by the experimental examinations in future, it will conversely prove that, those new concepts in author's former article (New Concepts to Big Bang And Black Holes—Both Had No Singularity at All) may be all right.

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The Nature of Consciousness and the Meaning of Life

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Abstract: The laws of physics that apply within living organisms are identical to the laws that hold outside them. But this implies that there is nothing "special" about life -- nor about consciousness! And it implies that anything that can happen inside a living organism can also happen outside living things (if a distinction between living things and nonliving things even makes sense) -- including consciousness. The fall of Newton's deterministic physics, and the triumph of "probabilistic" quantum mechanics, implies that our behavior is neither predetermined nor predictable. Since it is apparently decided at a molecular (hence quantum) level, the Heisenberg uncertainty principle prevents us from ever knowing causation for certain. In other words, we probably don't have free will, but we have no way of ever knowing for sure, and we feel that we have free will. In spite of centuries of thought and research into human-, animal, and plant behavior we still don't know why people commit murder -- or much else. [The Journal of American Science. 2006;2(1):38-41].

Keyword: consciousness; meaning of life; nature; quantum mechanics

"Consciousness is not to be found among physical objects", E. H. Walker, p.147

I think that there must be very few books that live up to the promise implicit in their title. It is very tempting to exaggerate, in order to get people to buy the book. (By contrast, Walt Whitman's Leaves of Grass, one of my favorite books, does discuss leaves of grass, but also a lot more!) As far as I can tell, Evan Harris Walker's The Physics of Consciousness: Quantum Minds and the Meaning of Life discusses neither the physics of consciousness, quantum minds, nor the meaning of life.

Woven throughout the book is a very charming and entertaining thread devoted to describing Walker's relationship with his high school sweetheart, Merilyn Ann Zehnder, and her tragic death from leukemia. I enjoyed this glimpse into the author's life, but I don't see how it contributed to fulfilling the book's promise. I suppose it gave some "human interest" to a book that otherwise could be too taxing on the brain, or served as a dramatic device -- interrupting the physics thread and creating suspense.

For me, by far the greatest value of the book was the fascinating and very detailed recounting of the history of physics -- especially the description of particle physics and quantum mechanics. It's comforting to know that quantum mechanics and relativity are an accurate reflection of the world -- all of it! It's also fascinating to watch humanity (who, according to Reg Morrison (The Spirit in the Gene), are genetically predisposed to spirituality or religion) be forced to relinquish one myth after another to the persuasive power of science. Walker's writing is lucid and generally easy to understand -- quite a feat, considering the difficulty of the subject matter and the fact that its essence can be expressed only in mathematical form! For me the book brought together numerous disparate bits of physics that I hadn't fully grasped or integrated. For that, I am very grateful.

Walker then takes a giant leap and asserts, without citing any evidence, that consciousness is different from anything ever studied or described by physics -- it's "special". He seems to assume that this is so obvious that it doesn't need proof, but, on the contrary, not only does it require evidence, but it is actually false, which derails the rest of his arguments. Remember, he has just finished describing the fact that current physical theories describe the entire universe (at least since it was 10-43 seconds old), from subatomic particles to galaxies, with enormous precision! So it is illogical to suddenly claim that there is something -- consciousness -- which is not described by those equations! (And yet, he later contradicts himself by equating consciousness with a quantum mechanical "tunneling" of electrons.) That consciousness is "special" is an assumption. If it falls, then the rest of the book -- and probably all other writing and thinking about consciousness -- also falls.

Here are some of Walker's statements in support of this assumption: "Science is incomplete and must be greatly expanded if it is to meet the challenge of this data." (p.159) "If we approach what is in those equations [of physics] exclusively in terms of those ideas physicists have put there, we will see that there are some things that are missing and that cannot be derived from the things that have gone into those equations. The

equations have positions and intervals, quantities and forms, and they describe responses. But feelings are not there, nor is pain, C#, or the colors we see in the budding red rose. 'Motives' are there, but emotions are not. Conscious being is not in these equations. [That is an assumption! In other words, he is begging the question, not answering it.] If consciousness is to play its role in physics, it must be included in its own right, on its own terms. [That's funny -- ethics, philosophy, art, music appreciation, and government are also not in those equations, but no one has ever suggested that we need to expand physics in order to explain them!]. … It will be necessary to introduce something new into physics on its own terms. This is how it has always been in physics when we have wished to understand something totally new. This is how we must do things now." (p.176) "Consciousness is something that exists in its own right and has its own identity. It is distinct from all other objects, processes, energies, and realities that physics or science as a whole reveals." (p.178) "Consciousness is nonphysical. … It is real and nonphysical." (p.182) "The classical machine cannot have consciousness, and it cannot have any identity of its own." (p.253)

Walker then describes his theory of the functioning of the synapse, and argues that consciousness is the quantum mechanical "tunneling" of electrons across the synapse: "There, in those minute switches, at the miniscule intersynaptic cleft -- that is where the quantitative link between mind and brain is to be found." (p.194)

He then goes on to make the absurd assertion that nothing exists until it is observed by a conscious observer! "Only our observation of the object [a die thrown onto a craps table] leads it to take on one out of all its possible orientations and come to rest with one of its six faces up." (p.270) "We have seen matter and space as the natural consequence of nothing more than the fact that conscious observers exist." (p.331) In order to understand this assertion, we need to think about quantum mechanics and the Heisenberg uncertainty principle. Heisenberg showed that when one tries to measure either the location or momentum of an object, the act of measuring itself disturbs the object, so that one can determine either characteristic to arbitrary precision, but not both. This is not simply a defect in our equipment! This is the fundamental nature of matter!

For example, if we shoot an electron at a phosphorescent target, until it hits the target and creates a flash of light, it has no position, but exists only as an infinite set of possible locations and momenta, with varying degrees of probability.

But it is not the observer that determines where and how the die will land! It is the table and the forces of gravity and electromagnetism! The observer enters the picture only after the die has settled into its final resting position. This is Walker's means of injecting (human, or at least animal) consciousness (and, ultimately, meaning and God) into physics. It fails. (However, I wish that Walker had spent more time on this matter, since it is the crux of his argument. I had trouble following the part that centered on Bell's Theorem, where supposedly quantum mechanics triumphs, and belief in concrete reality has a stake driven through its heart. This section (Chapter 8) was intriguing, but very difficult to understand).

In mathematics there is a tool called "reductio ad absurdum". One makes an assumption, and then argues logically from that assumption to arrive at a conclusion that is "absurd" (obviously false). That proves that the assumption upon which the argument was based must be false (for example, one can assume that a number exists which is zero divided by zero; from this one can "prove" that 1 = 2). Thus, in the present case, the assumption that consciousness exists as something "special", not describable by physics, is false: it leads to absurd conclusions.

The other serious error that Walker makes is that he identifies consciousness with wakefulness. The state of being awake, which, according to my physiology text, is controlled by the brain's reticular activating system, is only one meaning of "conscious" ("having mental faculties undulled by sleep, faintness, or stupor: awake" (Webster, p.238)). The more important use of the word is being conscious of something: "aware of and responding to one's surroundings" (Compact Oxford English Dictionary). Wakefulness is a necessary (except possibly for dreams), but not a sufficient, condition for being aware of something. Although I am awake, I am rarely aware (conscious) of the traffic outside my house, nor even the temperature of my own skin. I am very good at focusing on one thing, and ignoring everything else. (No wonder we men are so often accused of being "insensitive"!)

A third serious error is that Walker identifies consciousness with something that takes place in a very specific location: the nerve synapse. This would imply that organisms without nerves cannot be conscious. However, Donald Griffin (Animal Thinking) has argued convincingly that thinking (complex decision-making) goes back as far as single-celled organisms, which are aware of chemicals in their environment and respond appropriately -- approaching or avoiding them based on whether they represent food, mate, or threat. Green plants detect (are aware of) sunlight and turn their leaves so as to maximize the energy they receive.

Humans are genetically 98.6% identical with chimpanzees, so it is unlikely that so important a characteristic as consciousness could be present in humans but not in chimps. But we also share a large percentage of our genome with all animals, and in fact

with all living things! Since consciousness (awareness of things and events outside the organism) is so integral to all life, it most likely is not simply a matter or nerve synapses, and probably is an essential feature of all living things: "All living beings, not just animals but plants and microorganisms, perceive. … Mind and body, perceiving and living, are equally self-referring, self-reflexive processes already present in the earliest bacteria". (Margulis & Sagan, p.32) "Life … is awareness and responsiveness; it is consciousness and even self-consciousness." (ibid., p.177) "Mobile microbes make selections -- they choose." (ibid., p.179) "The gulf between us and other organic beings is a matter of degree, not of kind." (ibid., p.182) "Thinking and being are the same thing." (ibid., p.188)

So how can we determine what consciousness is? Obviously, the laws of physics that apply within living organisms are identical to the laws that hold outside them. Walker admits that the laws of physics apply to the entire known universe. ("Life is less mechanistic than we have been taught to believe [we obey probabilistic quantum mechanics, rather than the deterministic Newtonian physics]; yet, since it disobeys no chemical or physical law, it is not vitalistic [i.e., there is nothing "magic" or "special" about life]." (Margulis & Sagan, p.178)) But this implies that there is nothing "special" about life -- nor about consciousness! And it implies that anything that can happen inside a living organism can also happen outside living things (if a distinction between living things and nonliving things even makes sense) -- including consciousness! The splitting of H2O into hydrogen and oxygen takes place in green plants, but it can also happen outside them. Every event that can happen within a living organism can potentially (given the right conditions) also happen outside them. In fact, if we assume that life and consciousness are "special", then (by reductio ad absurdum) it follows that they don't exist! No wonder they are so hard to define and describe! It is hard to define something that doesn't exist (such as, for example, God). …

So what is consciousness? Simply the registering of an effect. A scale is conscious of weight. It is not conscious of (able to measure) anything else. If it could be arranged so as to weigh itself (I don't know if that is physically possible), then it would be self-conscious (in that one dimension). We are also capable of being conscious of weight. I can feel pressure on my skin from a weight resting on top of it, and I can also hold the weight in my hand and feel the strain on my arm muscles. These are just two possible ways of being conscious of weight, neither of which is the same method used by the scale. I am also conscious of light, which the scale is not. But I am not conscious of ultraviolet radiation, although a bee and a UV meter are. A robot is conscious, but not of enough things to survive on its own -- not enough to survive in this rough-and-tumble world. Humans are visually conscious of the movement of distant objects, but we are nowhere as perceptive as birds. Of course, being conscious of more dimensions doesn't make one superior, except in the narrow sense of those dimensions. Bacteria are undoubtedly superior in their consciousness of chemical nuances. In any case, there are obviously many ways to be conscious, not just one, just as there are many different ways to store information. Consciousness is not a fundamental constituent of reality -- nor anything new or unitary.

To show how life and non-life (whatever they are, if they even exist!) shade into each other, look at a couple of examples. Frogs in Canada freeze solid every winter and thaw out again in the spring. While frozen, they are neither alive (they don't meet any of Margulis and Sagan's criteria, since they are doing absolutely nothing) nor dead (death is, by definition, final). Okay, maybe you believe that the frozen frogs are alive, and doing something, although you don't know what. The frogs don't contain much extra energy, so if they were doing anything, all their stored energy would get used up, and they would have none left to allow them to awaken in the spring. If that example doesn't convince you, then look at the seeds stored in the pyramids for 3,000 years. Dead, or alive? Since they were able to germinate upon being given water, they couldn't have been dead, according to Margulis and Sagan and every other biologist. But they can't have been alive either, because if they were doing anything during those 3,000 years, all of their tiny store of energy would have long since been exhausted. Viruses and prions are two more examples of life shading into non-life; viruses are not considered alive, but they perform some of the same functions as living things, such as reproduction. In other words, it is not possible to detect the difference between life and non-life: i.e., there is no real difference! Life is an indefinable state of matter, kind of like (but even less definable than) the liquid- vs. solid state of water.

Thus, the real mystery is not consciousness; the real mystery is how humans can miss what is "hidden" in plain sight -- right in front of our noses! Obviously, we can't know directly whether any other organism is conscious. We can only infer that from its behavior. That goes for our own friends and family, pre-verbal or dumb (unable to talk) humans, animals, plants, bacteria, etc. Bacteria and protists (e.g. protozoa) act as if they are conscious. Or perhaps I should say that we sometimes act like them -- turning our faces toward the sun, sniffing out attractive smells from the kitchen, reacting instinctively to environmental hazards. Try this experiment: turn on the television, but turn off the sound. You will be amazed at the things you become conscious of (the mole on an actor's nose, the blond hair and brown eyebrows, the funny way people move, etc.), that

you had been forced to ignore due to trying to follow (be conscious of) the (verbal) story. Meditation is another experiment in consciousness. Try meditating on the self-conscious scale. … It's no wonder that no one has discovered what consciousness is. If consciousness is a white horse (or nothing special at all), but you insist that it is a green dragon, you can look all you want, but you will never find it. …

Two more things remain to be discussed: will, and the meaning of life. On page 333 Walker admits: "But for all this terror, there is one thing that is worse: the thought that all the suffering and all the pleasure of life have no meaning." I don't see how the meaning of my life, or any life, depends on the existence or importance of consciousness. While life has no single, canonical meaning (else we would long ago have discovered what it is!), each person's life has -- to them -- the meaning that he or she chooses to give it. (Of course, we get some ideas from others, past or present.) The same goes for morality and ethics: what is moral is what we think (based partially on input from others) is moral. Science and physics have little to do with any of this, except to keep us honest. Science can only tell us what is, never if it should be. Therefore it cannot be blamed for any alleged decline in morality. I suspect that "immorality" is like a recessive gene -- impossible to eliminate. We also can't depend on evolution to "improve" humankind. Evolution is like justice: blind. It only ensures the survival of those who survive -- not necessarily those with any given characteristic (including alleged "fitness", whatever that is).

Then what about free will? (Walker simply refers to "will", and sidesteps this question.) The fall of Newton's deterministic physics, and the triumph of "probabilistic" quantum mechanics, implies that our behavior is neither predetermined nor predictable. (That's nice! It would be pretty boring, otherwise!) The "butterfly effect" rules. But this also doesn't imply that our behavior is under our own control. And since it is apparently decided at a molecular (hence quantum) level, the Heisenberg uncertainty principle prevents us from ever knowing causation for certain. In other words, we probably don't have free will, but we have no way of ever knowing for sure, and we feel that we have free will, so … who cares? (Well, the criminal justice system may care, thinking that people should only be held responsible for what they deliberately do. But it's impossible to know for sure, and … nature (evolution) doesn't care.) In spite of centuries of thought and research into human-, animal, and plant behavior we still don't know why people commit murder -- or much else. Can you resist eating that cookie? If humans were rational, no one would smoke, right? I know that I am irrational, because no matter how often I see people behave irrationally, I still continue trying to treat them as if they were rational, by reasoning with them!

This paper would be incomplete without discussing the purpose of life -- something Walker skipped, even though he is obviously interested in it. The purpose of life is to have fun! I mean, what else could it be?! (Of course, that excludes hurting wildlife or other people, even if you happen to think that that's fun.) And I certainly had fun reading this book, and thinking about it.

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Mandatory HIV Notification: Bioethical Concerns vs. Public Health Concerns, Health and Medical Dilemmas

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Abstract: The topic of mandatory HIV notification is controversial and conflicting for counselors and public health workers. Counselors may seek to maintain patient confidentiality and public health workers are concerned with combating the spread of sexually transmitted infections. Embedded between bioethical priorities and public health concern is the HIV positive patient. Thus, there exists a convoluted dichotomy between privacy and prevention; as it pertains to HIV notification for the patient, counselor and public health advocate. [The Journal of American Science. 2006;2(1):42-45].

Keywords: AIDS; Bioethics; HIV; Public Health

In understanding the complexities of HIV notification, it is imperative to understand and evaluate the critical public health laws regarding HIV/AIDS notification. Currently, all 50 states require mandatory HIV/AIDS reporting to state or local health officials, this policy is viewed as the first major statute. However, there is some variance among the states concerning different statutes mandated by state legislatures. According to Stephen J. Paskey and Karen H. Rothenberg, the privilege to disclose statute, which authorizes physicians to notify needle-sharing or sexual partners directly, without consent or previous knowledge of the positive HIV patient, varies the most among states (1995, p.1573). Physicians who adhere to the 'privilege to disclose' statute are immune from civil liabilities, which would ordinarily ensue from a patient breach of confidentiality; however, "in some states, including California, New York, and Pennsylvania, the privilege is restricted by carefully worded legal conditions" (1995, p.1573). The privilege to disclose statute is often synonymous to the duty to warn concept faced by counselors. The Tarasoff decision is the predecessor of the duty to warn concept. Essentially, Tarasoff v. Regents of University of California, 1976 stipulated that a "therapist who knew, or according to professional standards should have known, that a client posed a threat to another individual, has a duty to warn the intended victim" (Hazler & Stanard, 1995, p.397). Thus, the duty to warn is often viewed as a limitation of the confidentiality code.

Overall, it is not unreasonable to suggest that such statutes appear to be in conflict with patient autonomy and patient confidentiality. With respect to HIV notification, confidentiality is a particularly important notion. Beauchamp and Childress illustrate the importance of confidentiality by examining the ethical ideas of deontology and consequentialism (Bayer & Tooney, 1992, p. 1163). For the most part, the deontological belief highlights the importance of the patient's trust in the counselor. The consequentialists advocate that confidentiality is important to uphold because it encourages patients to divulge information that would not be given otherwise, in the absence of confidentiality. Although counselors value the importance of confidentiality, they understand that confidentiality is not absolute, or without limitations (Bayer & Tooney, 1992, p.1163). For example, counselors recognize the need for communicating confidential patient information with other health care workers as parts of the client's care. However, the communication of confidential information to a third party that is not responsible for the treatment or care of the HIV positive patient is problematic for many ethicists. However, the divulgence of such confidential patient information may be significant for public health workers.

The practice of public health workers overriding patient rights is not a new concept. However, according to Carmody, the notion of individual liberties is a relatively new concept and was not widely recognized during the birth of aggressive public health measures (Carmody, 1999, p.112). For example, the practice of quarantining, isolation, and mandatory immunization were widely practiced without objection. Furthermore, according to Carmody, with the advent of sexually transmitted infections such as: Chlamydia, syphilis, hepatitis B, and gonorrhea, national contact tracing programs were firmly implemented during the late 1940s (1999, p.110). Thus, the practice of contact tracing, or partner notification is not a recent phenomenon. But there is objection to the practice because: "These strategies [such as, mandatory partner notification] remove control from the individuals' life and place it in the hands of government" (Carmody, 1999, p.113). Also, there was little objection to contact tracing because it provided the benefit of treatment and

decreased the prevalence of syphilis by the late 1950s (Carmody, 110). Despite many of the perceived benefits of mandatory HIV notification and its parallels to other sexually transmitted infections, the virus is unique in that there is no cure for HIV. The newfound presence of the bioethical perspective is also partially responsible for the controversy and inherent conflicts between the goals of the counselor and the goals of the public health worker.

As a result, there is a profound importance for public health laws and efficacy regarding mandatory HIV/ AIDS notification. The 1905 case of Jacobson v. Massachusetts, in which the statute for mandatory vaccination was challenged, is recognized as the foremost court decision regarding the limits and authority of mandatory public health measures (Carmody, 1999, p.127). The decision of the landmark case was that public health measures supercedes infringement of individual rights because "the police power of a state must be held to embrace, at least, such reasonable regulations… as will protect the public health and the public safety" (Carmody, 1999, p. 127). Consequently, in most states, physicians are legally responsible for reporting all new HIV infections and, to some extent, responsible for partner notification. Notwithstanding, disagreements certainly arise out of this practice, because of the unique nature of HIV. As Carmody points out, the practice of mandatory partner notification may adversely affect the scope of public health goals: "…mandatory partner notification may deter people from getting tested for HIV in the first place…[thus,] this necessity may actually be more of a liability in the state's effort to protect the health of its citizenry" (1999, p.128).

Still, there is a concern over a patient's breach of confidentiality and a counselors' duty to warn the partners of positive HIV patients. There appears to be a direct conflict of interest. Rebecca Stanard and Richard Hazler address the conflict of confidentiality versus the duty to warn and assert, " [that] confidentiality is an essential component of counseling practice whose original intent was to promote full client disclosure and protect clients from stigmatization" (1995, p. 397). Stanard and Hazler, like many other bioethicists, maintain this view despite the 1976 benchmark case of Tarasoff v. Regents of University of California. Essentially, the Tarasoff decision held that therapists had a duty to warn third parties (such as, sexual partners of HIV positive patients) of inherent danger and victimization. The Tarasoff decision presented limits to the notion of confidentiality; perhaps, even, a complete breach of patient confidentiality. Regardless of its flaws, it is important to note that the Tarasoff decision has limitations and ethical benefits. Eliot D. Cohen advocates the significance of the Tarasoff decision from a utilitarian stance (1990, p. 283). However, because of its foreseeable conflict of interest, application of the Tarasoff decision dictates strict caution from the clinician and that the decision be used only as a last resort, after all other possibilities have been exhausted. Tarasoff mandates three conditions before its application: "(a) a special relationship, (b) a reasonable prediction of conduct that constituted danger; and (c) a foreseeable victim (Gehring, 1982)" (Hazler & Stanard, 1995, p. 398).

Overall, it is imperative that HIV counselors and physicians be mindful of ethical principles as guidelines for their decision making. There are two major ethical theories that concern confidentiality and a counselors' code of ethics: utilitarianism and Kantian ethics. Utilitarianism consists of the questions "how much good will the performance do?" and "how likely is it to produce this value" (Cohen, 1990, p. 282). Similarly, Kantian ethics upholds the strict belief that persons never be treated as objects and that persons must "be willing to accept the logical implications of the reasons for their actions when these reasons are applied to all relevantly similar cases (Hazler & Stanard, 1995, p. 399). The two major ethical theories set the framework for rudimentary ethical principles, established by Kitchner, which include autonomy, non-maleficence, beneficence, justice and fidelity.

However, because HIV and AIDS are classified as highly infectious and without a cure, positive patients have a limited scope of confidentiality protection (Curran & Gostin, 1987, p. 364). Much of the debate concerning prominent ethical principles and the duty to warn centers around the question posed by Posey: "who is responsible for whom?" (Hazler & Stanard, 1995, p. 398), and to what extent should that responsibility be exercised by counselors and public health officials. There are countless proposed answers to Posey's question, whom herself viewed the Tarasoff as a last resort. Conversely, Gray and Harding strongly advocated breach of confidentiality, by direct informing of sexual partners if the client does not take the action him or herself, because of the fatality of HIV and its lack of an existing cure. Ultimately, the decision to breach confidentiality should be made in conjunction with the ethical principles defined by Kitchner, and with the unique judgment of the counselor and the physician.

The judgments of the counselor and physician are not absolute, or always ethically correct. Norton et al, concluded that there is a pattern of decision among physicians who breach the confidentiality of HIV positive patients. A stratified random sample of 628 primary physicians, practicing in Tennessee during 1986, indicated that a patient's sex, race, sexual preference and socioeconomic status were taking into consideration before a physician decided to breach or uphold patient confidentiality (Norton et al., 1990, p.829). The study concluded that "Black heterosexual

women and homosexual men were less likely to have their confidentiality maintained," which was of little surprise because of the "stigmatization of Blacks, more specifically of Black men, by Whites" (Norton et al., 1990, p. 833).

The Tennessee study illustrates some of the flaws, which result from confidentiality breaches and mandatory HIV notifications. Sadly, the practice of overt breaching of confidentiality, which can sometimes be inconsistent and biased, for HIV positive patients can cause serious ramifications for already suffering patients who must cope with their HIV positive status (Carmody, 1999, p.108). Adverse risks of HIV positive persons include: stigmatization, isolation, domestic violence, depression, and suicide. The risk for domestic violence and depression is of particular significance for females.

Rothenberg and Paskey stress the importance of specialized intervention and partner notification procedures for women, which must be responsible for placing the safety of women as paramount (1995, p.1574). Mandatory partner notification and confidentiality breaches create a second problem; in that it may discourage HIV testing. In such cases, persons who are infected with HIV will forgo treatment and counseling for the sake of maintaining privacy and autonomy. Although such a stance would be highly counterproductive for public health workers, it is a rationale decision from the psychological view of a person who seeks to maintain his or her privacy. Furthermore, people who refuse HIV testing are more prone to late diagnosis and susceptibility of spreading the fatal infection. Clearly, the benefits and harms of mandatory HIV notification must be further analyzed because, "Mandatory HIV partner notification weighs the value of public health over the individual personal liberties of HIV infected persons" (Carmody, 1999, p. 135). And, such a stance is in direct contrast to autonomy and justice. In the aspect of patient isolation, depression, and suicide, mandatory HIV notification can be reasonably viewed as an action that conflicts with the principles of nonmaleficence and fidelity too.

Above all, breaches of patient confidentiality poses profound problems for the traditional relationship of trust between a patient and a counselor. A patient is less likely to speak freely with his or her counselor when confronted with the issue of trust and breach of his or her confidentiality. Such an action would prevent proper treatment and counseling in all capacities. Thus, "Counseling should be sensitive to the cultural, historical traditions and prevailing public health practices, social values and political differences in attitude toward the importance of treating someone as a private individual" (Lie & Sauka, 2000, p. 737). In other words, it is important to maintain the perspective of treating and counseling the HIV positive patient as an individual and not merely as another case. Since, a paucity of physician trust and confidentiality can have negative implications the quality of patient care. Such practices of trust and confidentiality must be demonstrated to the patient ensure treatment.

Mandatory HIV notification has not been proven effective at lowering transmission, it "is really only effective in slowing transmission in situations where the notified partner is unaware that the behavior he has been engaging is risky, and is willing to discontinue that behavior" (Carmody, 1999, p. 109). Therefore, there are some benefits of HIV notification for sexual partners. Also, epidemiological studies have shown mandatory HIV notification to be successful with people who are not readily exposed to HIV counseling and HIV notification, such as in rural communities (Carmody, 1999, p. 109).

Similarly, mandatory HIV notification to U.S. Departments of Health does present countless benefits for the public health spectrum. For example, Andrew Bindman and Grant Coflax indicate that HIV notification enables public health departments to link HIV positive patients with " medical referrals, risk reduction counseling, and partner notification programs" (1998, p.1158) and to monitor long-term counseling and treatment. However, one has to question if such practices are truly in the best interest of the HIV positive individual. In other words, an HIV positive person may feel that such programs, despite their perceived benefits by public health advocates, are intrusive and insensitive to their autonomy and privacy. But, public health advocates would assert that HIV notification presents rewards for the patient and the general public; it helps prevent the spread and control of an infectious disease that is currently without a cure. From the standpoint of the partner of the HIV positive patient, some ethicists would argue in favor of mandatory partner notification. One who may have been infected has a moral right to know such information, so that he or she may get tested, seek treatment, or take preventive measures for their own autonomy.

There is a fragile balance that must be maintained in the dilemma between HIV notification and HIV prevention for public health workers, bioethicists, counselors and the HIV positive patient. Despite the delicate issue of HIV notification and confidentiality, it is clear that confidentiality has a binary aspect of not being absolute yet of great importance for counselors (Hayter, 1997, p.1163). The twofold position of confidentiality exists because of the responsibility to protect the public health and the greatest number. However, "some mantras of bioethics…are not necessarily congruent with the greatest benefit to the greatest number" (Lachman, 1998, p.302). And, the principles of bioethics should not be a function of merely the greatest number, but also the individual.

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Cholesterol and Human Health

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Abstract: Cholesterol plays a major role in human heart health and high cholesterol is a leading risk factor for human cardiovascular disease such as coronary heart disease and stroke. There are 102.3 million American adults who have total blood cholesterol values of 200 mg/dl and higher, and about 41.3 million. Cholesterol can be good (high-density lipoprotein) or bad (low-density lipoprotein) to the cardiovascular system. For the total cholesterol in blood: less than 200 mg/dl is desirable level, 200 to 239 mg/dl is the borderline high for heart disease, and 240 mg/dl and above is High blood cholesterol. A person with this level of 240 mg/dl or above has more than twice the risk of heart disease as someone whose cholesterol is below 200 mg/dl. Statin drugs are very effective for lowering LDL cholesterol levels and have few immediate short-term side effects. Some bacteria can change cholesterol in food to coprostanol that cannot be readily absorbed by the body and some oral bacteria such as *Lactobacillus acidophilus* have been commercial available for the cholesterol lowering. [The Journal of American Science. 2006;2(1):46-50].

Keywords: cardiovascular; cholesterol; health; heart; lipoprotein

1. Introduction

Cholesterol is a waxy substance made by animal liver and also supplied in diet through animal products such as meats, poultry, fish and dairy products. Cholesterol is needed in the body to insulate nerves, make cell membranes and produce certain hormones, and it is an important lipid in some membranes. However, the body makes enough cholesterol, so any dietary cholesterol isn't needed.

Cholesterol plays a major role in human heart health. Cholesterol can be both good and bad. High-density lipoprotein (HDL) is good cholesterol and low-density lipoprotein (LDL) is bad cholesterol. High cholesterol in serum is a leading risk factor for human cardiovascular disease such as coronary heart disease and stroke - America's number one killer (Tabas, 2002). Excess cholesterol in the bloodstream can form plaque (a thick, hard deposit) in artery walls. The cholesterol or plaque build-up causes arteries to become thicker, harder and less flexible, slowing down and sometimes blocking blood flow to the heart. When blood flow is restricted, angina (chest pain) can result. A heart attack will result when blood flow to the heart is severely impaired and a clot stops blood flow completely. When there is too much LDL cholesterol in the blood, it is deposited inside the blood vessels, where it can build up to hard deposits and cause atherosclerosis, the disease process that underlies heart attacks.

There are 102.3 million American adults who have total blood cholesterol values of 200 mg/dl and higher, and about 41.3 million American adults have levels of 240 mg/dl of cholesterol or above. Total blood cholesterol is the most common measurement of blood cholesterol. Cholesterol is measured in milligrams per deciliter of blood (mg/dl). A person's health cholesterol content is based on other risk factors such as age, gender, family history, race, smoking, high blood pressure, physical inactivity, obesity and diabetes.

2. Chemical Structure of Cholesterol

Cholesterol is present in eukaryotes but not in most prokaryotes. The oxygen atom in its 3-OH group comes from O_2 (Figure 1). Cholesterol evolved after the earth's atmosphere became aerobic. The animal plasma membranes of eukaryotic cells are usually rich in cholesterol, whereas the membranes of their organelles typically have lesser amounts of this neutral lipid (Stryer, 1988).

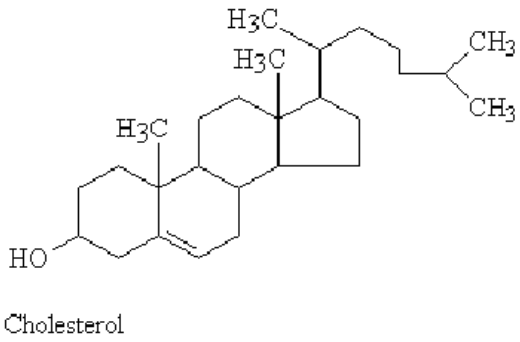

Figure 1. Chemical structure of cholesterol

3. Good Cholesterol and Bad Cholesterol

Cholesterol can be good or bad. HDL is called "good cholesterol" that is good for the cardiovascular system and LDL is called "bad cholesterol" that is bad for the cardiovascular system. These are the form in which cholesterol travels in the blood. LDLs have little protein and high levels of cholesterol and HDL has a lot of protein and very little cholesterol. LDL is the main

source of artery clogging plaque. HDL actually works to clear cholesterol from the blood.

The standard test of cholesterol is done after a 9-12 hours fast without food, liquids or pills. It gives information about total cholesterol, LDL, HDL and triglycerides (blood fats). The cholesterol content in blood is the key data for the health information of cholesterol related (Table 1). If a person's total cholesterol is 200 mg/dl or more, or his/her HDL cholesterol is less than 40 mg/dl, he/she needs to have a lipoprotein profile done to determine LDL cholesterol and triglyceride levels.

A person's LDL cholesterol goal depends on how many other risk factors he/she has: (1) If he/she does not have coronary heart disease or diabetes and have one or no risk factors, his/her LDL goal is less than 160 mg/dl. (2) If he/she does not have coronary heart disease or diabetes and have two or more risk factors, his/her LDL goal is less than 130 mg/dl. (3) If he/she has coronary heart disease or diabetes, his/her LDL goal is less than 100 mg/dl.

Table 1. Initial classification based on total cholesterol, HDL, LDL and Triglyceride

Cholesterol	Cholesterol Level	Category
Total Cholesterol	Less than 200 mg/dl	Desirable level.
	200 to 239 mg/dl	Borderline high for heart disease.
	240 mg/dl and above	High blood cholesterol. A person with this level has more than twice the risk of heart disease as someone whose cholesterol is below 200 mg/dl.
HDL Cholesterol	Less than 40 mg/dl	Low HDL cholesterol. A major risk factor for heart disease.
	40 to 59 mg/dl	The higher HDL level, the better.
	60 mg/dl and above	High HDL cholesterol. An HDL of 60 mg/dl and above is considered protective against heart disease.
LDL Cholesterol	Less than 100 mg/dl	Optimal
	100 to 129 mg/dl	Near or above optimal
	130 to 159 mg/dl	Borderline high
	160 to 189 mg/dl	High
	190 mg/dl and above	Very high
Triglyceride	Less than 150 mg/dl	Normal
	150-199 mg/dl	Borderline high
	200-499 mg/dl	High
	500 mg/dl and above	Very high

4. Triglyceride

Triglycerides are another fat in the bloodstream. High levels of triglycerides is also linked to heart disease.

Triglyceride is the most common type of fat in the body. Many people who have heart disease or diabetes have high triglyceride levels. Normal triglyceride levels vary by age and sex. A high triglyceride level combined with low HDL cholesterol or high LDL cholesterol seems to speed up atherosclerosis, which is the buildup of fatty deposits in artery walls that increase the risk for heart attack and stroke.

People should reduce the amount of saturated fat, *trans*-fat, cholesterol and total fat in their diet. Some studies have shown a higher mortality in people with low cholesterol levels - that is, lower than 160 mg/dl. These deaths are from non-coronary causes (some cancers, chronic respiratory disease, liver disease and trauma). On the other hand, some evidence suggests that total cholesterol levels below 160 mg/dl are not dangerous. In many countries a major portion of the population has cholesterol levels in this range throughout life without serious health problems. Also, less than 6 percent of the American population has a cholesterol level below 160 mg/dl. It's rarely necessary to lower total cholesterol below that.

5. Hyperlipidemia

Hyperlipidemia is an elevation of lipids (fats) in the bloodstream. These lipids include cholesterol, cholesterol esters (compounds), phospholipids and triglycerides. They're transported in the blood as part of large molecules called lipoproteins. These are the five major families of blood (plasma) lipoproteins: (1) chylomicrons, (2) very low-density lipoproteins (VLDL), (3) intermediate-density lipoproteins (IDL), (4) low-density lipoproteins (LDL), (5) high-density lipoproteins (HDL). When hyperlipidemia is defined in terms of class or classes of elevated plasma lipoproteins, the term hyperlipoproteinemia is used. Hypercholesterolemia is the term for high cholesterol levels in the blood. Hypertriglyceridemia refers to high triglyceride levels in the blood. The average American man gets about 337 mg of cholesterol a day from food and the average woman gets about 217 mg. I suggest that a person should limit cholesterol from food to an average of no more than 300 mg per day.

6. Cholesterol from Foods

Cholesterol from food is hard to get away from, even though one may be watching his/her diet. All foods of animal origin contain cholesterol, including eggs, red meat, and shrimp. Generally, foods that are high in saturated fats or trans fats should also be limited. These include foods you may not even think of, such as grilled-cheese sandwich, margarine, potato with butter and chicken pot pie, etc. As we eat, cholesterol from food is absorbed by our digestive tract. It then makes its way into our liver and can circulate through our body in the bloodstream. That's one source. There's also a little-known second source of cholesterol — human body.

7. Cholesterol Produced by Body Based on Genetics

Like many people, one may not know that his/her body produces cholesterol naturally, based on family history genetically - despite the fact that it's where more of one's total cholesterol comes from. The liver makes cholesterol, as do other individual cells throughout the body. Once cholesterol is produced, it can make its way into the bloodstream.

What does this process mean to people? Take the cholesterol the body makes and add it to the cholesterol one gets from food. Now one can see how easily cholesterol can build up in the bloodstream and how the overall cholesterol level can increase.

8. The Factors Affect Cholesterol Levels

A variety of factors can affect your cholesterol levels. They include:

8.1 Diet. Saturated fat, trans fat, and cholesterol in the food you eat increase cholesterol levels. Reducing the amount of saturated fat and trans fats and cholesterol in your diet helps lower your blood cholesterol level.

8.2 Weight. In addition to being a risk factor for heart disease, being overweight can also increase your cholesterol. Losing weight can help lower your LDL, total cholesterol levels, and triglyceride levels, as well as raise your HDL.

8.3 Exercise. Regular exercise can lower LDL cholesterol and raise HDL cholesterol. You should try to be physically active for 30 minutes on most days.

8.4 Age and Gender. As we get older, cholesterol levels rise. Before menopause, women tend to have lower total cholesterol levels than men of the same age. After menopause, however, women's LDL levels tend to rise.

8.5 Heredity. Your genes partly determine how much cholesterol your body makes. High blood cholesterol can run in families.

8.6 Medical conditions. Occasionally a medical condition may cause an elevation of cholesterol levels in the blood. These include hypothyroidism (an underactive thyroid gland), liver disease and kidney disease.

8.7 Medications. Some medicines, like steroids and progestins may increase the "bad" cholesterol and decrease the "good" cholesterol.

9. Medications

The main goal in lowering cholesterol is to lower your LDL and raise your HDL. To lower cholesterol, eat a heart-healthy diet, exercise regularly, and maintain a healthy weight. Some may also need to take cholesterol lowering medications. Cholesterol-lowering medicine is most effective when combined with a low-cholesterol diet and exercise program.

The drugs of first choice for elevated LDL cholesterol are the HMG CoA reductase inhibitors, e.g. lovastatin, pravastatin and simvastatin. Statin drugs are very effective for lowering LDL cholesterol levels and have few immediate short-term side effects (Jongh, 2002). They are easy to administer, have high patient acceptance and have few drug-drug interactions. Patients, who are pregnant, have active or chronic liver disease, or those allergic to statins shouldn't use statin drugs. The most common side effects of statins are gastrointestinal, including constipation and abdominal pain and cramps. These symptoms are usually mild to severe and generally subside as therapy continues. Another class of drugs for lowering LDL is the bile acid sequestrants - cholestyramine and colestipol - and

nicotinic acid. These have been shown to reduce the risk for coronary heart disease in controlled clinical trials. Both classes of drugs appear to be free of serious side effects. But both can have troublesome side effects and require considerable patient education to achieve adherence. Nicotinic acid is preferred in patients with triglyceride levels exceeding 250 mg/dl because bile acid sequestrants tend to raise triglyceride levels.

Other available drugs are gemfibrozil, probucol and clofibrate. Gemfibrozil and clofibrate are most effective for lowering elevated triglyceride levels. They moderately reduce LDL cholesterol levels in hypercholesterolemic patients, but the American FDA hasn't approved them for this purpose. Probucol also moderately lowers LDL levels and it has been received FDA approval for this purpose.

If a patient doesn't respond adequately to single drug therapy, combined drug therapy should be considered to further lower LDL cholesterol levels. For patients with severe hypercholesterolemia, combining a bile acid sequestrant with either nicotinic acid or lovastatin has the potential to markedly lower LDL cholesterol. For hypercholesterolemic patients with elevated triglycerides, nicotinic acid or gemfibrozil should be considered as one agent for combined therapy.

9.1 Drugs

There are a variety of medications available for lowering blood cholesterol levels. They may be prescribed individually or in combination with other drugs. Some of the common types of cholesterol-lowering drugs include (1) Clofibrate, (2) Gemfibrozil, (3) Nicotinic acid (niacin), (4) Resins, (5) Statins, (6) Fibric acid derivatives (7) Fibrates:

9.1.1 Clofibrate (Atromid-S). This drug raises the HDL cholesterol levels and lowers triglyceride levels.

9.1.2 Gemfibrozil (Lopid). This drug lowers blood fats and raises HDL cholesterol levels.

9.1.3 Nicotinic Acid (niacin). Niacin is a B-complex vitamin. It's found in food, but is also available at high doses by prescription. It lowers LDL cholesterol and raises HDL cholesterol. The main side effects are flushing, itching, tingling and headache. Niacin or nicotinic acid, includes the brand names Niacor, Niaspan, or Slo-niacin. Over-the-counter preparations include extended-release, timed-release, and controlled-release. Niacin found in dietary supplements should not be used to lower cholesterol. The doctor or lipid specialist will let patients know what type of niacin is best for them. This drug works in the liver by affecting the production of blood fats. It's used to lower triglycerides, lower LDL cholesterol and raise HDL cholesterol.

9.1.4 Resins. Resins are also called bile acid-binding drugs. They work in the intestines by promoting increased disposal of cholesterol. There are three kinds of medications in this class: (1) Cholestryamine (Questran, Prevalite, Lo-Cholest), (2) Colestipol (Colestid), (3) Coleseveiam (WelChol).

9.1.5 Statins. Statins block the production of cholesterol in the liver itself. They lower LDL, the "bad" cholesterol, and triglycerides and have a mild effect in raising HDL, the "good" cholesterol. Statin drugs are very effective for lowering LDL cholesterol levels and have few immediate short-term side effects. They work by interrupting the formation of cholesterol from the circulating blood. These drugs are the first line of treatment for most people with high cholesterol. Side effects can include intestinal problems, liver damage, and in a few people, muscle tenderness or weakness.

Examples of statins include: (1) Altocor, (2) Baycol (cerivastatin), (3) Crestor, (4) Lipitor (atorvastatin), (5) Lescol (Fluvastatin), (6) Mevacor (lovastatin), (7) Pravachol (pravastatin), (8) Zocor (simvastatin). Advicor is a combination of a statin and niacin. Caduet is a new drug that is a combination of a statin (Lipitor or atorvastatin) and a blood pressure-lowering drug called amlodipine (Norvasc). Commonly prescribed statins include: (1) Atorvastatin (Lipitor), (2) Cerivastatin (Baycol), (3) Fluvastatin (Lescol), (4) Lovastatin (Mevacor), (5) Pravastatin (Pravachol), (6) Simvastatin (Zocor).

9.1.6 Bile Acid Sequestrants. These drugs work inside the intestine, where they bind to bile and prevent it from being reabsorbed into the circulatory system. Bile is made largely from cholesterol, so these drugs work by reducing the body's supply of cholesterol,, thus lowering total and LDL cholesterol. The most common side effects are constipation, gas, and upset stomach. Examples of bile acid resins include: questran and questran light (cholestyramine), colestid (colestipol), WelChol (colesevelam).

9.1.7 Fibrates. Fibrates lower triglyceride levels and can increase HDL and lower LDL cholesterol. The mechanism of action is not clear but it is thought that fibrates enhance the breakdown of triglyceride-rich particles and decreases the secretion of certain lipoproteins. In addition, they induce the synthesis of HDL. Examples of fibrates include: tricor (fenofibrate), lopid (gemfibrozil), lofibra (fenofibrate).

9.1.8 Side Effects of Cholesterol-Lowering Drugs

The side effects of cholesterol-lowering drugs include: (1) Muscle aches, (2) Abnormal liver function, (3) Allergic reaction (skin rashes), (4) Heartburn, (5)

Dizziness. (6) Abdominal pain, (7) Constipation, (8) Decreased sexual desire.

One newer drug is Zetia. This drug works by inhibiting the absorption of cholesterol from the blood. Side effects include back pain, joint pain, diarrhea and abdominal pain.

As of August 8, 2001, Bayer Pharmaceutical Division voluntarily withdrew the drug Baycol (cerivastatin) from the U.S. market because of reports of fatal muscle damage caused by the drug.

9.2 Bacteria on Cholesterol

Some bacteria can change cholesterol in food to coprostanol that cannot be readily absorbed by the body. These kinds of bacteria are called friendly bacteria. This helps recycle cholesterol to make hormones. Bifidobacterium and Lactobacillus acidophilus may play an important role in cholesterol metabolism of their host. Intestinal bacteria convert cholesterol into a less absorbable form coprostanol thus hampering its absorption from the intestinal tract (Lin, 2000). Lactic acid bacteria in intestine have the cholesterol lowering effect (Pereira, 2002). Some oral bacteria such as Lactobacillus acidophilus have been commercial available for the cholesterol lowering. Feeding friendly bacteria can do: (1) reduce the growth of unfriendly bacteria, (2) maintain regular bowel movements, (3) maintain cholesterol and triglyceride levels, (4) maintain healthy blood sugar levels (Ma, 2004).

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Statistics and Probability in Lottery of "WINFall"

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Abstract: The "WINFall Lottery" has been closed since May 14, 2005. By the analysis of the lottery game WINFall's design of, there was significant change to win. This article is describing how it runs. . [The Journal of American Science. 2006;2(1):51-53].

Keywords: lottery; probability; statistics; win; WINFall

Introduction

The "WINFall Lottery" has been closed since May 14, 2005. I am sorry that you lost your chance to win money! There was significant change to win by the design of lottery game WINFall. This article is describing how it runs. All data are from www.michigan.gov/lottery (Michigan Lottery Website, 2005).

Analysis and Discussions

When you open the advertisement for the "WINFall Lottery", you read the following:

"Simply choose six numbers from a field of 49 and enter them on your play slip."

"Players win the jackpot by matching all six of the numbers drawn. There are also prizes for matching five, four and three numbers…"

"If the jackpot reaches $5 million and no one hits it, get ready for a "WINFALL." Then ALL of the prize money, including the cash accumulated in the jackpot, is paid out to match five, four and three lower-level prizes increase by approximately 10 times!" (Lottery Results Website, 2005; Michigan Lottery WINFall Results Website, 2004).

The above statements are the advertisements for the WINFall lottery. All of the information has been summed up in Table 1. The total prizes, in the last two years (from May 14, 2003 to May 14, 2005), have been listed in Table 1 as well.

The jackpot has reached $5 million 10 times in the last two years. This has been summed up in Table 2. At the same time, the probability $P_{jh,}$ of the jackpot being hit each time, when the jackpot reaches $5 million, is estimated and listed in the Table 2.

Knowing the total tickets N_{tt} each time, P_{jh} can be estimated easily:

$$P_{jh}=1-(1-P_6)^{N_{tt}}$$

Lottery P_6 is the probability of matching 6 numbers. In the case of the WINFall lottery, $P_6=1/13,983,816$.

The total tickets N_{tt} each time can be estimated by its samples and their probabilities. The WINFall lottery has 4 samples, matching 6 numbers N_6, matching 5 N_5, matching 4 N_4 and matching 3 N_3 respectively. N_3 is the largest sample of the WINFall lottery. As far as we have four samples in hand: N_6 N_5 N_4 and $N_{3,}$ we use N_3 to calculate the total tickets. Because the more sample are there, the small differences (Statistics Accuracy) we have. The N_{tt} is:

$$N_{tt}=N_3/P_3$$

P_3 is the probability of matching 3 numbers. In the case of lottery WINFall, $P_3=1/57$.

According to the rule of the WINFall lottery, when the jackpot reaches $5 million, if someone hits the

jackpot-matches 6 numbers, there is no WINFALL.

Table 1. WINFall lottery information

Match Number	6	5	4	3
Theory Probability	1/13,983,816	1/54,201	1/1,032	1/57
All prizes (in 2 years)	15	2,158	117,685	2,150,651
Prize (normal)	Jackpot	$2,500	$100	$5
Prize in Fall (estimated)	The jackpot not be hit	$25,000	$1,000	$50

Table 2. WINFall lottery result history

Match Number	6	5	4	3	Probability of the jackpot be hit (P_{jh})
#Sat. Jun 14, 2003	1($5.4m)	38($2500)	1,793($100)	30,825($5)	1/8.4694
#Sat. Aug 30, 2003	0	30($21170)	1,327($1005)	23,943($50)	1/10.7547
#Sat. Oct 18, 2003	0	32($20,758)	1517($919)	27,715($45)	1/9.3615
#Wed. Dec 03, 2003	0	26($24,142)	1331($990)	25,397($46)	1/101686
#Sat. Jan 17, 2004	0	27($24,012)	1,499($908)	28,536($43)	1/9.1071
#Wed. Mar 03, 2004	1($5.4m)	48($2500)	2321($100)	38,934($5)	1/6.8145
#Wed. Jun 02, 2004	0	70($9,508)	2,585($540)	33,504($37)	1/7.8339
#Sat. Oct 23, 2004	0	24($25,641)	1211($1067)	23,868($48)	1/10.787
#Sat. Mar 26, 2005	0	33($20,930)	1,585($915)	28,303($46)	1/9.1778
#Sat. May 14, 2005	0	28($22,816)	1,527($878)	28,715($42)	1/9.0535

Table 3. WINFall lottery result analysis

	Probability of hitting jackpot	5	4	3	Total prize	Net incoming
Match number	1/259	1	53	951		
#Sat. Jun 14, 2003	1($5.4m)	$2,500	$100	$5	$12,555	-$41,646
#Sat. Aug 30, 2003	0	$21,170	$1005	$50	$121,985	+$67,784
#Sat. Oct 18, 2003	0	$20,758	$919	$45	$112,260	+$58,059
#Wed. Dec 03, 2003	0	$24,142	$990	$46	$120,358	+$66,157
#Sat. Jan 17, 2004	0	$24,012	$908	$43	$113,029	+$58,828
#Wed. Mar 03, 2004	1($5.4m)	$2,500	$100	$5	$12,555	-$41,646
#Wed. Jun 02, 2004	0	$9,508	$540	$37	$73,315	+$19,114
#Sat. Oct 23, 2004	0	$25,641	$1067	$48	$127,840	+$73,639
#Sat. Mar 26, 2005	0	$20,930	$915	$46	$113,171	+$58,970
#Sat. May 14, 2005	0	$22,816	$878	$42	$109,292	+$55,091

If we spend $54,201 on WINFall lottery tickets when the jackpot reaches $5 million, and choose the numbers of all tickets carefully, our law of choosing is:

Group A: being composed of 57 tickets. Among them, there are no 3 same numbers on any two tickets. From the probability of matching 3 numbers, at least one ticket will hit the prize of matching 3 numbers;

Group B: Coming from Group A and being composed of 1032 tickets. Among them, there are no 4 same numbers on any two tickets. From the probability of matching 4 numbers, at least one ticket will hit the prize of matching 4 numbers;

Group C: coming from Group B and being composed of 54,201 tickets. Among them, there are no 5 same numbers on any two tickets. From the probability of matching 5 numbers, at least one ticket will hit the prize of matching 5 numbers;

At same time, the probability P of the jackpot being hit by our 54,201 tickets is

$$P=1-(1-P_6)^{54201}=1/259$$

According to the information from Table 1, we can estimate our situation when the jackpot reaches $5 million (Table 3).

From Table 3, we know that: if we are unfortunate and the jackpot is hit by someone other than us, we lose $4.3 and only get prize of only $1, losing money!

But, "if the jackpot reaches $5 million and no one hits it", we use $1 get relatively $2.3 prize. We win money!!

We know that also: the probability of the jackpot being hit by someone (including us) is between 1/7 & 1/11. That means: the probability that we win money is large!

Now suppose that: from Sat. Jun 14, 2003 to Sat. May 14, 2005, every time the jackpot of the WINFall lottery reaches $5 million, we buy 54,201 tickets following the rules above, we lost money two times, but we won money 8 times. See table 4.

The total money that we get from the WINFall lottery is:

-$41,646+$67,784+$58,059+$66,157+$58,828-$41,646 +$19,114+$73,639+$58,970+$55,091=$374,350

We can win money indeed! Au, don't forget pay taxes!

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Even the Dial-up Internet Users , temp. IP Address Owners Deserve an FQDN Address

--Short Paper and a Request for Comment--

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Abstract: It is Common knowledge that a DNS name is always granted to the select few who own or procure permanent IP address. We say "a Select few" because plenty of surveys have shown that the ratio of nodes with temporary address on the Internet to that of the stations with permanent address is whopping-ly high. Here let us re-clarify that servers with permanent IP address are registered in the DNS hierarchy with some FQDN like http://abc.xyz.com. The protocol "http" taken as an example here could be any other protocol like ftp. or mms. etc . The unfortunate lot who log on to Internet to reap the services offered, maybe, for a few hours are the ones who arrive to the Internet arena thru some ISP and are temporarily provided an IP address. They do not have permanent Ip since they have not paid for that again since they might not require a permanent presence on Internet. But , the point we are making is that it is slowly turning into a myth that these unfortunate lot do not require a DNS name. We shall cite a few examples of such requirements, which the majority of temporary Intrenet users are feeling to have and the number is growing with the penetration of Internet-enabled education in society. [The Journal of American Science. 2006;2(1):54-55].

Keywords: dial-up; DNS; Internet; IP; ISP

Cases

A media lover would like his friends and his forum-partners to watch his documemntaries that he shoots regularly and edits afterwards. He would like to place his media on his computer. He logs on using his Broadband thru predetermined hours and turns on the media encoder and services. His so many acquaintances could watch the stream using an URL, from any corner of the world, but which URL ?? . His IP address is going to change every day or could be every half 'n hour if the connection so graces. He could go for a permanent Ip address and a Proper DNS registration, but he does not want to make a career out of this. This is just for the time being till he cultures another hobby. Morover he does not have such persistent requirement to shelve out the necessary extra money and bear the inconvinience of extra correspondence and a long wait.

A person might want to host his own FTP server from his house thru his Dial-up connection for others to download light pic and doc files. It would be very convinient if his FQDN would remain ftp://david_r.vsnl.com rather than accessing his domestic site using a different Ip address every day.

A Lady would love to host her own domestic WebSite , where every day at 5:00 pm she illustrates some new gastronomic preparation. She wants her audience to access her page thru http://sheila1972@sify.com rather that dole out her new ip address every day to a 150 odd viewers.

These are a few instances which exhibit the requirement of such a mechanism, that could keep the DNS name static, though the ip address will change regularly. There is similar mechanism that is followed in LANs especially those which house Microsoft platforms called DHCP-DNS integration but the exact methodology would be unsuitable for the Internet-ISP scenario.

This paper strives to find and suggest a solution where evry ISP dialup user or Braodband customer could receive a permanent DNS name on request, a name which shall be housed primarily on the ISP's DNS servers , a name with extension of the ISP's DNS name and which could be accessed from the world over. The solution lies in changing or rather upgrading the present DHCP, DNS and to some extent PPP algorithms, a little bit. The paper also digresses into discussing the pros and cons of such a mechanism. Because we sincerely believe there is a tremendous need of this facility and convinience, out there !!!

It is my desire to have an honest feedback from the Internet Community on this humble work.

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Studies on the Effects of Catching Rainwater with Saving Water Technology of Covering Film between Furrows in Eestern Semi-arid Area of Heilongjiang Province

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Abstract: Considering the allocation rainwater effect of covering film between furrows, the article takes data of Gannan County as an example studied the catching rainwater effect of saving water technology with covering film between furrows. The catching rainwater effects relate to the width of covering film and natural rainfall intensity. When the width of covering film is 60-80 cm, natural rainfall intensity is at 5-15 mm, the pant belt beside 15 cm of covering film remained rainwater can be 2.1-3.2 times of rainfall. When less water in the Spring season or the sprinkler irrigated land, the covering film between furrows can catch rainwater efficiently. [The Journal of American Science. 2006;2(1):56-60].

Key words: Semi-arid area; covering film between furrows; effect of catching rainwater

Introduction

The western semi-arid area of Heilongjiang Province is located in north latitude from 45° 58 ′ to 48 ° 58 ′ , east longitude from 122° 24 ′ to 128° 19 ′ .Gross area is 10.18×104 km^2, it accounts for 22.4 percent of gross area in the whole province agricultural acreage in the district is 6043×104 acreages, it accounts for 44 percent of agricultural acreage in the whole province agricultural acreage. There is 27 counties and cities in the district. Including Longjiang, Gannan , Tailai county, etc. the district is continental climate, it is more windy and less rain in Spring, it is sweltering and little in Summer , it is cold in Winter. mean annual precipitation is between 380mm and 500mm, and mean annual evaporation is between 1400mm and 1600mm, it is the essential characteristic of drought in spring, bed sowing and sprinkler irrigation as representative of water saving irrigation have been generalizing in large area here in last ten years, they attained better effects of fighting a drought and increasing production. For the sake of improving the general capability of fighting a drought in this area, from 2002, "863 project " of national program —— "integration and demonstration of water saving agriculture integrative system in northeast semi-arid drought resistance irrigation area" come into effect in this area, in virtue of combination of water conservancy measures and mechanization of farming, agriculture measures, people searched after general technologic pattern of fighting a drought and water saving to adapt to local nature condition. Mechanized dry crops semination covering films between furrows was one of the dominating technical measures which were adopted there inro, it has played a important role in improving agriculture integrative capability of fighting a drought, in order to further discuss the effects of catching rainwater of dry crops with saving water technology of covering film between furrows in western semi-arid area of Heilongjiang Province, this paper combined Gannan county data to study. the effects of catching rainwater with saving water technology of covering film between furrow.

1. The analyses of distribution law of rainfall time interval and field moisture deficit amount in growth period.

1.1 The analyses of distribution law of rainfall time interval

The statistical analyses were monthly done by 48 years' s daily rainfall data in the weather station in the Gannan county, from 1955 to 2002, the results were listed in Table 1.

K is a percent which monthly precipitation takes up total precipitation in crop growth period. From tab 1 we can see : ① precipitation distributed asymmetrically in a year, precipitation amount in April, May and June only accounted for 28.2 percent of precipitation in all crops growth period , rainfall centralized in July and August , rainfall in July accounted for 34.7 percent of precipitation in all crops growth period, difference in each month precipitation

was biggish，precipitation in Spring was less. ② The characteristic of precipitation in overyear distribution was that variability coefficient in April and May arrived at 0.78 and 0.91 respectively，but variability coefficient in July and August where precipitation was centralized was less.

Table 1. The rainfall of per month in crop growth period (April-September)

Months	4	5	6	7	8	9	Σ
Precipitation amount mean value P（mm）	16.94	31.27	70.83	146.54	105.15	51.51	421.80
Standard deviation S（mm）	15.36	24.30	39.12	78.77	48.53	31.22	
Variability coefficient C_v	0.91	0.78	0.55	0.54	0.46	0.60	
Proportional coefficient K（%）	4.0	7.4	16.8	34.7	24.9	12.2	100.0

1.2 The analyses of field moisture deficit amount in growth period

The researchful production of water saving and high yield irrigation program of main crop in Heilongjiang Province and isoline map of water demand was quoted，with a view to the effect of non-copious irrigation on crop water demand，that crop water demand of soybean and maize as representative was comfirmed，each month water in crops growth period，compared with precipitation amount in the corresponding period. each month arid degree was analyzed in crops growth period in Gannan county.

According to soil moisture equilibrium theory，without regard to level movement of soil moisture，soil moisture equilibrium equation in the certain soil layer is that

△W= P + I + k—ET。 （1）

combining the characteristic of seedling period of local soybean and maize，and taking into account of the effects of subsoil frozen crust，K of capillary ascending water equals to zero. I equals to zero under no irrigation，soil moisture equilibrium equation in the certain soil layer is that

△W=P — ET。 （2）

△W stands for soil moisture change quantity in time interval in the formula，when △W value is positive number，that shows that soil moisture increase. When △W value is negative number，that shows soil moisture wane；P stands for rainfall in time interval. ET。stands for field transpiration and evaporation in time interval，namely crops water demand.

Applied to（2）formula，and found water saving and high yield irrigation program of main crop in Heilongjiang Province and isoline map of water demand，with a view to the effects of non-copious irrigation on crop water demand，each month water demand in soybean and maize seedling period，compared with precipitation amount in the corresponding calculated and gained period，wane amount which was in seedling growth period was listed in Table 2.

Table 2. Soil moisture deficit analysis in land of soybean and corn during growth season

Month	4	5	6	Σ
Precipitation uniform value P（mm）	16.94	31.27	70.83	119.04
soybean and maize’s general water demand ET。（mm）	22.2	38.8	112.5	173.5
Soil moisture wane △W（mm）	5.3	7.5	41.7	54.5

Soil moisture wane △W which was shown in Table 2 was counted by mean annual precipitation，thus，which was shown was mean annual moisture wane amount.. Natural rainfall in June was 70.83，water demand in June was 112.5mm，moisture wane amount in June was 41.7mm，June was the month when moisture wane amount was the most，and drought was the most serious，that was fully coincident with factual condition in Gannan area，thus it can be seen that searching after supernal efficiency measures which suited. precipitation in Spring seedling growth season in this area，and increasing natural precipitation utilization factor，it was important significance to improve general fighting a drought capability.

2. The analyses of the technology of covering film between furrows and the effects of catching rainfall

2.1 The ridge form and width of covering film

Dry copy covering film between furrows was that people made use of special covering film sowing machine to sow, space between furrows might adopt equal and unequal space between furrows, such as 85 cm/45 cm, 75 cm/65 cm, 65cm /65cm, in order to improve earth temperature, ground film was covered in wider space between furrows , and reduce soil evaporation and preferably collect natural precipitation. seeds were sowed in bare soil outside film, covering film, there was 2～3cmbetween seeds and margin of film, mulching soil and crushing were completed by coverer and crusher, respectively. The ridge form of covering film approximately was flat ridge, but, in order to improve the quality of covering film, the soil under film should be leveled by special plastic board to wipe off the big clod and root stubble, ridge form should be symmetrical, the middle of ground film which were covered was higher 3～4cm than both sides, so that rain water that flat on the surface of film uniformly flowed to plant belt of film sides, rain water concentratively irrigation to crop root.

2.2 The analyses of catching water of covering film amount and rainfall amount in plant belt

Catching water of covering film amount with different width of covering film might be calculated by next formula:

$$W = X + Y + Z \qquad (3)$$

In the formula

W——unit ridge length amount of catching water of covering film between furrows (m^3);

X——unit ridge length amount of catching water of covering film between the film surface of furrows, it equals the product of catching water depth h in film surface and unit ridge length covering film area A(m^3);

Y——unit ridge length amount of catching water on covering film soil of film sides (m^3), it equals the product of covering film soil bulk V of film sides and field capacity of soil θ_f;

Z——unit ridge length amount of catching water of covering film soil above film surface (m^3), it equals the product of covering film soil area A_0 above film surface and precipitation amount P.

or $$p_a = 1000\ W / a\ L \qquad (4)$$

In the formula

p_a ——The depth of catching water of covering film with different width of covering film by conversion (m^3);

a——The depth of covering film (m), it equals that distance between furrows subtracts twofold distance from plant belt center to ground film (it may select 2～3cm);

L——Unit ridge length of covering film between furrows (m).

When rainfall began, rain water that fell on the surface of film collected towards both sides of the film, firstly, contenting water storage of catching water on the surface of the film and covering film soil by the sides of the film, after moisture of covering film soil by the sides of the film was up to field moisture capacity, rain water that fell on the surface of film further stored water up to saturation, succedent precipitation may be collected to irrigate into the soil near plant belt; When rainfall stopped, gravity water in covering film soil by the sides of the film finally infiltrated into the soil of plant belt. If precipitation amount was larger than Catching water of covering film amount between furrows, rain water would exceed precipitation of catching water and that collected into the crop root soil near film, this action corresponded to local irrigation in the crop root soil (like drip irrigation).

Precipitation amount in plant belt might be calculated by next formula:

$$p_b = p + (p - p_a) \cdot a / 2b \qquad (5)$$

In the formula

p_b ——Precipitation amount which was received by plant belt (mm);

P——Natural precipitation amount (mm);

b——The width of plant belt (m), there was relationship between its value and soil permeability, irrigation amount, etc. Taking into account of the effects of catching rainwater of covering film, The width which was received by plant belt may be selected 12～20cm;

The meaning of other symbols was the same as the above symbols.

During the practice of covering film between furrows in western semi-arid area of Heilongjiang Province, by investigation, survey and calculation, double-side covering film soil of each 1000 extended meter between furrows was 2.5m^3, according to the calculation of thirty percent (percent that moisture accounts for soil bulk) of field moisture capacity of loam and clay, so that the precipitation of catching rainfall when water volume of 2.5m^3 covering film soil was up to moisture-holding capacity, the precipitation of catching rainfall was 0.75 m^3; In order to prevent that ground film was blown by wind, a shovel of soil was covered in the middle of film every 2.5m^3, the covering film soil of each 1000 extended meter was 400 shovels, the area of covering film was 0.1m^3 according to covering film soil of each shovel, so the area of covering film soil above film was 40m^3, under the

circumstance that the precipitation was not very large, the corresponding precipitation of catching rainfall was the product of the area of covering film soil and precipitation; taking into account of the effects of catching rainwater of ground film itself, the precipitation of catching rainfall above film may be calculated by 1mm, received rainwater in plant belt with deferent width of covering film, deferent natural precipitation in Table 3.

Table 3. received rainwater in plant belt with deferent width of covering film, deferent natural precipitation

a（cm）	80	70	60
P=5mm	12.5	11.5	10.4
P=10mm	30.3	27.5	24.8
P=15mm	48.3	43.5	39.2

The width of covering film between furrows in table 3 was calculated by outboard film seeding, the width of plant belt was selected 15 cm. From Table 3 we can see that under the circumstance of 60～80 cm, when natural precipitation was 5～15 cm, the precipitation received practically of 15 cm width of plant belt was 2.1～3.2 fold of quondam precipitation, it is very obvious to the effects of catching rainwater .

3. The effects of catching rainwater with saving water technology of covering film between furrows in western semi-arid area of Heilongjiang Province

taking an example of Gannan county, if the technology of covering film between furrows was adopted, according to the calculation of mean annual precipitation during growth period from April to June, when the width of covering film between furrows was 60 cm, the precipitation received practically in 5mm natural precipitation plant belt was 10.4 mm, the precipitation received practically in 10mm natural precipitation plant belt was 24.8 mm, the precipitation received practically in15 mm natural precipitation plant belt was 39.2mm, the precipitation received in plant belt corresponded 2.1～2.6 fold of natural precipitation. If the technology of covering film between furrows was adopted from the late April to the early May, the mean value of the precipitation received practically in corresponding plant belt in May and June precipitation was not under 84 mm （May）and 148 mm （June), from mean annual precipitation we can see that covering film between furrows in May and June made plant belt excessively receive precipitation 129mm, it is very important to prevent drought during growth period.

According to foregoing analyses, from mean annual precipitation we can see that water deficit of soybean and maize in May was 7.5 mm, water deficit in June was 41.7mm, water deficit in two months was 49.2 mm, which was out and away less than the 129 mm precipitation received excessively of covering film between furrows. But, because of annual precipitation randomicity, it was no practically significant to the effects of catching rainwater of covering film between furrows in the month in Spring when precipitation was more, if precipitation in Spring was less, then it was finite to the effects of catching rainwater of covering film between furrows. Only when rainfall was little in Spring but not especially little in some year or there was sprinkler condition in some plots, the effects of catching rainwater with saving water technology of covering film between furrows were commendably brought into play.

4. Conclusions

(1) The statistical analyses were done by 48 years' s daily rainfall data in the Gannan county, from 1955 to 2002, findings were shown that there was a question of drought in each month of growth period, the probability of happening gentle drought in June came up to 89.6 percent, June was the month when field moisture wane was most, drought was the most serious.
Therefore, utilization factor of natural precipitation in growth period was enhanced, that was important significance to improve general capability of fighting a drought in agriculture.

(2) The technology of covering film between furrows had better effects of catching rainwater, the effects of catching rainwater has a very relationship with the width of covering film and natural precipitation, under the circumstance of 60～80 cm, when natural precipitation was 5～15 cm, the precipitation received practically of 15 cm width of plant belt was 2.1～3.2 fold of quondam precipitation.

(3) From mean annual precipitation we can see that covering film between furrows in May and June made plant belt excessively receive precipitation 129mm, it is very important to prevent drought during growth period. But, because of annual precipitation randomicity, it was no practically significant to the effects of catching rainwater of covering film between furrows in the month in Spring when precipitation was more, if precipitation in Spring was less, then it was finite to the effects of catching rainwater of covering film between furrows. Only when rainfall was little in

Spring but not especially little in some year or there was sprinkler condition in some plots，the effects of catching rainwater with saving water technology of covering film between furrows were commendably brought into play.

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Chitosan and Randomly Methylated β-cyclodextrin Combined to Enhance the Absorption and Elevate the Bioavailability of Estradiol Intranasally: in situ and in vivo Studies

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Abstract: Chitosan and randomly methylated β-cyclodextrin were the most to be studied absorption enhancers for nasal administration recently. The enhancing absorption mechanisms of each other were different. Authors chosen estradiol as the model drug used in situ and in vivo methods to study whether or not they could combine to enhance the nasal absorption. In situ study data indicated that the optimal concentration and pH for chitosan to enhance the nasal absorption of estradiol in rats were 0.5% and 5, and in this condition the remaining percentage of estradiol was significant difference with RAMEB formulation after perfusion 30 min (P<0.05). The absolute bioavailabilities after intranasal administration were estradiol ethanol (70% w/w) solution: 22.24±7.88%; RAMEB: 58.78±11.19%; chitosan + RAMEB: 78.51± 23.13%. They were different significantly from each other (P<0.05). Based on the in situ and in vivo studies results, it's clear that chitosan and randomly methylated β-cyclodextrin could combine to enhance the absorption and elevate the bioavailability of estradiol after nasal administration. [The Journal of American Science. 2006;2(1):61-65]

Keywords: chitosan; randomly methylated β-cyclodextrin; estradiol; absorption enhancers; in situ; in vivo

1. Introduction

Chitosan is a polymer obtained from deacetylation of chitin, a naturally occurring structural polymer abundant in crab and shrimp shells. It is a cationic polysaccharide with linear chain con- sitting of b-(1,4)-linked 2-acetamino-2-deoxy-β-Dglucopyranose (GlcNAc) and 2-amino-2-deoxy-β- D-glucopyranose (GlcN) [1]. The greater the extent of deacetylation, the smaller is the proportion of GlcNAc in the polymer chain.

Recently, chitosan has been shown to enhance nasal and intestinal absorption of hydrophilic drugs like peptide hormones in both the in vitro and in vivo models [2-4]. According to the study using an in vitro Caco-2 cell model, its absorption enhancing mechanisms were reported to be a combination of mucoadhesion and an effect on the opening of the tight junctions [2]. Schipper et al. [5], using the same in vitro model, reported that the structural properties of chitosans such as degree of acetylation and molecular weight are very important for its drug absorption enhancement . They found that a low degree of acetylation (i.e. high percent deacetylation with greater charge density) and/or a high molecular weight appear to be necessary for chitosans to increase the epithelial permeability. Toxicity of chitosan also depends on its high charge density but appears to be less affected by the molecular weight.

With respect to mucosal drug delivery, chitosans show strong mucoadhesive properties [6]. In addition, interaction of the positively charged amino group at the C-2 position of chitosan with the negatively charged sites on the cell surfaces and tight junctions allows paracellular transport of large hydrophilic compounds by opening the tight junctions of mucosal membrane barriers [2, 5, 7]. The interaction with the opening mechanism of the tight junctions has been demonstrated by a decrease in ZO-1 proteins and the change in the cytoskeletal protein F-actin from a filamentous to a globular structure [8, 9]. These characteristics reveal the potential of chitosan and chitosan salts as penetration enhancers for mucosal paracellular pathways. Chitosans have been found to enhance the nasal absorption of degracalcitonin and insulin in rats and sheep [3], morphine-6-glucuronide and goserelin in sheep [10] and D-Arg -kyotorphin in rats [11], and the intestinal absorption of buserelin in rats [4].

Most of studies utilized chitosan alone as absorption enhancer. Currently, it is not known if the combination of chitosan and other absorption enhancers, as well as some other factors could exhibits a synergistic effect in the nasal absorption of drugs. Cyclodextrins (CDs) could also extract the phospholipids and proteins from membrane [12], so there was opportunity that chitosan and cyclodextrins combined to enhance drug nasal absorption.

The purpose of this paper was to evaluate the effects

of chitosan concentrations and pH in chitosan solutions on the estradiol permeation across the rat nasal mucosa in situ and the plasma estradiol concentrations after nasal administration of estradiol to normal rats. Moreover, tried to identify whether chitosan and randomly methylated β-cyclodextrin had a synergistic effect in enhancing nasal absorption of estradiol or not.

2. Materials and methods

2.1. *Materials*

Estradiol (17β-estradiol) was purchased from Xianju pharmaceutical factory, China. Randomly methylated β-cyclodextrin (RAMEB) was purchased from Wacker-Chemie, Germany. The 98% deacetylated Chitosan was obtained from Xindie Chitosan Company, China. All other reagents were of analytical grade or highest grade commercially available. All the chemicals were used without further purification.

Male Sprague–Dawley rats weighing 250–300 g were procured from the local animal house. Animals were further acclimatized to the environment of the experimental room for 2 days before starting the experiments.

2.2. *Methods*

2.2.1 *Preparation of RAMEB - estradiol complexes chitosan solution*

Chitosan was first dissolved in 1% v/v acetic acid normal saline to make stock solutions of 2.0% w/v. Following overnight swelling, the chitosan solutions of different concentrations (0.3%, 0.5% and 0.8%) were obtained by diluting the stock solution with normal saline, the pH was adjusted to 5.0 by drop wise addition of either 1 mol/L hydrochloric acid or 1 mol/L sodium hydroxide. The different pH of 0.5% solution was adjusted to 3.0, 4.0, 5.0 or 6.0 by drop wise addition of either 1 mol/L hydrochloric acid or 1 mol/L sodium hydroxide, too. Isotonicity was further achieved by gradual addition of sodium chloride and was checked by osmometer (Osmomat 030-D, Gonotec, Germany).

Estradiol was dissolved in 95% (w/w) ethanol with RAMEB (molar ratio 1:2) to form inclusion complexes [13]. Ethanol was evaporated under a mild nitrogen stream (50℃) and added resolved in the chitosan solutions to obtain the final estradiol formulations for nasal administration. The estradiol formulations contained the following: 2 mg/ml eatradiol and 2%(w/v) RAMEB for nasal delivery. For intravenous perfusion, the inclusion complexes were dissolved in normal saline .The estradiol and RAMEB concentrations were 0.01 mg/ml and 0.01% (w/v), respectively.

2.2.2 *In- situ drug absorption study*

The absorption studies were carried out according to the in-situ nasal perfusion technique [14]. Rats were anesthetized by intraperitoneal injections of urethane (2 g/kg body weight). An incision was made in the neck of the rats laid on their backs and placed under a heating lamp to maintain body temperature. The trachea was cannulated with a polyethylene tube to aid breathing. Another tube was inserted through the esophagus into the posterior part of the nasal cavity. The nasopalatine duct was closed with an adhesive agent (cyanoacrylate glue) to prevent the drainage of the solution from the nasal cavity into the mouth. The tube inserted into the esophagus was connected to a reservoir of 5 ml drug solution under magnetic stirring and immersed in a water-bath at 37°C. The solution was circulated, by means of a peristaltic pump (DDB－600 electric peristaltic pump, Shanghai Zhixin instrument limited company) from the reservoir through the nasal cavity and out of the nostrils back into the reservoir. Flow rate was set at 2.5 ml/min. Aliquots (100 μl) were sampled after 30 min and stored at -20°C until the assay. Three rats were used for each condition tested. The estradiol concentration was determined by HPLC (HITACHI) using a C_{18} column and UV detector at 205 nm. These studies were performed in triplicate for each of the samples, but the average values were considered for data analysis. The S.D. was less than 5%.

2.2.3 In vivo drug absorption study

In vivo studies were performed as earlier reported [15]. Briefly, The rats were fasted overnight and anaesthetized by intraperitoneal injection of urethane (2 g/kg). The rats were tracheotomised to divert the airflow from the nasal passages and aid breathing. The oesophagus was closed by ligation onto the tracheal cannula. The right external jugular vein was cannulated for blood sampling and fluid (physiological saline) replacement. The estradiol preparation (2 mg/ml) were delivered through the right nostril using a PVC tube connected to a microliter syringe to give an estradiol dose of 160 μg/Kg. The preparation administered nasally was about 20–24μl, depending on the weight of the rat. Blood samples (0.3 ml) were taken at various time intervals up to 3 h after administration, After each blood withdrawal, the same volume of sterile normal saline was put back into the circulation to maintain total blood volume. Plasma samples were separated by centrifugation at 8000 rpm for 10 min and kept frozen at －20◦C for subsequent analysis of estradiol. Each group contains six rats. The estradiol in plasma was completely extracted with diethyl ether. Ether containing estradiol was evaporated to dryness in a clean beaker and the residue was dissolved in methanol. The estradiol content was then estimated by HPLC, using a C_{18} column and fluorescence detector at

excitation 267 nm and emission 302 nm.

Statistical analyses were accomplished using SPSS statistical package. Student's t-test was used to determine the statistically significant differences between the results. Results with P values < 0.05 were considered statistically significant.

3. Results and discussion

3.1 *In situ drug absorption*

3. 1.1 *Effect of chitosan concentration*

The remaining estradiol concentration of perfusions was detected after 30min perfusion experiment, the remaining percentages (mean ± SD) of RAMEB, 0.3%chitosan +RAMEB, 0.5% chitosan + RAMEB and 0.8% chitosan +RAMEB formulations were 63.94±9.24, 68.32±4.50, 40.24±14.61 and 45.34±8.38% respectively(Table.1). The RAMEB formulation and the 0.3% chitosan +RAMEB formulation were no significant difference on the remaining percentage of estradiol. The estradiol absorption was enhanced with increase of the chitosan concentration, the remaining percentage of RAMEB and 0.3% chitosan +RAMEB were significant difference with 0.5% chitosan + RAMEB and 0.8% chitosan +RAMEB, but there was no significant difference between 0.5% chitosan + RAMEB and 0.8%chitosan +RAMEB formulations, indicating that their enhancing activity was saturable. This was in agreement with previous reports, which suggested that the mechanism of absorption enhancement of chitosan might be different from typical membrane-disruption enhancers like sodium taurodihydrofusidate, synthetic surfactants, and bile salts [2,3]. Thus, based on the data obtained in this part, the concentration of 0.5% appeared to be optimal for chitosan to enhance the nasal absorption of estradiol in rats.

3. 1.2 *Effect of pH*

In order to study whether or not pH would influence the nasal absorption of estradiol, the 0.5% of chitosan containing RAMEB solutions of different pH were administered to rats, and the remaining percentages of estradiol were assayed after 30min perfusion. The remaining percentages (mean±SD) of pH 3.0, 4.0, 5.0 and 6.0 formulations were 52.87±0.70, 52.08±1.37, 53.72±2.49 and 62.27±1.57% respectively(Table.2). The enhancement of estradiol was declined with the increase of pH. There were no significant difference between pH 3.0, 4.0 and 5.0 formulations, but pH 6.0 formulation was significant different with the others. Considering the normal environment of the nose, pH 5.0 formulation seemed to be optimal for chitosan combined with RAMEB to enhance the nasal absorption of estradiol in rats.

Table 1. Effect of the chitosan concentration on estradiol nasal absorption clearance (n=3)

Formulations	Remaining percentages of estradiol after 30 min perfusion (%)			
	Individual values			Mean±SD
RAMEB	74.55	59.59	57.69	63.94±9.24
0.3% chitosan +RAMEB	63.55	68.93	72.48	68.32±4.50*
0.5% chitosan + RAMEB	39.41	26.06	55.26	40.24±14.61
0.8% chitosan +RAMEB	49.21	35.72	51.08	45.34±8.38

* Significant difference ($P < 0.05$)

Table 2. Effect of the pH on estradiol nasal absorption clearance (n=3)

pH	Remaining percentages of estradiol after 30 min perfusion (%)			
	Individual values			Mean±SD
3.0	52.06	53.27	53.27	52.87±0.70
4.0	53.16	52.53	50.54	52.08±1.37
5.0	55.29	55.02	50.85	53.72±2.49
6.0	60.97	61.82	64.01	62.27±1.57*

* Significant difference ($P < 0.05$)

3.2 *In vivo drug absorption*

To determine whether or not chitosan and RAMEB had a synergistic effect in enhancing the absorption and elevate the bioavailability of estradiol intranasally, these formulations were administered intranasally and intravenously in rats. The C_{max} (mean ± SD) of estradiol ethanol (70% w/w) solution, RAMEB and chitosan + RAMEB in plasma after intranasal administration were 70.56 ± 29.14, 20.51±6.02 and 62.41 ± 28.80 ng/ml, respectively; The t_{max} of the three formulations were 5, 15 and 30 min, respectively (Figure. 1). Intravenous administration of estradiol showed comparable plasma

concentration–time profiles compared to the nasal route of administration for these formulations. For all formulations the absolute bioavailabilities after intranasal delivery (estradiol ethanol (70% w/w) solution: 22.24 ± 7.88%, RAMEB: 58.78 ± 11.19%, chitosan + RAMEB: 78.51 ± 23.13%) differed significantly from each others (Table 3). The in vivo absorption data indicated the potential of chitosan combined RAMEB as effective nasal absorption enhancers of estradiol. There enhancing effects were better than single RAMEB under their corresponding optimum concentration and pH.

Table 3. Mean time (t_{max}) to maximal plasma concentration (C_{max}, weight corrected), area under the curve (AUC) from 0 to 3 h and bioavailability of intranasal estradiol formulations (ethanol solution, RAMEB and chitosan + RAMEB) after administration (results expressed as mean ± S.D.) (n = 6)

Formulation	t_{max} (min)	C_{max} (ng /ml)	AUC_{0-3h}	Bioavailability (%)
Intravenous		200.58±96.01	3394.85±676.05	
Ethanol solution	5	70.56 ± 29.14	754.99±267.66	22.24±7.88*
RAMEB	15	20.51±6.02	1995.33±58.78	58.78±11.19*
Chitosan + RAMEB	30	62.41 ± 28.80	3134.52±1425.74	78.51±23.13*

* Significant difference ($P < 0.05$).

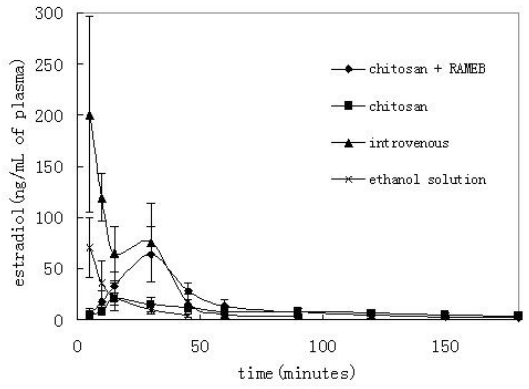

Figure 1. In vivo absorption of estradiol from intravenous and intranasal estradiol formulations [estradiol ethanol (70% w: w) solution, RAMEB and chitosan + RAMEB formulations in rats estradiol (ng/mL of plasma)]

The influence of chitosan on the effect of estradiol both in-situ and in vivo in our studies indicated that chitosan concentration and pH were the impacting factors influencing the enhancement of drugs to pass through the membrane, probably due to the mucoadhesive properties and high viscosity produced by the chitosan solutions, which make the drugs stay in the nasal cavity for a long time and be cleared slowly by mucocilia from nasal mucosa. But in this rat model, the mucociliary clearance mechanism is impaired hence the mucoadhesiveness has less importance in this studies. On the other hand, chitosan may open the tight junctions between cells due to the interaction of the positively charged amino group of it with the negatively charged sialic acid residues in mucus, leading to the transport increase of drugs across the epithelium, as it was mentioned in the introduction. Studies [2] demonstrated that an increase in chitosan concentrations resulted in an increase in the permeability coefficient of 14C-mannitol with a plateau level between 0.25 and 0.5%, using a human intestinal cell line (Caco-2) as the model epithelial cell layer. The combined effect mechanism of the absorption enhancement was when chitosan interacts with the epithelial membrane, the tight junctions are opened, and then RAMEB could penetrate into the opened gaps between cells and extract the phospholipids in biomembrane. Thus, the tight junction proteins such as occludin [16], claudin-1 and -2 [17] are naked and may collapse after the removal of surrounding phospholipids, resulting in these fusion points untied. So the opening of the tight junctions may be strengthened by co-administration of chitosan and RAMEB.

4. Conclusions

In-situ study data indicated the optimal concentration and pH for chitosan to enhance the nasal absorption of estradiol in rats were 0.5% and 5. After intranasal delivery the absolute bioavailabilitiy of chitosan + RAMEB formulation was higher than RAMEB formulation's, moreover they were different significantly (P<0.05). Based on the results above, we could conclude that chitosan and randomly methylated β-cyclodextrin could combine to enhance the nasal absorption of estradiol. This paper just studied the lipophilic and micromolecular drugs, such as estradiol; their effects on the hydrophilic and macromolecular drugs were waiting for the further studies afterward.

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A Study of Composting System of Municipal Solid Waste with Bio-surfactant

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Abstract: Three sets of adding Bio- surfactant experiments were conducted to understand composting processes with bio-surfactant. Inoculating Strains Ⅲ(2), Pseudomonas aeruginosa (PA) and Bio-surfactant to MSW system by 0.4%、0.4%、0.008% for Run 1, Run 2, Run 3, respectively. The composting experiments showed that: The system of treatment 1 (0.4% Strains Ⅲ(2)), reduce surface tension between liquid and solid to 36 mN/ml at 24 hours. Compared with the control, the quantity of humic from 10.6% to 18.2% and accumulation H_2S of outlet gas was around half of the control. Thus, Inoculation composting technology with bio-surfactant is a promised method to enhance composting efficiency and improve composting quality. [The Journal of American Science, 2(1):66-70].

Keywords: municipal solid waste; composting; bio-surfactant; efficiency composting process

1. Introduction

Composting is a well-know system for rapid organic matter (OM) stabilization and humification (Adani, 1995; Desai J D, 1997), and Compost is organic fertilizer containing primary nutrients as well as trace minerals, humus and humic acids, in a proportion that almost exactly matches plant requirements, and in a slow release form that does not burn plants. At present, because of the poor compost technology in China, some problems, such as, low efficiency of MSW compost, unstable production qualities, and some strong smells, made a lot of compost factory be a state of stop production and half –stop production owing to the unmarketable of compost production, worse environment of compost plant, and expensive fee of MSW treatment (Nakano, 1992), therefore, how to increase the efficiency of compost, improve the environment and qualities of compost have become the technological keys. Bio-surfactant comes from the metabolic product of microorganisms; it can improve the microenvironment of compost, promote the dissolution of infectant and accelerate the process of compost reaction. In this paper, the further study on strengthen compost technology by Bio-surfactant has important theory and practice meaning on popularization of MSW compost in China.

2. Materials and Methods

2.1 Materials

Because of the complex and unsteadiness of MSW compositions, primary MSW compost would produce many uncertainty factors. In this paper, compost materials are made up of many substances according to a certainty proportion (Table 1), properties of compost materials were showed in Table 2.

Table 1. The composition of compost materials

Materials	Potato	cabbage	meat	rice	paper	soil	unit	note
Contents	40	20	10	10	5	5	/%	

Table 2. Properties of compost materials

Treatment	Organic Carbon %	Water %	Ash %	Organic matter %	Total Nitrogen %	Total Phosphorus %	Total Potassium %	C/N	pH
Compost	30~35	50~60	25~35	55~65	1.2~1.5	?	?	24~30	6.5~7
Materials	35	68	20	70	3.4	1.8	?	10.3	7.2

Culture medium compositions: peptone, NaCl, K_2HPO_4, agaragar, potato distill juice, glucose, wort, barm juice, distilled waster, *et al*.

Experiment instruments: surface tension instrument, TOC analysis instrument, culture box, compost reactor, O_2-H_2S detection instrument, CO_2 detection instrument (ANALYZER LX-70) (Zhang, 2003).

2.2 Experiment methods

20 kg compost materials (water content 55%-60%) put into compost reactor (Figure 1) designed with a total volume of 27 L, and 300 mm in length, 300 mm in width, and 300 mm height. Additional equipments: churn-dasher, pH probe, gas flow meter, temperature maintenance box, an O_2-H_2S monitoring instrument (Model MD-520E), and a CO_2 analyzer (Model LX-710).

The experimental design included 4 treatments (Table 3). The experimental strains included strainsIII (2) and pseudomonas aeruginosa (PA) which produce bio-surfactant strongly. The different strains were respectively inoculated in 500 mL corresponding culture medium, and cultured by shake for 40 h at 28℃. And the suspension was inoculated in composting. Inoculating concentrations of the suspension were shown in Table 3. The bio-surfactant of treatment 4 was purified from the culture solution of strainsIII (2).

During composting, a 30 g sub-samples was taken once a day. A 10 g was analyzed for moisture content and ash. A 10 g was extraction by $Na_2P_4O_7$ solution, and analyzed humus. A 10 g was added to distilled waster, and analyzed surface tension and pH.

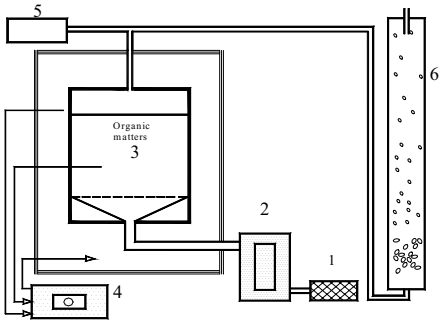

Table 3. Quantity of Bio- surfactant accession in compost materials

Trentments	Additive	Dose, % w/w
Control (CK)	--	--
1	Strainsβ（2）	0.4
2	Pseudomonas Aeruginosa (PA)	0.4
3	Bio-surfactant	0.008

1.3 Analyses methods

1.3.1 Analyses items and methods

(1) Surface tension measurement

To 10 g fresh MSW sample and 90 mL of distilled water was added, And the solution was shaken (100 rpm, 27℃) for 1h, the suspension was then centrifuged (4×10^3 r · min^{-1}) for 30 min and the supernatant was filtered through a 0.45-um membrane filter, then measured by surface tension instrument (Xi, 2003).

(2) Air feed quantity and gas concentration in outlet tested by O_2-H_2S detection instrument and CO_2 detection instrument, respectively.

2.3.2 Calculated methods

Oxygen consumption rate can be defined as the consumption oxygen quantity of per unit time in dry compost materials degradation. Oxygen consumption rate and accumulated oxygen consumption profile can

$$\sum R = A_0 a \int_0 \frac{q(z_i - z_e)}{V_M} dt$$

be calculated by the gas difference of inlet to outlet (Haug, 1993).

Where, R is the oxygen consumption rate (mol · (h · kg)$^{-1}$); q is the airflow (m^3 · h^{-1}); z_e is O_2 concentration of outlet gas (mol · kg^{-1}); z_i is O2 concentration of inlet gas (mol · kg^{-1}); V_M is the volume of per mol gas (mol · mol^{-1}); M_d is the weight of dry matter (kg); a is the oxygen quantity of per unit organic matter degradation (1.27g · kg); A_o is the molecular weight of oxygen (0.032 kg · mol).

2. Results

2.1 Surface tension profile during composting

The surface tension profile was showed at fig. 2,

during composting, the surface tension of CK declined to the minimal value (46.5mN·m^{-1}) at 72 h, and could maintain under 50 mN·m^{-1} only for 60 h; but that of adding strain III (treatment 1), pseudomonas aeruginosa (treatment 2) and bio-surfactant (treatment 3) declined to the minimal value (36.0 mN·m^{-1}, 36.5 mN·m^{-1}, 39.8 mN·m^{-1}) and maintain under 50 mN·m^{-1} for 108 h, 96h and 96h, respectively. The results showed, to a certainty range, the surface tension related to the adding strains which could produce the surfactant, or directly adding bio-surfactant. In this study, the decline range of surface tension at treatment 1 and 2 were lower than that of CK and treatment 3 during composting. And ordered as follow: treatment 1, treatment 2 > treatment 3 > CK. the results suggested, the inoculating strains which selected from composting, could regulate metabolism according to surroundings, and produce relevant surfactant to reduce the surface tension between liquid and solid, then make the substance easily to be extracted from inherent of solid waste. Compared to adding strains, the ability of adapting composting system by directly adding bio-surfactant was limited. Therefore, to declined the surface tension between liquid and solid during composting, inoculating microbes which could produce surfactant, is a effective way.

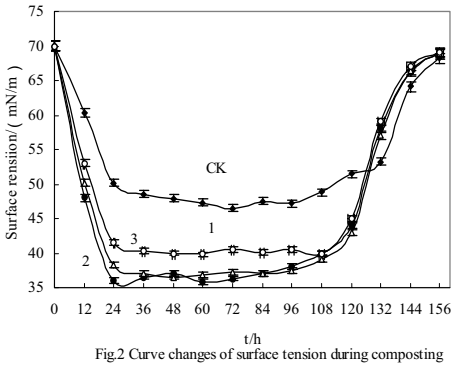

Fig.2 Curve changes of surface tension during composting

2.2 Oxygen consumption rate and accumulation oxygen consumption

The Figure 3 and Figure 4 showed, Oxygen consumption rates and accumulation oxygen consumption of treatment 1, 2 and 3 all increased at a different degree compared to CK. For CK, treatment 1, treatment 2, and treatment 3, the maximal oxygen consumption rates were 0.10 mol·(h·kg)$^{-1}$ at 96 h, 0.163 mol·(h·kg)$^{-1}$ at 48 h, 0.15 mol·(h·kg)$^{-1}$ at 72 h, 0.125 mol·(h·kg)$^{-1}$ at 72 h, and the accumulation oxygen consumption were 300.5 g·kg^{-1}, 460.1 g·kg^{-1}, 442.8 g·kg^{-1}, 380.17 g·kg^{-1} with 240 h operation, respectively. The results showed that inoculating microbes on composting could increase the oxygen consumption rate rapidly, and the maximal oxygen consumption rate was 1.6 times of CK.

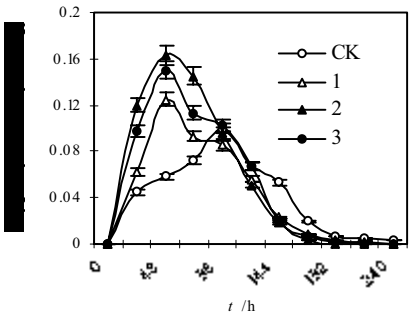

Figure 3. Curve changes of oxygen conxumption rate

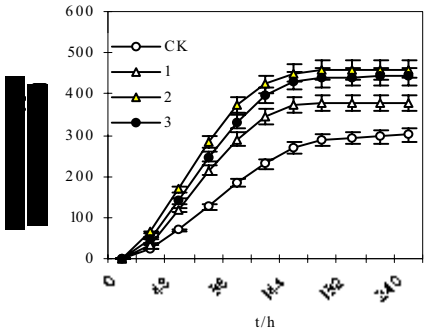

Figure 4. Curve changes of oxygen consumption accumulation rate

2.3 CO_2 and H_2S evolution of outlets gas

CO_2 and H_2S evolution of outlets gas could further study the compost proceed. During composting, the CO_2 and H_2S concentration was measured (Table 4). CO_2 concentration of treatment 1 and 2 reached up to 11.9%, 9.13% at 48 h, respectively, and was 2-3 times of CK (4.62%). During composting, H2S concentration in CK was highest among all treatments, whose maximal emission was 16.00 mL·m^{-3}, while the concentration in treatment 1, 2 and 3 was 3.5 mL·m^{-3}, 5.4 mL·m^{-3}, 8.8 mL·m^{-3}, respectively. The results indicted adding bio-surfactant could incline the surface tension between liquid and solid, increase the translation of organic matter, improve the surroundings of composting, and then restrain the emission of malodor gases. The orders were as followed: StrainsⅢ(2)> PA> Bio-surfactant, the reason for this was the inoculated microbes selected from composting system, could adapt the composting matrix environmental quickly, and produce

bio-surfactants incessantly during composting process. The activity of directly adding bio-surfactant weakened owing to the limited ability to adapting composting environmental.

Table 4. Density changes of CO_2、H_2S by composting equipment export

Times	Outlet CO_2 (%)				Inlet H_2S ($mL \cdot m^{-3}$)			
（h）	Control	1	2	3	Control	1	2	3
24	2.267	7.11	5.58	4.19	3.5	0.54	1.9	1.9
48	4.62	11.89	9.13	8.48	5.6	1.14	5.4	6.3
72	6.89	10.72	7.57	6.85	16	3.5	4.8	8.8
96	7.61	7.43	5.09	5.92	13	2.1	3.6	8.4
120	5.63	3.02	3.70	3.21	10	1.8	3.1	3.9
144	3.63	2.00	0.99	1.14	5.8	0.8	1.3	0.5
168	2.87	0.43	0.405	0.31	2.0	0.09	1.01	0.2
192	1.25	0.1	0.12	0.19	0.9	0.06	0.08	0
216	0.54	0	0.08	0.14	0.2	0.0	0	0

Table 5. Compare of compost quality

Treatments	Humus(C,%)	TN(%)	TP(P_2O_5,%)	TK(K_2O,%)	Date rate of ova(%)	Colibacillus value
Control	10.6	0.7	0.50	0.6	95	10^{-1}~10^{-2}
1	18.2	2.1	0.75	0.9	100	10^{-1}
2	15.8	1.4	0.55	0.8	95	10^{-1}
3	12.2	0.73	0.54	0.9	95	10^{-1}~10^{-2}

2.4 compost quality

The product qualities including humus, TN, TP, TK, death rate of ova and colibacillus are investigated and listed in Table 5.

Table 5 showed the humic concentration of inoculating microbes treatment 1 and 2 increased compared with that of control. The total nutrition (N, P and K) were 3.75%, 2.75%, and were 2.08, 1.53 times of that in control (1.80%), respectively. Therefore, inoculating microbes which excrete bio-surfactant on composting not only can enhance composting rate, but also can improve the composting quality greatly.

3. Conclusions

In conclusion, we observed that inoculating Strains III(2), Pseudomonas aeruginosa which could produce bio-surfactant, can not only accelerate the composting reaction rate but also improve the quality of compost. The paper analyzed the changes of concentration of outlet gases, surface tension, and compost quality in different treatments during static state composting, the result indicated, the effect on composting efficiency of different treatments were as followed, strains III(2) > pseudomonas aeruginosa > bio-surfactant > control.

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Study on Enterprise's Core Competence

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Abstract: Having been a member of WTO, China have nothing to do but develop her own enterprises' core competence to face more and more furious market competition. But so far, our enterprises have no abundant core competence, for there are no preparations for strategically adapting themselves to their resources. As for the above questions this article stresses that enterprises hold up strategic procedures, undertake super-competition strategy, maintain the main products, and nurture their core competence. [The Journal of American Science. 2006;2(1):71-74].

Key words: Core competence; strategy; WTO

Introduction

The term "Core competence" was first put forward in the 1990. In the book The Core Competence of the Corporation,collaborated on by famous management experts C.K. Prahalad and Gary Hamel. It points out, "Core competence is optimized knowledge and skills inside some organization, especially regarding how to adjust diverse manufacturing skills and optimize different technologies and skills." In their view, core competence first of all should provide the enterprises with the potential to enter different markets. Secondly, core competence contributes largely to the value of customers of the ultimate products. At last, we should know, enterprises' core competence should be something that can't be duplicated and imitated by their rivals. Just as Zhang Ruimin, president of Haier Group said, "Novelty is the real core competence for Haier, which is no way difficult to be imitated by our rivals."

Besides the above characteristics, core competence owns other features. Firstly, core competence is the ability to collect. In most cases, it is a collection of different abilities in groups. Few enterprises survive just for their dominant single ability. Core competence is an optimized and integrated knowledge and skills which are developed by the faculty in different departments through their continuous learning, acquiring knowledge, sharing knowledge and applying knowledge. This is also the reason it is not easy to imitate some enterprise's core competence. Single things could be duplicated but the complex are harder to imitate. It is impossible to copy the core competence optimizing system and relative surroundings, let alone that core competence is invisible and untouchable, which only could be shown by the core products by way of its carrier. So there is no way (invisible and untouchable) or difficult (costly expenses) to purchase.

As the conflicts of competition in the market increase in China, the competition between enterprises lies mostly in the competition of core competence.

1. Analysis on our Enterprises'Core Competence

We could say that core competence to China is a new problem as well as an old one. It is old for once enterprises enter the market, and want to survive the market, possession of core competence is a necessity; it is new for most of China's enterprises to develop themselves away from the old-fashioned system, and gradually strengthen themselves in the immature market economy. Because of lack of core competence, enterprises couldn't manage affairs freely when

competent against their rivals. Especially facing the top 500 in the world, for the survival risk after being member of the WTO, they would lose more than large areas of the market unless they make the proper preparations with consideration.

According to the characteristics of core competence, observing whether some enterprise has established its own core competence depends on the following indicators: the first is whether there are obvious competition differences; the second is induplicatibility; the third is the possibility of shifting from the current business to the future business; the fourth is the possession of some recognized unique value.

Compared with foreign ones, few Chinese enterprises will reach standard level. Moreover, most enterprises are chasing the advancement of equipment and large scale of the enterprise. The largest bottleneck lies in how to make the experience-based acceleration lacking the market economic conditions. Therefore, although those enterprises possess a considerable amount of physical resources, fortune resources and industry right of possession, they can't make these resources some kind of competent resources integration. As a result, they can be outstanding for a time, but they can't keep any advantage for long, specifically speaking, the competence of products made by Chinese enterprises mainly derives from the following aspects:

Firstly, cheap resource advantages. In the past, Chinese enterprises had squandered lots of rare resources such as soil, capital or intellectuals, but they didn't afford enough cost. The land for state-owned enterprises is something granted, and supply of lots of cheap manpower. It The cheap and even free-of-charge rare resources made the products of some enterprises competent in the market.

Secondly, monopoly of the government and protection of local government. With the existence of monopoly and local protection, other enterprises outside the place and in the foreign countries are excluded, and Chinese enterprises even refused the entering of alien commodities with fake commodities.

Thirdly, hard work and tolerance. Foreigners generally work eight hours per day, five days per week and have about 20 days off every year; but in share-owned and private companies, employees always work every day per week, and more than ten hours per day. The competence of some products mostly comes from the cheap cost of manpower.

Great changes have taken place for the exterior circumstances of Chinese enterprises till today when a market economy has developed. Especially after entering the WTO, with the strengthening of integration of domestic and international markets, rivals for Chinese enterprises are foreign enterprises with mature market experience. Objectively the new and higher demands for Chinese enterprises'core competence are required. Subjectively with more than ten years'acceleration and development, with the experiences from successes and failures, Chinese enterprises have made experience preparation for their core competence. Now is the moment to develop with all the favorable conditions.

If Chinese enterprises are considered according to some standards of core competence, Haier Group may be called a big industry enterprises on the way to form its own core competence. In a couple of years, Haier has integrated 18 enterprises, collected 1.52 billion yuan capital, employed 15 thousand staff; products made by Haier cover from "white household electronic machines" such as washing machine, refrigerator and air conditioner to "black household electronic machines"and even to "brown ones", which total together more than 20 classifications, more than 5000 products; a whole set of formula models of household electronic machines promoted publicly accepted by Chinese consumers; an all-oriented, three-dimensional, multi-stage internationalized high-technology opening network, and the speed of two new products made within 3 days, quality management system with no error and the like, all contribute to the features of the concept of serving the customer to create Haier Group said, all

the achievements rest in Haier-featured core competence. And Zhang Ruimin himself "the role in the future mainly is set on the integration, connecting the resources from all aspects together ideally." Integration virtually is a collection of all advantages to form core competence. So far what China lacks must be this "integration". But only depending on Zhang Ruimin himself to integrate the resources of enterprise individually, no doubt it is a risk. It also proves to be that what Zhang was just kidding: "Haier will be another Titanic only if there is some question in it."

Therefore, Chinese enterprises (including Haier), lack some kind of strategy to integrate enterprises' resources. Although Haier has its own promotion rules, market strategies, it is Zhang Ruimin who is in charge of the final decisions, which should be common in Chinese enterprises. It must be embarrassing to discuss which is more powerful, right or laws. It has a long history in the bureaucratic system and it is also known that it is a long way to build a country controlled by law in China.

Entering the WTO means placing China into a match with a public international game rule, if Chinese enterprises don't obey the rule, they will be fouled out. Under the legal conditions, Chinese enterprises come to know how to do, while facing the top 500 in the world, they know what to do.

2. Nurture the enterprise core competencies

The enterprise core competencies are nurtured by the enterprise itself. When we take a comprehensive view of two long-lasting top 500 international enterprises, we discover that the core ability of these business enterprises comes from the same and particular link of the business enterprise value chain, namely a strategic link. This link can be production one, sales one or research one. It can have certain supportive added-value one as well. To keep the strategic advantage of the enterprise, the key is a strategic link that controls the business enterprise value chain. NIKE is one of the biggest international enterprises that manages sports wear. But NIKE doesn't make shoes: what they do is design and sale. They leave production to the developing countries. Korea and China are its biggest producing bases. Its headquarters have no more than 70 people, mainly engaging in the product design and marketing, set up its own core ability, make it grow prosperously. .

The market economy is the competition economy, an enterprise that doesn't have competition ability can hardly exist and develop in the market. The result of the competition may be more market share, may also be profit decrease or loss capital due to the high competition cost. Therefore, the high life span company follows the super competition principle to develop generally. Competition principle is all the competitors race on the same track.

It's Intel that researched the memory of a computer. In 1965, a Japanese semi-conductor enterprise made Intel lose business for 6 months after entering the American market with the cheap or price, the company of Intel took super competition principle as the guide line finally, gave up the memory, and the brain parts chip of the information technique, made the company create the brilliancy continuously, and even held the lead in the frontier of information techniques. At present, the production of Intel takes 80% of world chip market share. The numerical color television of the United States vanquishing the emulation color television of Japan, the quartz clock of Japan vanquishing machine clocks of Switzerland are all results that pursue the super competition principle. Most Chinese enterprises follow the traditional competition principle. They have to imitate and follow the foreign rivals; thus it is difficult for them to form their own core capacity because of their lack of advanced techniques. In these two years the profitable the once glorious Chinese enterprise, ChangHong Group, fell to their market suffered a defeat. The initial reason was what they follow is competition principle, such as price wars.

Why don't fight directly but search for value

innovation? To answer this question, we must first answer that to a enterprise are your rivals important, or a customer important? Is competition itself important, or profits and growth important? Competition and profit is a contradiction. If the former weaken, the profits grow. While defeating the opponent can acquire larger market share at the same time, then increase the profits. This is traditional strategic logic. According to new strategic logic, value innovation can solve the contradiction . The basis is to acquire more and more customers because the main purpose of the business enterprise is profits and growths. Although the profits mode based on competition for principle acquired the same customers the former, it can not reach the expected result. The profits mode value innovation can not only acquire customers but also avoid competition cost. The enterprises reach their goals by the goals by the increased value and excess value.

We can conclude the lack, uniqueness and the character of hardly to be imitated of the core capacity request the enterprise insist the difference principle in the links of researching, manufacturing and marketing.

Moreover for Chinese enterprises, carrying out a diversified strategy currently is a main aspect that the enterprise loses the core competencies. Being one of the most important management, diversified strategy is widely used by Western big enterprises in the 60's and 70's. It has many successful examples. But it is not suitable for most of the Chinese enterprise to use diversified strategy. First, this strategy request four basic conditions--capital, technology, management and marketing. Only when the core business can't absorb surplus capital, the enterprise is entitles to consider diversified problem. Whether they walk on diversified road, they need to analyze if enterprise has the necessary technique, management and the sale abilities in another profession, because these three main factors of different professions are different. Second, many enterprises walked back to their original field, thus highlight the core capacity since the end of 80's.The GE company, put reorganize the diversified execution completely in the 80's. They put forward the "top" principle and reorganize more than 200 subsidiaries as 13. GM let other companies do the purchase flow and gather strength and resources therefore highlight the core capacity. After suffering the financial agitation in 1997, the Korean big enterprises cut 15 fields on the average. The government regulated that big enterprises can be engaged in 4 to 5 professions at the most.

Therefore, based on the current condition of Chinese enterprises, we shouldn't be puzzled by the present temporary prosperity in the current phrase. They should recognize their own position, insisting own characteristics, implementing the super competition principle, strengthening the core competencies of the enterprises.

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The Integration Effect of the Corn Technology That Saves Water and Combats Drought in the Northeast Half Arid Area

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Abstract: Based on the field test and through the technical integration of saving water and combating drought about the limited water supply and the ridge culture area field, this article conducted the research on the influence of our country's northeast half arid area on the corn output. It establishes a two-experiment-factor-quota-relation model which relates the corn output and the limited water supply and the ridge culture area field after the examination. The result indicates that the water supply and the area field technology integration in the definition horizontal sector scope may control and forecast the output goal and so on. The technology of saving water cultivation for the northeast half arid area corn provides the quantitative combination plan which may regulate its factors as well as scientific basis to its local application. [The Journal of American Science. 2006;2(1):74-79].

Key words: Save water; output; model

1 Introduction

Because of the spring dry, the soil moisture sentiment is insufficient, which seriously affects the big field crops germinates and emerges, then seriously affects crop growth and output of Northeast's half arid area in our country. Under the limited water supply, the measure of seating water and compensating water can cause the corn's earlier growth to be healthy. Therefore, seating and making up the water are effective measures that can resist the spring's dry, guarantee all buds and the strong sprout, simultaneously, also builds the good foundation for the corn later high production, stable production and the bumper crop. The ridge culture area field as an item agricultural measure of slope cultivated land conservation of water and soil, can both maintain the water and soil and enhance the soil's water content. Therefore, this experiment, with the features of making up the water and the ridge culture area field technology that saves water, conducts the technical integration effect research, and provides the scientific basis for the extension of the technology.

2 Pilot areas and the experiment introduction

This experiment carried on the "863" item -- "The integrated pattern and the demonstration of saving water in northeast arid, half arid area" in the model district in 2003, and the concrete testing field was located at Dongxing village, Xinglong, Gannan county, Heilongjiang Province. The Gannan county is located in the west of Heilongjiang Province, which situates on the right bank of the middle of Nenjiang River, east longitude 122° 5 ' 46 " to 124° 28 ' 12 ", and north latitude 47° 3 ' 57 " to 48° 3 ' 25 ", crossing the second and the third product temperate zone of Heilongjiang Province, the annual mean tempe ration is 2264℃, the annual mean rainfall amount is 455.2 millimeters, it belongs to the half arid monsoon climate. Because the spring rain is few, spring dry has become the primary factor which limits the Gannan county agriculture production. According to the investigation statistics, the

Gannan county's average spring rainfall mounts to 40mm, accounting for 8.8% of the whole year rainfall, and drought actually occupies 62% of the county-wide disaster, so it has the saying of "seven drought springs out of ten.

In order to discuss the limited water supply and the area field technology integration's effect on this local characteristics and the rule, this experiment used the following design: it established 3 times of repetitions (block), 8 experimental processing, and altogether 24 experimental plots. The plots were rectangles, each 20m long, 2.6m wide, and the total area was 52m^2. Nurture 4 corn was used as the trial crop, and the dark seat hydraulic engine and the intertillage hydraulic engine, developed by Heilongjiang Province Water Conservation Academy of Science, were used to carry on sowing seeds and making up the water. After the intertillage, the build obstruct machine, developed by Northeast Agricultural University, was used to construct the area field. In corn birth period, stem height, leaf area, and lodging rate were investigated. At last, harvesting, testing plants and recording production were executed on October 7th, 2003.

3 Reduction and analysis of test results

3.1 Comparison between the influences of water supplies and area fields on corn output

The outputs of different processing plots are shown in Table 1, and F statistics examination on the data of Table 1 is shown in table 2. In Table 2, F value indicates: In the experiment, water supply is the main factor, the next main factor is the area field, while the correlation between water and the area field is not remarkable; the difference among experimental processing, water supply horizontals and area field levels is remarkable.

Table 1. Corn plot output result analytical table

Operation number	Output of each plot（kg）			
	Ⅰ	Ⅱ	Ⅲ	T_t（kg）
1	13.44	14.39	30.67	58.50
2	26.71	22.99	35.08	84.78
3	29.44	37.61	38.41	105.46
4	47.28	37.86	42.66	127.80
5	41.04	38.40	48.34	127.78
6	53.26	42.47	54.44	150.17
7	44.64	39.50	49.57	133.71
8	62.92	46.53	58.90	168.35
T_r（kg）	318.73	279.75	358.07	965.55（T）

Table 2. Table 1 material variance analyzation

Variable	DF	SS	MS	F	$F_{0.01}$
Each of block	2	383.379			
Each of experimental processing	7	2929.969	418.567	18.83	4.28
Water supply	3	2448.143	816.048	36.70	5.56
Area field	1	465.080	465.080	20.92	8.86
Water supply×area field	3	16.746	5.582	<1	5.56
Error	14	311.270	22.234		
Total dissociation	23	3624.618			

3.2 Influence of area fields' technology measure on corn output

Because the area field factor has only 2 levels, therefore it does not have to do the examination again. From Table 1, the average yield of processed area field is 567.70 kilograms per mu, the average yield of non-processed area field is 454.77 kilograms per mu, and the average Chinese acre output increases 112.93 kilograms, the production increase rate is 24.8%.

3.3 Influence of water supply technologies measure on corn output

The q examination of the LSR law is used to compare remarkable differences of the corn yield per mu due to different water supplies, and the examination indicates: when the water supply is 12 m^3 per mu, it is superior to any other water supply amount extremely remarkably, except the difference between it and 8 m^3 per mu processing performance is not remarkable.

3.4 Influence of water supplies and area field's technology integration measure on corn output

In order to compare the difference of corn yield per mu between water supply and the area field technical integration, q test procedure of LSR law is also used to test eight operations during the experiment. The final result indicates: The best technical integration for supplying the water volume is 12m^3 per mu, simultaneously constructing the area field Operation 8. Operation 8 is remarkable or extremely remarkable in result than other operations except Operation 6.

4 Mathematical models establishment and analyzation

In this experiment, it mainly studies quota relations between variable y and two experiment factors x: water supply and the area field, and it uses two Yuan linear returns' central model to describe relations, data structural formula as following:

$$y_{\alpha} = b_0 + b_1(x_{\alpha 1} - \overline{x_1}) + b_2(x_{\alpha 2} - \overline{x_2}) + \varepsilon_{\alpha} \qquad (1)$$

Table 3. Table of each operation output and other characters in the random grouping experimental design

No.	Levels of water supply	Levels of area fields	Specific operations		Yield per mu (kg) y_1	Ear number per mu (ear) y_2	Seed number of each ear (seed) y_3	Weight of a thousand seeds (g) y_4
			Water supply (m^3/mu) x_1	Constructing area field x_2				
1	1	1	0	0	250.13	1983	602	208
2	1	2	0	1	362.49	2786	603	219
3	2	1	4	0	450.91	2735	602	274
4	2	2	4	1	546.43	3128	648	272
5	3	1	8	0	546.34	3197	630	271
6	3	2	8	1	642.07	3419	663	283
7	4	1	12	0	571.70	3231	622	285
8	4	2	12	1	719.80	3812	639	296

Note: In the line of constructing area field, 0 refers to "not constructing the area field", 1 refers to "constructing the area field".

4.1 Determination of mathematical models parameters

According to Table 3, through the statistical analyzation, it may determine each coefficient b_0, b_1 and b_2 in formula (1), thus obtains the corresponding mathematical model:

Model of yield per mu： $\hat{y}_1 = 287.6918 + 27.8464x_1 + 112.9275x_2$ Ⅰ

Model of ear number per mu: $\hat{y}_2 = 2218.375 + 94.6875x_1 + 499.75x_2$ Ⅱ

Model of seed number of each ear： $\hat{y}_3 = 598.175 + 2.6375x_1 + 24.25x_2$ Ⅲ

Model of weight of a thousand seeds： $\hat{y}_4 = 224.25 + 5.875x_1 + 8x_2$ Ⅳ

The obtained various models are one regression equation, which needs a remarkable examination.

4.2 Regression equation and regression coefficient significant examination

In order to examine the model significance, first it carries on the variance analysis, then carries on the examination according to statistic F; In regression equation, each variable function may use t to examine appraises. The examination result is shown in Table 4: The model I and II is extremely remarkable, the model IV is remarkable, Model I, II and IV are credible; Model III examination is not remarkable, Model III is not suitable for this model, therefore it can not be accepted. The t examination result indicates: Regarding Model I, b_1 is extremely remarkable, b_2 is remarkable; regarding Model II, b_1 and b_2 are both extremely remarkable; regarding Model IV, b_1 is extremely remarkable, and b_2 is not remarkable.

Table 4. Regression equation and regression coefficient significant check table

Model	Model name	F test in regression equation		t test in regression coefficient		
		F	F critical coefficient	t_1	t_2	T critical coefficient
Ⅰ	Model of yield per mu	33.65		7.472	3.388	
Ⅱ	Model of ears per mu	32.41		6.934	4.091	$t_{0.05} = 2.571$
Ⅲ	Model of seeds per ear	3.96	$F_{0.05} = 5.79$ $F_{0.01} = 13.30$			$t_{0.02} = 3.365$
Ⅳ	Model of per-thousand-seed weight	9.13		4.224	0.643	$t_{0.01} = 4.032$

4.3 Model analysis

The limited water supply and the area field technology integration production increase effect are realized by such combined factors as ear number per mu, seed number per ear and weight of per thousand seeds. Because Model III has not achieved the remarkable level, therefore only Model I, II and IV are analyzed as the followings:

4.3.1 Output model analysis

(1) It can be seen that one time of coefficient b_1 and b_2 by the model are both just, indicating that both

limited water supply and construct area field in half arid areas have obvious production increase effect, and corn's output enhances along with the increase of water supply. The t examination result in b_1 and b_2 shows that, in this experiment, under arid year condition, the production increase effect due to water supply is more obvious.

(2) Forecasting and controlling the technical integration effect can be made with the model. For example: when the water supply is under the condition of 0~12m^3 per mu, and the reliability is 0.05, from Model I, it can be forecasted that the yield per mu will be, by 95% probability, between $y' = 241.6918 + 27.8464x_1 + 112.9275x_2$ and $y'' = 333.6918 + 27.8464x_1 + 112.9275x_2$ two planes.

4.3.2 Model analysis of output constitution factor

(1) The coefficient mark of Model of yield per mu II is completely consistent with that of Model of yield per mu I, which indicates that the influence of technical integration on the output is shown mainly from ear number per mu, and this also explains that the water supply and the ridge culture area field technical integration is under the condition of reaching the proper level of Chinese acre ear amounts. The t examination result in b_1 and the b2 shows that under this experimental year the water supply and the area field are both obvious to the Chinese acre ear number effect.

(2) From the weight of a thousand seeds model IV, the effect of supplying water on the output can also reflect from the weight of a thousand seeds, displaying that proper increase of water supply can raise the weight of a thousand seeds; the weight of a thousand seeds is enhanced along with the water supply horizontal enhancement. While the t examination result of b_2 shows, under this experimental year, the area field is not obvious to the weight of a thousand seeds effect.

5 Conclusions

5.1 Different horizontal water supplies and the area fields technology integration has a great influence on the corn output and the output constitution factor, theoretically speaking, there are many kinds of supplying water and the area field combination. In order to achieve certain output goal, combined the local existing productivity level, when machinery is used to get water sowing seeds, make up the water and construct the area field, the processing 8, in which the water supply was 12m^3 per mu and the area field were built, supplied the reference.

5.2 Corn's output are usually realized through the output constitution, therefore the first goal for technical integration should guarantee the reasonable Chinese acre ear number, and in the meantime, good ear number of seeds and the weight of a thousand seeds are needed as well.

5.3 Besides the seed number per ear model, other models established in this experiment all reached remarkable or extremely remarkable level, therefore it is credible, which shows that water supply and the area field technical integration in confined horizontal sector scope may control and forecast the goals such as output.

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Study on the Interfere Factors of Signal-Noise Ratio during Scanning Gene Chip

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Abstract：This paper study on the interfere factors of signal-noise ratio during scanning gene chip after hybridization basis on analysis of scanning results in different conditions of hybridization solution, blocking solution, hybridization hours, SDS washing and wavelength. Suggestion proper hybridization conditions of genechip. Established better foundation for application of genechip. [The Journal of American Science. 2006;2(1):80-82].

Key words: genechip; signal-noise ratio; hybridization

Introduction

Nucleotide sequence analysis of whole genome of HGP had been accomplished in advance in 2001, and it is coming into functional genome times. That human being is facing even more formidable task is to study the function of genome. Not only find out base sequence of genome but also mastery space-time information which is included. Emergence of genechip technology make that integrate analysis certain life phenomena completely is possible. Along with the HGP is achieved, use genechip technology can ascertain many gene express in cells, search target gene, etc. Genechip technology has high-through character, thousands upon thousands gene hybridization in same conditions, no other than the results of hybridization has reliability and veracity can reflect correctly function express of life information.

This study focus on the genechip which is made by the method of spotting by Robot hand. Study systemically on the interfere factors of signal-noise ratio during scaning gene chip after hybridization. Ascertain proper hybridization conditions of genechip. Providing valuable material for application of genechip.

1. Materials and Methods

1.1 Experimental material:

Gene of hepatitis D was provided by Beijing Military Affairs Medicine Academy of Science.

1.2 Reagent and make up:

UltraHyb hybridization solution and blocking solution ,bought it in Ambion Co., make up hybridization solution and blocking solution by ourself, 1% SDS.

Make up 2X hybridization solution: 10XSSC，0.2%12-alkyl creatine sodium, 0.04% SDS, 500 ug/ml DNA of salmon milt, 10% vitriol sephadex.

Make up blocking solution: 0.25gNaBH4 dissolved in 100ml PBS solution with 20%ethanol.

1.3 Instruments:

Biorobotics Co. MicroGrid TAS Ⅱ Robot, AXON Genechip Scanner, PE Co.9700 PCR Instrument,France BLX-312 UV Crosslinkers, CEL Co.Aldehyde-slide, 384Well, Wet Box, etc.

2. Methods:

2.1 Make up the genechip

(1) 50% DMSO dissolve Oligo nucleotide probe，end concentration 50uM，carry through spotting it with Robot.（If PCR product as spotting DNA，concentration is 0.2 uM ～ 0.5 uM ， spotting DNA need denaturalization）.

(2) Put spotting DNA in designed array, transfer into 384 well，begin to spotting with Robot，Make certain temperature and humidity according to practice circumstances.

(3) After spotting，slides on the condition of dustproof overnight in room temperature.

(4) Put slide in the blocking solution，treated 10 minutes，remove solution from the slides, put in sterile deionization water 30 seconds, take out the slides carefully.

(5) Put treated slides in to the 95℃ water 2 minutes，95% ethanol 5minutes，this slides can be use to hybridization as oligo nucleotide.

2.2 Hybridization and Scanning

(1) Mix 5 ul purified and fluorescence labled PCR product with 5ul sterile deionization water uniformity as

hybridization working solution.

(2) Put genechip on unknited ice, wipe off dust and fibre on the chip, put 20ul hybridization working solution on the centre of genechip, cover with cover slides, eliminate air bubble.

(3) Put genechip in the wet box, hybridization 1.5 hours at 58℃.

(4) Take out genechip after hybridization,put into 0.1% SDS solution, cover slides slide naturally, fulling 2 minutes, fulling with sterile deionization water 2 minutes, 100% ethanol drip on the two sides of genechip, washing again slowly, put on the paper uprightness, airing, scaning.

3. Results and analysis

3.1 Blocking solution influence on signal-noise ratio

Different blocking solution cause different effect of hybridization. From Figure 1 and Figure 2, apart from different of blocking solution, other conditions are same about two genechips, the results of hybridization are difference. Figure 1 use the blocking solution which made by ourselves, Figure 2 uses UltraHyb blocking solution, the effect of blocking solution of making by ourself is not better than UltraHyb bloching solution and easily make false positive. The main composition of blocking solution is NaBH4 which can make aldehyde on the slide deoxidization, moreover not combine with the sample which was labled. The reason that cause the false positive possibly because purity of NaBH4 is not inadequate, cant not make whole aldehyde on the slide deoxidization. The result of scanning is difference use same blocking solution but under different wavelength, from Figure 3 and Figure 4, the definition of scanning is distinct higher under 532 nm wavelength than 635 nm wavelength.

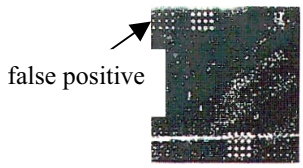

Figure 1. Blocking solution which made by ourselves

Figure 2. UltraHyb blocking solution

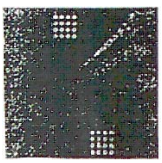

Figure 3. Under 532nm wavelength

Figure 4. Under 635nm wavelength

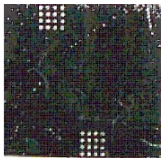

Figure 5. UltraHybhybridization freeze then melt one time

Figure 6. UltraHybhybridization freeze then melt time after time

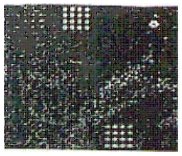

Figure 7. Wash one time with SDS

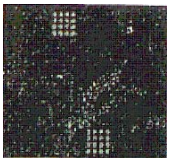

Figure 8. Wash two times with SDS

3.2 Hybridization solution influence on signal-noise ratio

The result of experiment indicate that the hybridization of making by ourself has more difference than UltraHyb hybridization. Moreover UltraHyb hybridization under difference conditions, e.g. freeze then melt time after time has not better result than one time, Figure 5 and Figure 6. Therefore the quality and status of hybridization is key to the hybridization success or not. The times of washing with SDS is affect the result of hybridization, from Figure 7 and Figure 8, the result of wash one time with SDS is better than two times.

4. Discussion

4.1The treatment before spotting on the slides

The sample of spotting on the genechip is the first step of hybridization during hybridization of genechip. If the sample of spotting on the genechip is PCR product,the sample need be denatured before spotting because denatured sample which double strand were opened, make it hybrid easily .If the sample which use to spot is Oligo nucleotide, need not to be denatured. Therefore the sample which is use to spot on the slide should be treated depended on the different situation.

4.2 The circumstance condition of spotting genechip is important

The circumstance condition of spotting genechip before spotting is important condition that determine the hybridization success or not. We should pay more attention that temperature and humidity.based on our many times experiment show that under condition of temperature is 25℃, humidity is 50%, we can get anticipate results. So we need notice that spotting circumstance before hybridization, otherwise the result will be affected.

4.3 The treatment of genechip after spotting and before hybridization

Base on the our experiment, the spotting genechip need to be irradiation about 60 MJ in UV crosslinker, in order to make DNA sample combine with slide fastness.

4.4 Because genechip scanner has intensive sensitivity and differentiate.

The mini-dust or impurity on the genechip can cause brightness background and noise, therefore it should be carry through as clean as condition in process of making, hybridization, washing.

4.5 It should be scanning and determine as soon as possible after hybridization and washing in order to avoid molecular degeneration which was marked by fluorescence.

4.6 Because there are machine transmission device during genechip scaning, the scanner should be put on stable and firmly plat roof, prevent fountainhead shake.

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A Point Mutation of S Gene from TGEV Isolate TH-98 Followed Construction of Shuttle Plasmid used in *E. coli*/Yeast Expression System

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Abstract: Using primer-specific PCR and multiple-step subcloning, a point mutation of S gene of transmissible gastroenteritis virus (TGEV), TH-98 isolate was performed, resulting in the replacement of a potential pre-termination codon sequence (TTTTTATA) of the S gene by DNA sequence TTTTTACA. The deduced amino acid of S gene is the same as original one due to utilizing nucleic acid silence mutation. The mutated S gene was inserted into *EcoR* I and *Pst* I sites of pCR3.1 vector. Subsequently, the resulting recombinant was digested with *EcoR* I and *Not* I and subcloned into the same sites of *Pichia pastoris* yeast expression vector pPIC3.5, which might be expressed in yeast cells. [The Journal of American Science. 2006;2(1):83-88].

Keywords: TGEV; S gene; reconstruction; shuttle plasmid; construction

Introduction

Swine meat is the main protein source for most Chinese people, and China is one of the countries of the high swine meat production. Therefore, it is very obvious that swine industry owns important portion in Chinese economy. Transmissible gastroenteritis virus (TGEV), a porcine coronavirus belongs to the family of coronaviridae, and is a causative agent for transmissible gastroenteritis (TGE) (1). TGE is associated with high morbidity in susceptible animals of all ages and with high mortality in suckling piglets (2). TGEV is composed of four major structural proteins, the spike (S), the integral membrane (M) glycoprotein, a small membrane protein (sM), and the nucleocapsid (N) protein. In which the spike (S) protein encoded by S gene, about 4.3 kb in length, is the major target of neutralizing antibodies (3), and usually is employed to prepare effective vaccines and other functional studies. The initial aim of our study is to develop genetic subunit vaccine against TGEV by using the S gene of TGEV isolate TH-98 and yeast expression system. However, we found there is a potential pre-termination codon sequence in the S gene cloned in our laboratory, which might influence future expression in some host cells including yeast (4). Therefore, we made a point mutation by PCR and subcloning recombination in order to eliminate the pre-termination codon sequence. The modified S gene was subjected to further subcloning to establish a shuttle plasmid containing the S gene that may be induced to express the S protein in yeast cells. This study produced the useful material for future preparation of TGEV vaccine.

Materials and methods

Vector, host cells, tool enzymes and primers

TA cloning vector (pMD-18T), DH5ρ competent cells, restriction enzymes, T_4 DNA ligase were purchased from TaKaRa Biotechnology Company. TA cloning vector pCR3.1 and yeast expression vector pPIC3.5 were products of Invitrogen Company. Recombinant pUC-S was constructed as previously described (1). Primers, PS1: 5'-GGTAAGAATTCGTTAACACACC–3', PR1N: 5'-AAAAGTACTAAAGAAATTGTAACCATTAATGTA–3', PS2N: 5'-CAATTTCTTTAGTACTTTCC-3', PR3: 5'-GGTGTTGTTGTCCAATGTG-3' and PS3: 5'-TACAGTGAGTGACTCGAGCT-3' were used (underlined parts are recognized by *Sca* I, framed part is the induced mutation, which results in the nucleotide T in template was replaced with C in subsequent PCR amplification, but the encoded amino acid is not changed within the correct open reading frame).

PCR amplicfication

Based on the S gene sequence (GenBank accession number: AF494337), an anti-sense primer, PR1N and a sense primer PS2N correspond to nucleotides 1323 and 1337 of S region of TGEV were designed respectively. By the use of the silence mutation of codon, a point mutation was introduced in primer PR1N. Two PCR reactions were performed with primers PS1, PR1N and PS2N, PR3. The temperature profile of each of the 25 cycles comprised at 94℃ for 1.0 min at 51℃ for 1.0 min and at 72℃ for 1.5 min. There was a final extension time of 10 min at 72℃. Two PCR products named SNa and SNb, of 1.3 kb and 1.0 kb, were obtained respectively. The products are identical to the 5' end about half sequence of S gene with the exception of the point mutation.

Strategy of subclonal recombination

SNa was ligated with pMD-18T vector, transformed into DH5ρ cells and a negative recombinant named TSNa was selected in LB agar plate containing appropriate antibiotic. TSNa was incompletely digested with *Sca* I and *Kpn* I, and a linearized fragment containing the TA vector and SNa, about 3.9 kb, was purified with gel purification kit (Qiagen). The fragment was ligated with SNb fragment digested with the same enzymes. A positive recombinant name TSNab was selected as above described. TSNa. PUC-S was digested with *EcoR* I and *Kpn* I in order to produce a fragment, pUC-Sb containing pUC18 vector and the 3' end half of S gene (1). TSNab was also digested with the same enzymes to give the 5' end half of S gene named SNab. PUC-Sb and SNab were ligated and a recombinant containing the complete S gene was produced that named pUC-SN.

Identification of recombinant

According to the S gene sequence and the physical map of pUC vector, the recombinant pUC-SN was verified with restriction enzymes (RE) and nested PCR using primer PS3 and PR3.

Construction of the S gene–containing shuttle plasmid used in *E.coli*/Yeast cells

Recombinant pUC-SN was digested with *EcoR* I and *Pst* I, and the full-length S gene, about 4.3 kb, was subcloned into the same sites of vector pCR3.1. A positive recombinant named SNPCR3.1 was identified with RE. SNPCR3.1 was then digested with *EcoR* I and *Not* I, and the resulting fragment containing the S gene was subcloned the same sites of a yeast expression vector pPIC3.5. The recombinant designated as SNPIC3.5 was identified with RE, PCR and sequencing.

Results

PCR amplicfication of fragment of interest

Using specific primers, two PCR reactions were performed. Two PCR products named SNa and SNb, of 1.3 kb and 1.0 kb, were obtained respectively. The products are identical with the 5' end about half of S gene

sequence (Figure 1).

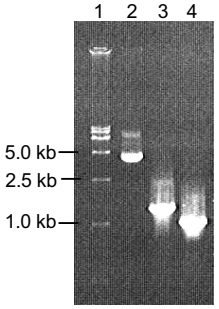

Fig.1. PCR amplification of fragment of interest

Lane 1: DNA Marker (DL15, 000, TaKaRa)

Lane 2: PCR control.

Lane 3: PCR product, SNa, of about 1.3 kb.

Lane 4: PCR product, SNb, of about 1.0 kb.

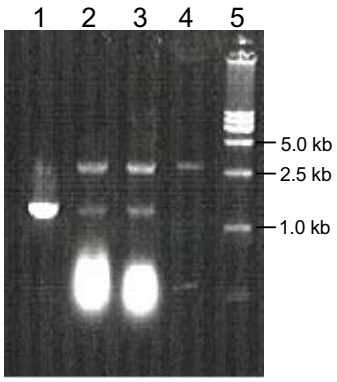

Fig.2. Identification of TSNa with RE

Lane 1: PCR product, SNa, of about 1.3 kb.

Lane 2 and 3: TSNa digested with *EcoR* I,

of about 1.3 kb and 2.7 kb repectively.

Lane 4: Linearized TA vector, of about 2.7 kb.

Lane 5: DNA marker.

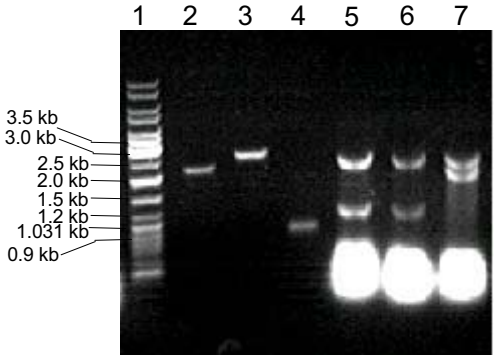

Fig. 3. Identification of recombinant TSNab with RE

Lane 1: DNA Ladder

Lane 2: SNab digested withEcoRI and KpnI，of about 2.3 kb.

Lane 3: Linearized T/A vector, of about 2.7 kb.

Lane 4: SNb digested with ScaI and KpnI, of about 1.0 kb.

Lane 5 and 6: TSNa digested with EcoRI, of about 1.3 kb and 2.7 kb respectively.

Lane 7: TSNab digested with EcoR I, of about 2.3 kb and 2.7kb repectively.

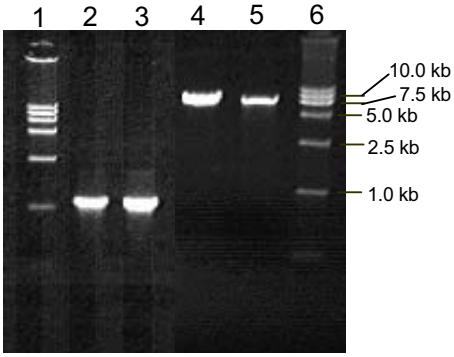

Fig. 4. Verification of pUC-SN by nested PCR and with RE

Lane 1: DNA maker used for evaluating samples in lane 2 and 3.

Lane 2: Identification of pUC-SN by nested PCR,

and the resulting PCR product is about 1.2 kb.

Lane 3: PCR positive control, of about1.2 kb.

Lane 4: Plasmid pUC-SN digested with *EcoR* I, of about 7.0 kb.

Lane 5: Plasmid pUC-S digested with *EcoR* I, of about 7.0 kb.

Lane 6: DNA maker used for evaluating samples in lane 4 and 5.

Point mutation of S gene

As described in materials and methods, a recombinant named TSNa was produced via inserting SNa into T/A cloning vector and identified with RE (Figure 2). A linearized fragment containing the TA vector and SNa, of about 3.9 kb, was purified from TSNa, and ligated with SNb digested with *Sca* I and *Kpn* I. The resulting fragment named TSNab was identified with RE as expected (Figure 3). PUC-S with *EcoR* I and *Kpn* I in order to produce a fragment, pUC-Sb containing pUC vector and the 3' end half of S gene was digested from pUC-S and ligated with the 5' end half of S gene named SNab derived from TSNab. A resulting recombinant, pUC-SN containing full-length S gene was verified with RE and by PCR (Figure 4).

Construction of the S gene–containing shuttle plasmid used in *Ecoli*/Yeast cells

The full-length S gene was obtained from pUC-SN with *EcoR* I and *Pst* I, and subcloned into the same sites of vector pCR3.1. The positive recombinant, SNPCR3.1 was identified with RE as expected (Figure 5). SNPCR3.1 was then digested with *EcoR* I and *Not* I, and the resulting fragment containing the S gene was subcloned the same sites of yeast expression vector pPIC3.5. The recombinant designated as SNPIC3.5 was identified with RE, PCR (Figure 5 and 6) and sequencing. The sequencing report verified there are no nucleotide insertion and deletion, and the artificial mutation (the nucleotide T was replaced by C, see materials and methods) was successful (data not shown).

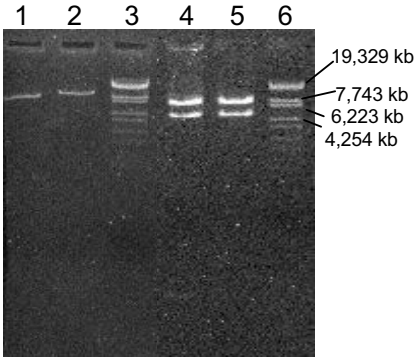

Fig.5: Identification of SNPCR3.1 and SNPIC3.5 with RE

Lane 1: Vector pPIC 3.5 digested with *EcoR* I, of about 7.8 kb.

Lane 2: SNPCR3.1 digested with *EcoR* I, of about 9.4 kb.

Lane 3 and 6: DNA marker (λ-EcoT14 Ⅰdigest, TaKaRa).

Lane 4 and 5: SNPIC3.5 digested with *EcoR* I and *Not* I, of about 4.3 kb and 7.8 kb respectively.

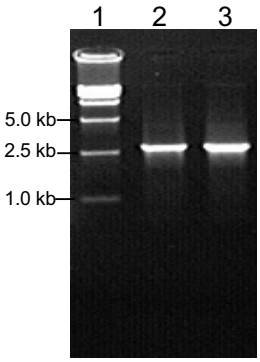

Fig.6: Identification of SNPCR3.1 and SNPIC3.5 by PCR

Lane 1: DNA marker.

Lane 2: Identification of SNPCR3.1 by PCR, of about 1.2 kb.

Lane 3: Identification of SNPIC3.5 by PCR, of about 1.2 kb.

Discussion

At present, the major prevention of TGE is vaccination with inactivated or attenuated vaccines in China. However, these vaccines pose potential disadvantages, such as the recovery of virulence, the need for adjuvant and high cost etc. With the progress of molecular techniques, the genetic subunit vaccines may be one of possible alternatives to conventional vaccines. The S gene of TGEV is widely used for genetic and vaccinological studies due to its important biological functions including inducing the neutralizing antibody. The S protein is a high glycosylation protein with a gross molecular weight (about 180-220 kDa), therefore, a suitable foreign gene expression system is needed for initiating an efficient expression. The S gene expressed in baculovirus/insect cell expression system has been reported (5, 6). We have also constructed a plasmid containing full-length S gene and expressed a soluble S protein of TGEV in this system (7 and unpublished data). However, this system seems a little expensive in terms of the production cost. The S protein has been also expressed by using adenovirus vector and transgenic plant (8, 9, 10, 11). However, no further application information is available.

The *Pichia pastoris* yeast expression system is one of the most successful host expression systems. As a unicellular eukaryote, yeast can potentially produce soluble, correctly folded recombinant proteins that have undergone all the post-translational modifications that are essential for their function (12). The system is freedom from endotoxins and oncogenes. Yeast cells are easier to culture and manipulate genetically than mammalian cells and can be grown to high cell densities. Many foreign proteins have been successful expressed in this system (for a review, see ref.13).

We intended to express the S gene using this system. However, we found there is a potential pre-termination sequence (TTTTTATA), locating about nucleotide 1300 in S gene, which might inhibit or decrease S protein expression in some eukaryotic host systems. In order to facilitate further expression, we mutated one nucleotide by site-specific primer, resulting in a new sequence (TTTTTACA). In this process, some details were important. First, by using TA cloning vector, the PCR product can be directly ligated and transformed, facilitating subsequent subcloning. Second, as there are *Sca* I sites in the sequence encoding antibiotic select maker of pUC18 vector and our designed primer, an incomplete digestion was inevitably adopted to obtain partial S gene and complete vector (see materials and methods). The usage concentration and digestion time of enzyme are key factors for incomplete restriction enzyme reaction. Third, in subsequent multiple-step subcloning, the sticky ligation has facilitated the positive recombination ratio. The shuttle vector, pPIC3.5 can be inserted foreign genes, and transformed in *E. coli*. The resulting recombinant can be transformed into yeast and recombined with the chromosome of yeast. Although there are no suitable RE sites for the S gene insertion, the problem was settled by utilizing TA cloning vector pCR3.1 and subcloning.

In summary, we eliminated a potential pre-termination codon sequence in the S gene of TGEV by site-specific mutation and DNA recombination. The mutated S gene was subcloned into the shuttle vector used in *E.coli*/yeast systems. The resulting recombinant can be used to express S protein in yeast cells in the future.

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The Study of Price Control in the Chinese Natural Monopolistic Industries in Order to Avoid A – J Effect

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Abstract: Because of the special technical and economic characteristics of natural monopolistic industries, it is generally in need of governmental price control to these industries. This paper discussed the low efficiency A-J effect under the price regulation based on the rate of return on investment and practiced the game theory of the government and natural monopoly corporation. On the base of theoretical analysis, the paper proposed effective methods to avoid the A-J effect and realize the reciprocity between government and natural monopolistic industries. Some selective methods are also suggested to perform the price regulation of Chinese natural monopolistic corporation. [The Journal of American Science. 2006;2(1):89-93].

Keywords: A-J effect; natural monopolistic corporation; price regulation based on the rate of investment return; price cap regulation; periodic censor system

1. Introduction

In order to prevent corporations from obtaining extra profit using monopolistic power which results in the net loss of consumers' residual and the social welfare, and guarantee consumers to enjoy the lowest price product, countries all around the world implement price control to different extent on the typical natural monopoly corporation such as telecommunication, electric power, mail, railway transport, tap water, coal gas, et. At present, among several more popular modes of price control around the world, the most typical mode is the rate of return on investment mode represented by America. This mode is a traditional price control mode and has a centuries-old history, which plays an important role in promoting corporations to increase capital input and extending investment. It has been studied and used for reference by many countries. However, the negative low efficiency A-J effect resulted from this mode is also a challenging difficult problem troubling controllers (government) and experts.

In China, government has implemented price control on the natural monopoly corporations which relate to the national welfare and people's livelihood such as telecommunication, electric power, railway transport, tap water, etc. The main mode of price control is cost mark-up pricing, which aims at reclaiming all cost and obtaining definitive target profit under the price established by corporations. According to the cost of corporations and the allowed target profit, government restricts the product price. If the unit cost is AC and specified cost addition rate is r, the cost addition price of the product is $p = (1+r) \cdot AC$.

Because serious information dissymmetry between government and corporations controlled and without effective exterior constraint system, the price control mode in China appears a number of similar phenomena to the 'A-J effect' resulted from the rate of investment return mode in America such as (1) the lack of motivation of promoting the natural monopoly corporations to reduce cost and increasing productivity which results in the waste of production resources; (2) the continuous increasing price of many natural monopoly operational productions which forces the consumers have to buy the production or service of the natural monopoly corporations under higher price and results in unreasonable distribution of social income and lower welfare level of all society; (3) the appearance of strange circle as "every year controlling the price every year making a loss, the more controlling the more loss, consequently, the more loss the more controlling" etc. In order to change the situations discussed above, the price control system for natural monopoly corporations (NMCs) must be reestablished in our country. This requires combining the real situation of the NMC in our country on the basis of the various price control modes in foreign countries and according to the basic economic theory, assimilating the outstanding experience about price control of other countries, avoiding its negative A-J effect and constituting the proper new price control system to realize the reciprocity between government and NMCs.

2. The connotative meaning of A-J effect

A-J effect is a low efficiency negative effect resulted from the price control mode of the rate of return on investment. Therefore, the analysis of A-J effect must start from the price control mode of the rate of return on investment, which is defined as that government does not establish the ultimate price of the NMC production directly, however, the profit in the price constitution is controlled by the established rate of return on investment, make the NMC could compensate the operational cost, then the price level of NMC is controlled indirectly. The price control model of the rate of return on investment is expressed as

$$R(p \cdot q)=C+S(RB) \quad (1)$$

where R is the function of corporation revenue, which defined as a function of the production price (p) and quantity (q), C is the cost fee (such as wage, tax and depreciation etc.); S is the rate of return on investment regulated by government; RB is the Rate Base, which means the total capital investment. The control price (P) is equal to the total corporation revenue dividing out the total quantity (Q) as P=R/Q. In the famous literature of Averch and Johnson (1962), named as "Behavior of the firm under regulatory constraint", the study showed that under the control of the rate of return on investment, corporations will generate a motivation of extend capital as large as possible and obtain more absolute profit under the regulated rate of return on investment. Consequently, in order to produce special productions, corporations will use overabundance capital investment to substitute for other input productions, which will result in the low produce efficiency. This phenomenon is called by later researchers as A-J effect.

3. The practice of some developed countries in avoiding A-J effect

From the viewpoint of the practice of some developed countries about price control on NMC, before the eighties of the twentieth century, the public natural monopoly industries investment and the insufficient supply is the main contradictory faced by government. Therefore, the developed countries mostly adopt the price control mode of the rate of return on investment of America, which has played an important role in the initial development and capital input for public natural monopoly industries. However, after the development of several decades till to the eighties of the twentieth century, the investment of public natural monopoly industries and the insufficient supply is not the main contradictory anymore, the problem of over high cost and price is more outstanding and the A-J effect phenomena are more obvious. The increase of efficiency and stabilization of price have been the new focus of the price control system. To avoid the A-J effect, many countries around the world and researchers has explored and practiced a number of effective price control modes. Among which, the maximum cap price control mode of England aimed at increasing efficiency and reducing cost has become the dominating and most influencing mode gradually in the west.

The maximum cap price control mode of England adopts the *RPI-X* model with the innovation of combining the control price and the retail price index with the advancement index of the produce efficiency of corporations. *RPI* means the Retail Price Index, also named as the rate of currency inflation and *X* is a given increase percent of produce efficiency decided by controllers during a certain period. For example, if the rate of currency inflation is 5% in a certain year (*RPI*= 5%)and X is fixed at 3% (*X*=3%), the maximum increase amplitude of price for corporations is 2%. This simple price control model means the nominal price established by corporations is determined by the relate value of *RPI* and *X*. If *RPI-X* is a negative value, the corporation must reduce the price with amplitude of the absolute value of RPI-X. Then, if the current price of a corporation is p_t, the next period control price (p_{t+1}) is $p_{t+1} = p_t(1 + RPI - X)$.

England attempted to control price directly to avoid the insufficient of the model of the rate of return on investment of America. The basic advantage of this model is to inspire the corporations reduce cost to obtain more profit with the fixed price increase amplitude during certain period. Meanwhile, the rate of corporation profit is limited by the price control, which inspires the corporations implement optimize combination on the produce factors and avoids the over capital-intensive phenomenon under the price control of the rate of return on investment. Therefore, compared to the price control of the rate of return on investment, the price control model of England is more benefit to inspire the corporations to reduce cost and increase efficiency. The disadvantage of this model is to restrain corporation investment, especially when approaching the price regulation period, the investment motivity of corporations is much smaller even to stop, which will influences the continuity of normal investment.

4. The selection of Chinese natural monopoly corporations to avoid A-J effect

In order to avoid the A-J effect in China, the corporations must combine the real situation of Chinese natural monopoly industries on the basis of the various price control modes in the foreign countries and the base of economic theory as references, assimilate the outstanding experience about price control of other countries, establish the new price control model suitable to the real natural monopoly industries condition and set up the proper effective price control system to realize the reciprocity between government and NMCs. Aiming at solving this problem, four advices are proposed as follows.

1) Reforming the present government price control system in China and introducing the inspiring price control mode

The present cost mark-up pricing for NMC in China should be reformed into the price control mode of the rate of return on investment or the price cap control model. However, the corresponding regulations must be performed correspond to avoiding the disadvantage of these two models. If the price control mode of the rate of return on investment is adopted, we must establish the effective cost constraint mechanism and set up the corporation price cost account book (成本台账) gradually and make sure the control parameters of corporations to engage the corporations to reduce cost and improve efficiency by themselves. At the meantime, in order to prevent over investment, for the new projects of monopoly corporations or the new investing projects preparing to entry this industry, the correlative government department must audit these projects strictly and control the expansion of the total investment in practice. If the price cap control model is adopted, we must realize that the economy in our country is still at the turning state and the market condition still exist great gap compared with the west developed country such as America and England. Therefore, the inspiring regulation implemented in our country could not be the same as the west model absolutely and we must combine the real state of our country to make choice or revise. Especially in recent years, for the very low retail price index and negative increase in majority years (the RPI is negative), the selection of RPI-X model is not suitable obviously. But using the base theory of this model as reference, we could establish the new price control model suitable to our country's situation.

2) Reinforcing the price formation reform and introducing the price competition rule

At the aspect of reinforcing the price formation reform of natural monopoly industries, the focus core is persisting in market economy direction and eliminating the basic obstacles of bounding productive power radically. Two main aspects need to be considered: One is the Tax homing (税费归位). The fee and foundation which has the character of tax should be merged or changed into tax, such as airport construction fee, seaport construction fee and railway construction fee. For the administrative fee (administrative fee of government department), the corresponding management rules must be established completely and it should be brought into the national financial budget gradually. On the other hand, introducing the competition mechanism should be selected to break up monopoly of the branches and industries. The monopoly price and profit in natural monopoly industries baffle technical advancement and service quality improvement, damage consumers' benefit seriously and raise the social cost. However introducing the price competition rule is an effective way to accelerate the technical innovation of natural monopoly industries, increase the service variety and reduce the price. We should lay emphasis on motivating the price reform of natural monopoly industries such as basic industries and public institutions, introduce the price competition rule into the open competing industries and promote the monopoly industries to reduce cost, perform intensive farming and improve technical innovation. For instance, for the competition of China Unicom and China Mobile, the entering network fee (入网费) of mobile phone reduced from 20, 000 to several hundreds Yuan since 1994 and free at present. The introducing price control system could be classified into three levels: 1) introducing the price competition into all the industries such as telecom, electric power and water supply etc.; 2) introducing the price competition into the interior of industries such as the "factory and network separation, price competition to entry network" ("厂网分离、竞价上网") in the electric power branch; 3) introducing the price competition in certain domain of the industry such as the call service, IP phone, service machine trusteeship and other increased value business domain. The following table shows the classification of the competition tache (product) and non-competition tache (product) in the main monopoly industries of China.

Table 1. Classification of producing tache of monopoly industries

Industries	Competition tache	Non-competition tache
electric power	electric power generation, power supply	electric network, load distribution
Telecommunication	Long distance call, mobile call, data transport, increase value service, wireless call	Local call network, fiber optical cable network
Post	Mail express	mail network
Civil aviation	Civil aviation passenger transport, freight service, airport, aviation oil, materials	Flight line regulation, aerial regulation, aerial communication
Railway	freight service, passenger transport, large goods transport communication service, bridge construction	Railway network, communication network
Tap water	tap water production, supply, reclamation and utilization of sewage	Water supply line net
Coal gas	Coal gas production, retail, supply	Gas supply line net

3) Reinforcing the reform of natural monopoly corporations and establishing the modern enterprise system

In the high free market economy country represented by America and England, the ratio of national enterprises in the natural monopoly industries is very small. The objective of controlling the natural monopoly industries price by government is maximization of the social welfare, which is different from the corporation operational objectives of maximization of profit. Government considers the social benefit in priority, not the economic benefit of corporations. However, the situation is different in many monopoly industries of our country at present. They are almost the national corporations with politics-enterprise background (政企不分). In a long period China implemented the direct investment and monopoly operation rule on the national monopoly industries. Government is not only the decider and the surveillant of the control rules performance but also the practice manager. Under this control mode characteristic as the high unity of government and industry, (政企高度合一) the objective of government control is the same as that of corporation operation, but contrary to the government's responsibility for society. Government is not only referee but also athletes, which leads to the phenomenon that when establishing the control rule on the natural monopoly industries, government must take into account the benefit of both corporation and society which is difficult to practice for the instinct contradictory. Therefore, in order to optimize price control of the national monopoly industries, the modern enterprise system must be established with the development of the reform and makes the monopoly corporations become the real modern corporations with clear property right, obvious power and duties, separated government-enterprise relation (产权清晰、权责明确、政企分开) and scientific management. Meanwhile, government control institution is only a monitoring functional department. Consequently, the procedure of general adoption of the market principle in natural monopoly industries will be promoted, the produce price will be reduced, the service will be improved and the consumers will obtain benefits ultimately.

4) Establishing the complement relative price

control principles by government and performing scientific price decision democratically

To overcome the informational asymmetry between government and the regulated enterprises and avoid the possible corruption during the price decision procedure, when deciding the industrial price of natural monopoly enterprises, Chinese government should set up complement relative price control principles and perform scientific price decision democratically. As far as the authors are concerned, the chief price control department of government should establish or perform the four principles as follows strictly: 1) Setting up the scheduled censor system by the price department. Performing the periodical overall censor on commodities and services of NMCs tabulated in the price list. The censor contents include the total state of enterprise operation, manufacturing cost, periodic fee situation, wage level and labor productivity, which provide the important base for avoiding false cost and inverse price decision. (虚置成本，倒逼定价) 2) Establishing the expert censor system organized by price department. By setting up the price censor expert library, when establishing the control price, the related experts and scholars are invited to audit the establishing and regulating price which will improve the scientific character of price decision. 3) Implementing the price hearing of witnesses system strictly. By implementing the price hearing of witnesses system strictly, selecting the various social areas, hierarchies and aspects widely to participate the hearing and listening to their advice, the hearing will be made as a procedure and a real system to control price and increase the scientific, democratic and normalized character. 4) Performing the group audit of government price decision system strictly. In order to make the price decision by government more scientific and normalized and avoid the camera obscura operation, practice graft and power seeking rent, (**暗箱操作，徇私舞弊，权力寻租**) the original national plan committee publicized the Government Decide Price Action Rule (trial implementation) **《政府制定价格行为规则（试行）》** on Dec.16, 2001, regulated definitely establishment of the group audit of government price decision system for the entire in charge departments and the group audit price committee consisting of the interior correlative staff in the departments, clarified their duties and operational procedure. The implement of fundamental price principle must be decided by the audit committee ultimately. However, this system is not implemented effectively at the surface (**流于形式**), the "price decision by three people" (**"三人定价"**)still exists popularly. The authors think that the group audit price system should be reinforced the penalty rule up to the legislation level and raise from the command of present director of National Development and Reform Committee to the administrational law of State Department, which should be added into the modified "Price Law" best.

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