Immortality: myth or becoming reality?
On the conservation of information

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Abstract

Immortality, in the personal sense, is defined as the potential to freely choose the moment of individual death, rather than having the meaning of eternal life. Man is a symbol and metaphor-creating being who apprehends the world through his imaginary power. The desire to give a place to an "inevitable" individual death, has led mankind to many powerful immortality symbols, of which some of the most important ones will be discussed. Apart from individual immortality, the term is also used in relation to collective survival of mankind as well as an ultimate rebirth of our universe.

Cell biology shows that humans are programmed to die and daily experience shows that we cannot escape fatal wear of our body. But should we really be satisfied with our mortal organism or should we declare war on this ancient enemy, and rather decide that death is not invincible? Genetic and nano-technological interventions in our body will become possible, but obviously will raise many ethical questions. How will the future on our precious planet evolve with regard to individual life span and the quality of life of its inhabitants? And how dominant will biomedical technology become in further pushing the limits of longevity? Molecular and genetic aspects of current longevity research shed a spectacular light on the first attempts to master immortality.

We entered the era of digital immortality while broadly experienced transcendental awareness suggests mental survival. Some claim that dying is only virtual on the basis of quantum physics and is being interpreted as one form of conservation of information.

Transhumanism advocates that mankind may become the first species in evolution to create its own successors. Human/machine hybrids (cyborgs) will be designed and the universe might be finally recreated by super-intelligent civilizations, providing a cyclic process of rebirth of our universe.

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Introduction

The author defines immortality as the potential for humans or mankind to freely choose the moment of (individual) death, rather than using the term in the sense of eternal life. Man is a symbol and metaphor creating being who knows the world through his imaginary power. The human desire to give a place to the seemingly inevitable death, has led to many powerful immortality symbols and opinions (see Fig.1), of which some of the most important ones will be discussed in the following. For example, we may distinguish between individual survival (of the self) versus collective immortality (of humanity). In addition, we know terms such as living on in the other (through our offspring). In addition, people may live on through their works (for instance digital immortality), or one may put hope in developments in technological and biomedical life extension.

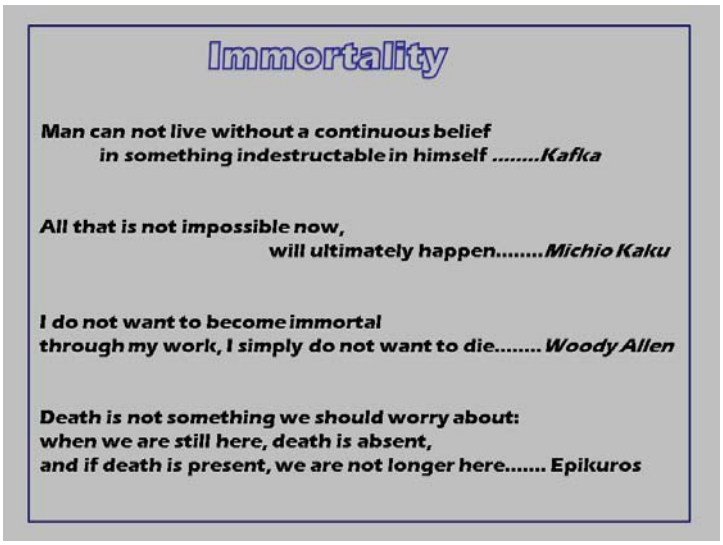

Fig. 1: Philosophical statements about (im)mortality

An incredible amount of thought has been written about (im)mortality. When these terms are "Googled" one will find hundreds of thousands of hits and the amount of literature is literally overwhelming. There are even academic dissertations written about the subject and some of them are really excellent! (van Bergen, 2002, Vidal, 2012)

In this essay the author will take a position of a "neutral" observer of this information and review a number of critical issues and opinions, albeit on the basis of a personal selection. These various aspects will be dealt with without much value judgments, so that the readers in their own way can judge their relative importance and value. It will become clear that immortality is a multilayered concept that deserves an integral approach. Some rightfully state that we should pursue "immortality" only in the brief life given to us. In this way we may finally become fully aware of the perfect intertwining of life with nature and the cosmos and become reconciled with the temporality of our existence, in favor of those who come after us. [Cave, 2012]. Although this is a sensible attitude, it is certainly not the whole story, as will be shown in the following.

1. Immortality in a historical perspective

The desire for immortality fascinated mankind already from the beginning of human history 2200 years BC, (see link Epic of Gilgamesh, Fig. 2). This mythological king, who sought immortality, was convinced to find it in the form of a plant which, according to the myth, after eating it, would provide eternal life. He plucked the particular plant from the seabed through tying heavy stones to himself, in order to lower his body to the bottom of the sea. Back on the beach, however, he fell asleep and after waking up discovered that it was stolen by a snake. This is probably typical for this type of quests, thinking that you have your hands on immortality, it eludes again at the same time! Gilgamesh seems still alive also in this time, albeit in the virtual world of computer games (see upper right inset, Fig. 2).

Fig. 2: The Gilgamesh Epic

Pyramids in Egypt were the supposed burial tombs of the pharaohs, but subsequent interpretations indicate that these enormous structures, with a still unexplained construction technology, in fact were intended as "soul-moving machines". Retrospective cosmological calculations suggest that the typical inclining channels of the burial chambers, appeared to be aimed precisely at those stellar constellations in which the Egyptian Gods were supposed to house, calculated back to the period of the probable construction of the particular pyramids. So Egyptians thought to acquire immortality through thorough cosmological knowledge!

2. Health technology: hope for life extension?

Man dies from trauma, disease or aging: all three processes are open to countermeasures (Fig. 3). Aging arises partly due to wear, oxidation and attrition of the ever more energy costing gene repair. The current and future developments in biomedical science offer perspectives for longer and healthier lives, that is, if we do not allow the living conditions in our world to deteriorate further (Best, 2012, De Grey, 2007 and the link Ageing). How old we will be able to become is certainly influenced by our own personal experience and attitude towards the meaning of aging. It is common knowledge that growing old is facilitated by an optimistic life style and courage to deal with the inevitable problems of aging. Staying healthy, according to modern concepts, requires an integrated approach, in which in each stage of the life-cycle, an optimal life style is adopted and also a right mix of interventions, tailored to the individual, is chosen. Proper drug treatment is an example of such an intervention where major progress was made.

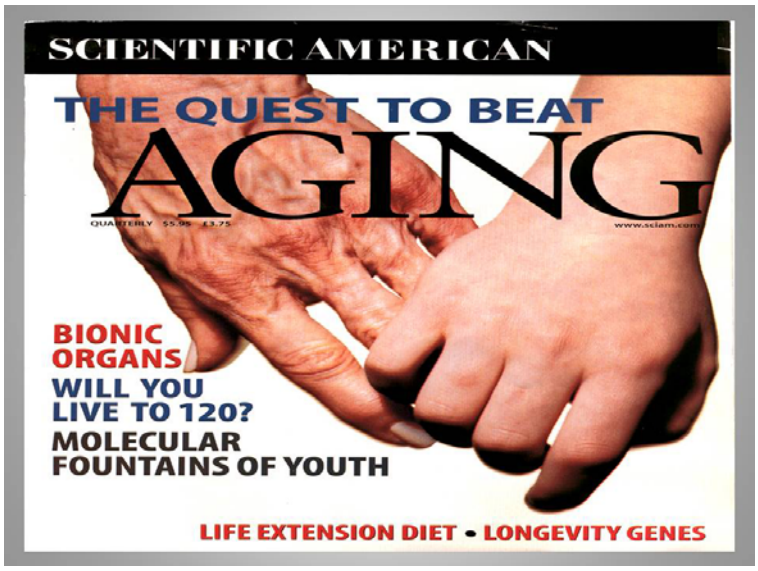

Fig.3: Stop aging: we may live to 120 years…

However, medication is often considered too abundant and multiple drugs per individual are sometimes uncritically prescribed, especially for the elderly (called poly-pharmacy). This may lead to fatal side effects or even to downright abuse (drug addiction): advanced drug-technology has also its downside!

Will we live to 120 and if so, should that be considered as natural or unnatural?

Long life and virtual immortality is not a new phenomenon in nature (see internet link List of long living organisms): not only colonies of primitive protozoa and bacteria are in fact immortal but even some animals can become more than 8.000 years old! (Fig. 4). The oldest human, recorded so far, was a French woman, living up to 122 years. She appeared quite smart at that age: when a journalist visited her for her birthday and after the interview said: well, see you next year perhaps, she answered: I count on that, you do not look too bad to me! In the circles of gerontologists and transhumanists (see link Transhumanism), it is strongly believed that life span can be boosted to an average of 120 in the coming years, through preventive health measures. At the time that this is achieved, genetic engineering will be developed to such a perfection that quite soon after that an average of 250 years is within reach, including an appropriate quality of life....The famous British gerontologist Aubrey De Grey tries to proactively deal with concerns people might have with his focus on extreme longevity research. He covers several contra-arguments such as overpopulation,

immortal tyrants, only the rich, first things first and playing god. And also discusses some other often heard remarks: I don't even want to live to 1000; I'm too old to have any chance of benefiting; we should focus on curing disease and feeding the starving first; let's become better people first – we don't deserve long lives; we should focus on postponing frailty, not death; life is already long enough to do the full range of what life offers; we'd be denying future generations the right to be born; this would not be saving lives, it would be extending lives; we'd forget so much about our youth that we wouldn't be the same person. De Grey states that this is a new perspective for those individuals who do not simply accept a restricted life time of 70-80 years and sees it as a typical human endeavor: modern man always pushes his limits (De Grey and Rey, 2007)! For others, this life-sustaining tendency represents an obvious ecological disaster scenario and is also viewed upon as contrary to the idea of evolution (survival of the fittest implies selection and the necessity of dying). For example, would there enough space and food for all those people who would wish to live so much longer? Yes, say the advocates of life extension: in the western world we now throw at least 50% of our food supply away, its production can be much, much higher and the unequal and unjust global distribution of food in fact is now the biggest problem. Moreover, they claim, we may eventually inhabit our oceans or ultimately colonize other planets. In any case, there seem to be only two choices: a short but powerful life or a much longer but perhaps more boring one... However the latter is a projection on the basis of the present state: why would a longer life with high quality in the future be boring anyway? What, on the contrary, would be won through the preservation of knowledge and experience!

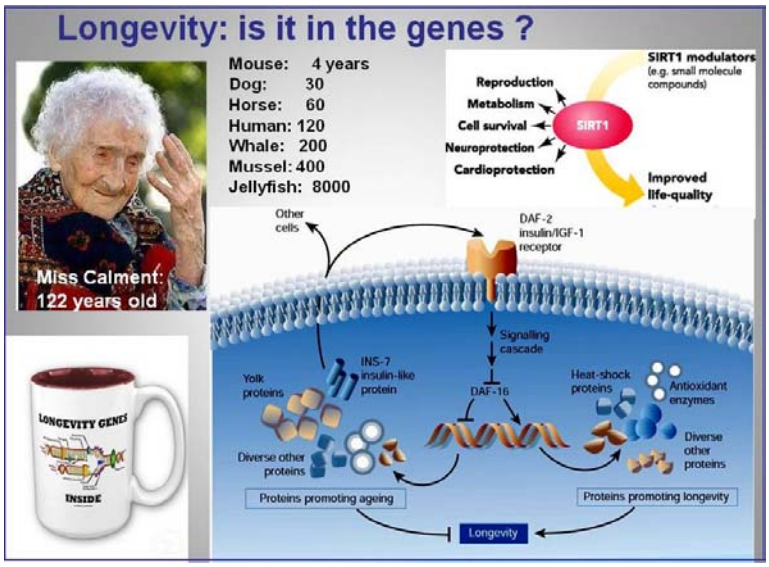

Fig. 4: Current human life is on the average rather short (70 - 90 years), but even a life span of 120 is now possible (see miss Calment!). In this century, a 150 years life span may become feasible too and some scientists claim that the first human that will become 150 year is already born! Some genes have been identified that code for proteins that may promote longevity, (for example SIRT 1, DAF -16 and INS-7). Note the variable life span of other species (right above).

Since the recent genetic / molecular biological revolution, expectations for a rapid development of more effective and safer medicines and gene therapy, are high. The latter includes gene correction, replacement and foreign gene transfection. More recently it has become clear that composition and expression of our genes is not always the only factor in the etiology and / or maintenance of a disease. Environmental factors such as over-consumption, stress, insufficient exercise, pollution, hunger and social insecurity are often very dominant [Jablonka, 2006]. Our chronic welfare diseases are often over-eating' diseases and there is a huge mismatch between our genes and the current

dietary patterns. We are not so much victims of our genes as well of our collective behavior! (see link Ben Best)

Healthy food consumption and calorie restriction

Conversely, there are indeed long lasting and favorable effects on the expression and repair of longevity genes by the quality of food that we use (low calorie, high fiber and antioxidants in fresh fruits and vegetables, (see Fig. 5) and a modest daily food consumption. It is certainly better to stay relatively lean by calorie restrictions and combine that with regular exercise. Research with mice on a low or high calorie diet regimes showed that the "fasted" animals lived at least three times longer compared with mice who received excess of food every day!. Calorie restriction is both for the young and the elderly individual a "must"... Other crucial advices are stress reduction, plenty of exercise, sufficient resting points throughout the day, (e.g, meditation) and last but not least, smoking cessation.

Fig. 5: The health pyramid: a good basis is plenty of water, fruit and fiber, but refrain from excess of fats and sugars (top of the pyramid). Exercise is essential and up to two glasses of red wine a day is fine, but one should stop smoking as soon as possible!

Another important factor is once activity pattern both physically and mentally. Ageing of our complex organism is in fact due to loss of complexity of various biological systems in our body (increased entropy over time). In order to counteract this, we must put more energy into the system in the form of cognitive stimulation, i.e. informational energy, which activates many biological processes. It is advised therefore that elderly people actively accept new challenges in their life and maintain much of their youngster lifestyle properties such as sports, sex and learning. Intentional cognitive stimulation (i.e. special brain exercises, sense exercises, seeking novelty and excellence) will add robustness to their planned positive attitude. The brain should therefore be forced to make more decisions and to select the best option among a number of possibilities. An appropriate selection itself creates information (Shannon's reduction of uncertainty). Meaningful information (knowledge, experience, wisdom, excellence), via expressive activation of appropriate brain mechanisms, increases the energy available to biological processes that then improve repair and maintenance, thus non-ageing.

Statistically, people who live according to these directions, may live 10-15 years longer than people who do not, although there are exceptions to this rule which are due to individual genetic make-up.

Also the psychological factor counts: people who are feeling old, become victim of a self-fulfilling prophesy, in contrast to those who accept the challenges of life even after sixty and may feel relatively healthy: aging is indeed is also something between the ears...The unraveling of the human genome with its DNA and RNA, opened the door to revolutionary and emergent developments in evolution. Examples are gene modification, gene replacement, gene transfection, improved gene repair and protection. Even the cloning of individuals will become possible, at least in principle. (see Fig. 6).

Genetic approaches

Genetic interventions in the humans are, by many, seen as a taboo item, but by others rather welcome its potential blessings. This principle ethical divide, may lead to a crucial split in the further evolution of humanity (See Greenfield, 2003, Chown, 2007, Post,2004, Goldsmith, 2012).

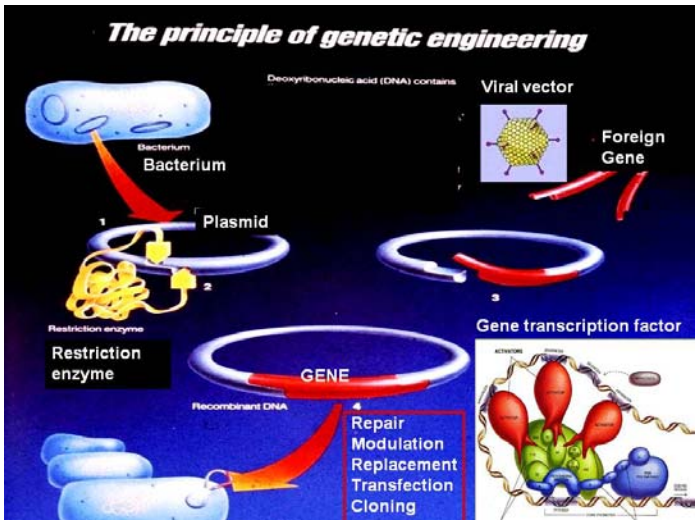

Fig. 6: Gene manipulation by the insertion of a gene (red) in circular DNA strands (plasmids), which is then are used for the synthesis of a therapeutic proteins (bottom left). Right: Gene-control (activation on and off) by protein complexes (transcription factors) that bind to the DNA promotor strand of a gene with in the cell (inset lower right, red, blue and green structure).

Genomics and proteomics now are the "buzzwords" in the life sciences. Our genome with approximately 22,000 genes, that code for the essential proteins of our cells, contains a sea of information which, as shown above, is trapped in the cell nucleus. The DNA is composed of a chain of nucleotides that are efficiently folded in a double helix, which, in turn, is packed in the chromosomes in a sophisticated manner. The reading of the nucleotide sequence in each gene can only occur when the folded double spiral can be unfolded on the spot and each triplet of nucleotides, corresponding to a particular alpha- amino acid, can be recognized. Through the reading of the entire gene, the individual amino acids are strung together into a specific protein in a, for that gene specific, sequence. This protein will then fold into a three-dimensional protein structure.

Any gene can thereby give rise to multiple proteins, either by partial reading of the gene or by variations in the folding of the amino acid chains. This whole process is subject to strict regulation by specific clusters of signal proteins that control whether a gene is really active or not (see bottom right inset in Fig. 6). Genes can, in this manner, be turned on or off, and this pattern of gene activations is different for each cell type. This creates the 200 different cell types in the body, all

with a slightly different mix of active genes and thus their corresponding proteins. In other words: liver, heart, muscle, - or brain cells do all have the same genes but not the same mix of proteins!

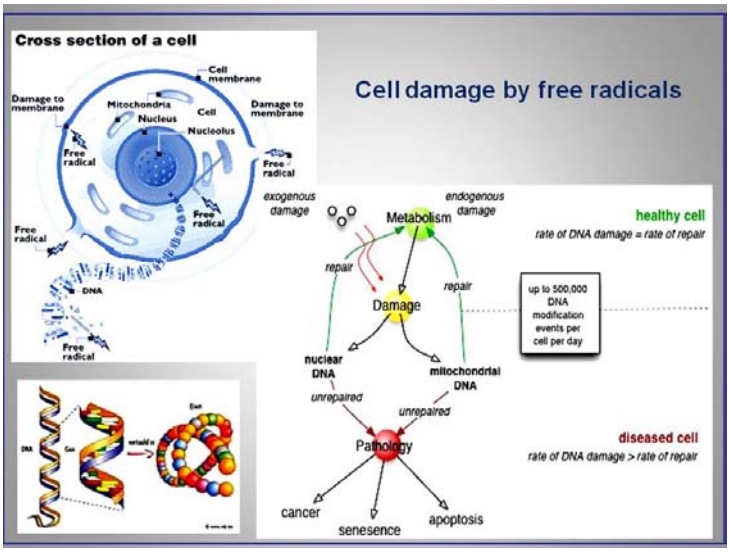

Fig. 7: A Cell with its organelles (above left) uses oxygen that as a byproduct produces reactive oxygen species (free radicals). Oxygen is needed for cellular metabolism, but the reactive oxygen species, are damaging DNA and proteins that, on a daily basis, makes many repairs needed, (bottom left). If repair does not keep pace with damage, ultimately severe tissue damage is produced and loss of function of organs and joints may occur.

It became clear also that environmental influences are "felt" by cells through modification of their gene expression. For example, major stress causes the production of stress hormones that in turn act on the genes of certain brain cells such as neurons. Specific genes in these cells undergo chemical modification (for instance by methylation of DNA) and thereby are turned off, so that the corresponding proteins are no longer produced (Jablonka, 2006). Consequently, gene expression is changed and cellular functions, as related to the particular proteins, are modified. Such changes can even be passed on to the next generation because they also occur in the germ cells of the particular individual. This newly discovered process is called epi-genetics and implies that the state of our organism is not only determined by our genes perse, but also by the influences of the environment via the individual gene expression. For example, it became clear that Holocaust victims, exposed to chronic stress indeed can pass certain behavioral patterns on to their children.

One of the disturbing facts of life is that we finally will end our life due to the fact that we inhale oxygen! Although essential for cell metabolism and the production of cellular energy, the major drawback is that we thereby all produce very reactive oxygen species (radicals) that react with essential cell components, finally leading to dysfunction and death of cells (Fig. 7). DNA repair (500.000 repairs per cell per day), can finally not cope with this damage, since the quality of the cellular repair machinery also becomes affected.

The whole process of gene expression, regulation and repair (Fig.7) is much more dynamic and variable than previously thought. The Darwinian evolution mechanisms, such as random DNA mutations coupled with a "survival" -directed selection of the variants of these genes, proved to be a rather primitive model. It should be stressed that diseases are often based on abnormalities in more than one gene and that such aberrations may also depend on individual gene expression, as influenced by the adopted lifestyle and behavior of the patient! Thus disease control may not only require the correction of multiple gene functions or their products (i.e proteins), but also an

adaptation of living conditions and/or psychic stability! (Best, 2012, Post, 2004, Bishop, 2010, Kirkwood, 2011, Lipton, 2005).

In practice, immortality is taken to mean not an eternal life perse, but rather an indefinite lifespan, i.e. a lifespan without a predetermined end, and thus the abolition of involuntary death due to ageing. In addition, it is taken to mean the continual absence of significant age-related pathology. Instead of accepting that our cells are programmed to die, it should be investigated if hidden (non-expressed) genes are present that code for longevity. If there was a way to activate this 'something' then human biological immortality would be possible. If there were one or more genes that code for immortality, and these may have been inactive for millions of years: they would have mutated over time and eliminated into oblivion. Take, for example, the genes for developing a tail. This ability is encoded in the fetal development and represents an active gene system also in humans. However new genetic controls have been added during evolution to overwrite them. The genes exist but their action is suppressed or inhibited. Human embryos have tails when they are a month old. Then the tail regresses and disappears through action of newer genetic controls, causing apoptosis and remodeling. If we would be able to activate the supposed genetic ability for continuing life, then this genetic system could be manipulated to operate along a different option, which may lead to a life without a pre-determined end (Kyriazes, 2013).

Scientists are also working now on the "genetic design" of drugs. For instance, chemicals or therapeutic proteins are screened for binding to and inhibiting of gene components or gene products. The latter can be a protein that in the cell is engaged in the metabolic network that is dysfunctional and may be the cause of the disease. In this manner the function of the diseased cell may be favorably adjusted (for example the relaxation of blood vessels in patients with abnormally high blood pressure or by influencing specific factors by which the folding of proteins is improved (for example, in Alzheimer's disease). However the hunt for the "disease genes", that are supposed to be the very cause of a particular disease appears extremely complex and the related costs are sky high (800 million Euros for each new drug that comes to the market). Nevertheless, scientists still await spectacular developments in this field.... Life extension by genetic modification certainly lies in the future as a reachable goal (Fig. 8). Yet, gene manipulation should always be accompanied with proper societal guidance and be preceded by a well-organized public debate about what is ethically justified on the long term (De Grey, 2007, Post 2004, Weiner, 2010).

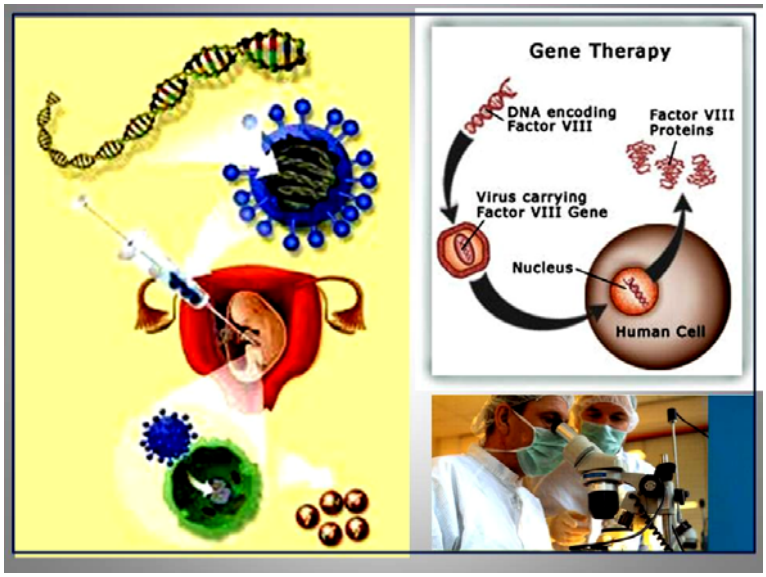

Fig. 8: In-utero gene transfection (left) and gene therapy to produce a therapeutic protein (right).

This is also true for the genetic aspects (for a number of relevant genes in this respect, see Fig. 4). A likely development is the modification of gene expression or even the addition of foreign genes that may enhance normal bodily functions. For example, there are current thoughts on the injection of viral carriers with a specific gene that promotes the production of a certain type of muscle cell that can largely improve the performance of athletes...., doping in the future may therefore be gene-doping!

Survival by cryopreservation

Programmed freezing and preservation of deceased individuals (called cryopreservation), in order to revive such individuals at a later time, when a definite cure for their disease is available, is already initiated by a specialized organization in the USA that, until now, keeps about 40 bodies in liquid nitrogen storage compartments (see Fig. 9 and link Cryonics). This requires a programmed freezing technology and injection of preservation fluids to prevent freezing damage to tissues. Even more complex is the de-freezing stage that still have to be fully mastered in the future. Anyway this seems a quite silly endeavor, since after all, it would be sufficient to store some individual stem cells in order to clone a young and healthy individual (see later). Even if this extremely costly procedure would be fully accomplished and the particular disease could be handled, the particular individuals would wake up in an environment that would be completely different from the previous one (relatives, societal conditions) so that, through the necessary adaption to the new situation, much of the original individuality would be lost.

An obvious complicating factor in the therapeutic intervention with drugs in our organism, is the sheer multiplicity and redundancy of cellular processes in each of our cells. Intervention with a single process by drug therapy will inevitably lead to either compensation reactions or to subtle changes in the whole organism that may be detrimental to the individual on the long run. We have no less than 100 million times a million cells in our body, which somehow work perfectly together and during the life also are replaced regularly! Each cell is, in itself is already a complex machine having at least 100.000 different functional proteins. About the fine regulation of this beautiful multi-cellular system we still are largely in the dark, although considerable progress have been made in the study of processes leading to aging and death in the last 20 years.

Fig. 9: Survival of the individual by cryopreservation of whole body or brain: a good idea ?

Cell rejuvenation

Recently it became known that removal of senescent (outdated) cells, that remain intact for too long in the body during aging, can yield major improvement of health. By programming of immune-competent cells that selectively destroy such cells, a dramatic rejuvenation of the respective tissue can be attained. Senescent cells, in between healthy cells (Fig 10, below, in the center) release a lot of harmful inflammatory substances that negatively affect the quality of life. The inset at the bottom of Fig. 10, shows a (relatively large) mouse after such an immunological treatment compared to an aged non-treated animal (Naylor et al, 2011,Treadwell, 2006).

Could the life prolonging effects of calorie restriction and removal of senescent cells be mimicked by the action of appropriate medicines? Last year, research convincingly showed, for the first time, that a drug could extend life span in mammals. The particular drug is rapamycin, a medicine prescribed to prevent rejection of transplanted organs. Despite its reputation as an immune inhibitor, earlier studies with worms and flies suggested that it might mimic the anti-aging effects of calorie restriction. And when researchers at three different U.S. labs gave it to late-middle-aged mice, the results were stunning: the life expectancy of the aged males was boosted by about 20 percent, that is on the average more than 15 years in human life span. It works by blocking a single protein – an enzyme called TOR or 'target of rapamycin'. TOR is the center of a massive signaling network in the cell, TOR influences how cells grow and divide, how rapid proteins are manufactured from RNA, and how unwanted components are recycled in the disposal units of the cells called lysosomes. Blocking TOR by rapamycin type of drugs, increases removal of dysfunctional proteins and organelles in cells, as well as helps to destroy cripple (senescent) cells so that damage by these tissue components is restricted and the aging process is greatly retarded.

Rapamycin's new powers were discovered as part of the National Institute on Ageing Interventions Testing Program, an ambitious research program that tests potential life-extending chemicals in mice. Green tea extract, aspirin, resveratrol (found in red wine) and simvastatin are all potential candidates, and it is quite possible that other already existing drugs could have life- prolonging effects. Supporting this idea, is the finding that metformin, an anti-diabetes drug, that steadies blood-sugar levels in people, clearly mimics the effects of calorie restriction on gene activity in mice. It has been shown to extend a healthy lifespan, even in non-diabetic rodents. More than 50 million prescriptions for metformin are written annually in the U.S. This means the anti-aging revolution may already have been accidentally launched! Years from now, we may discover that long-term use of metformin by diabetics increase their healthy lifespan far more than can be explained by its effect on their blood sugar levels. There's already evidence that people on metformin have lower risk of cancer, dementia, heart failure and other diseases of aging. This suggests that such drugs, if proved safe to take chronically as preventive medicines, would have unprecedented efficacy in ameliorating or warding off obesity-associated diseases, regardless of whether they induce weight loss or not.

Would such interventions lead to a sharp rise of health care costs because people simply live longer or would it rather spare costs because these older persons remain longer in a good shape?

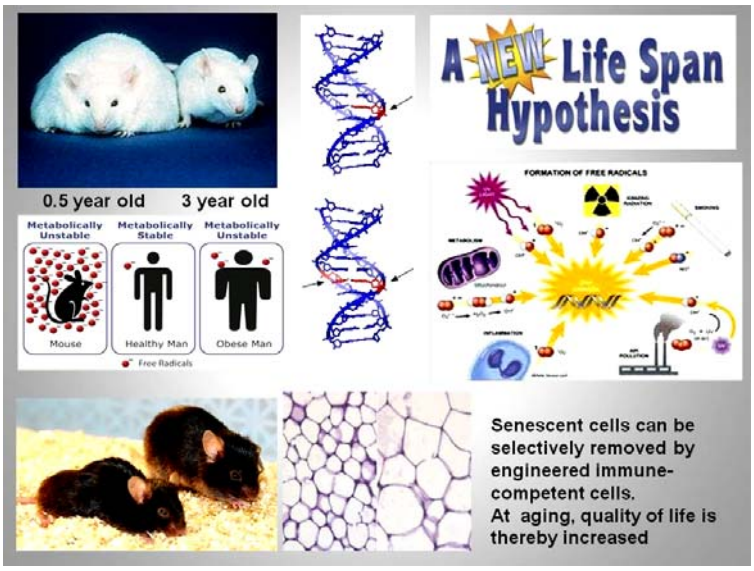

Fig. 10: Above: The "oxidative stress" hypothesis of aging. Cell damage occurs through oxidative reactions on DNA and proteins by oxygen radicals (red dots) occurs especially in metabolically unstable individuals, such as mice (upper left) and humans with obesity. Proper countermeasure is major calorie restriction in the diet or removal of senescent cells (below, right).

The proof for the latter came out in 2003 in the *New England Journal of Medicine*. Analyzing Medicare data, federal researchers showed that elderly people in good shape at age 70 — meaning they had no difficulties performing tasks of daily living such as walking and shopping — could expect to live up to 84 years, while after 70 they had average, cumulative health care bills totaling $136,000. In contrast, less healthy 70-year-olds with at least one limitation in daily-living activities could expect to live up to 81 years —three years less — yet had cumulative medical bills of over $145,000 during their shorter remaining lives. Thus, boosting longevity with anti-aging medicines might well lower Medicare expenses on a per-capita basis.

Conclusion: It is certainly not excluded that, even in the near future, combinations of gene therapy, healthier lifestyle and appropriate medical interventions, may lead to a substantial extension and quality of life (see the links for Engineered negligible senescence).

Stem cell therapy and cloning

Other examples, apart from gene transfections with life-prolonging genes, is the implanting of so-called stem cells into tissues of the diseased organism. Stem cells, prepared from embryonic tissue, can develop into any cell type wanted. For example, diseased cells in the brains can in this manner be replaced. For example, in the case of the fatal Parkinson's disease (see Fig. 11) promising results have been obtained by local injection of stem cells that, in the brain, grow out to dopamine producing cells (West, 2013).

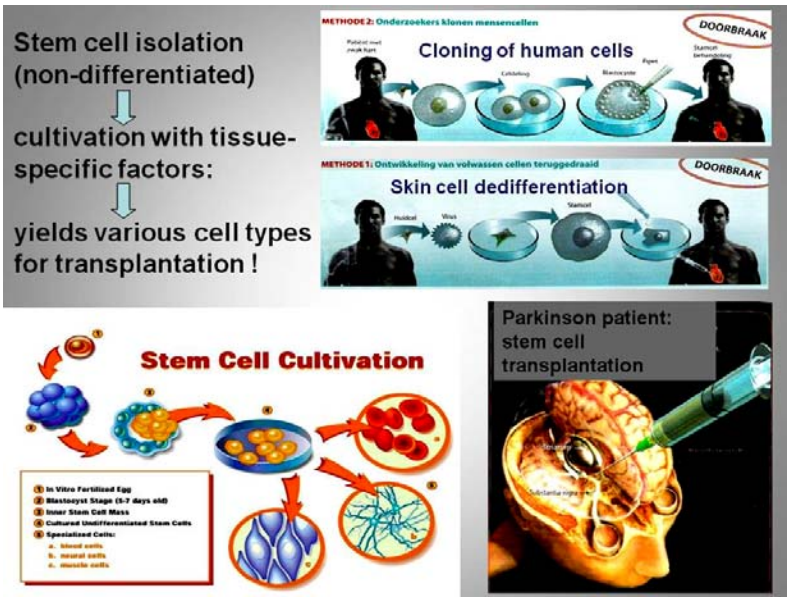

Fig. 11: Stem cells (grown on agar, below) and inserted into the brain by injection (left) or the heart (upper part right): a breakthrough in renovation and repair of organs!

Recently it has been demonstrated that stem cells from the skin of mice can be manipulated back into embryonic cells, and that using these cells a whole series of mice can be cloned (Fig. 11). If such cloning technology would be available for the reproduction of man, a special kind of immortality could be achieved that hitherto is only known from the world of micro-organisms like bacteria. By activating four different transcription factors (Oct4, Sox2, Lin28 and Nanog) in embryonic stem cells, induced pluripotent stem cells are produced in which the internal clock of aging is reversed and the cells regain immortality through lengthening of their telomeres (see also next section). Interestingly, it was shown that woman that smoke cigarettes suffer a considerable loss of telomere length, whereas lower levels of omega-6 fats coupled with increased omega-3 fats results in increased telomere length. The omega-3 boosting can be achieved by taking 1,500 mg fish oil daily and is probably due to the inhibition of inflammatory cytokines. These human studies indicate that it may become feasible in the near future to juvenile cells in the intact organism by therapeutic agents (Liu, 2003).

De-programming of inborn cell death

Another possibility to do something about our limited life span, is the genetic reprogramming of cells in our organism. The hard fact is that each of our cells (except germ cells) is programmed to die after a certain time: our cells are restricted to up to 40-50 cell divisions in our life time. Our death is therefore in fact built into our bodies…. From an evolutionary standpoint this is a useful mechanism since it guarantees that our organism dies after having accomplished its reproduction task. Also it stops senescent cells to get out of control. Cells in which this internal death mechanism is disabled, for example, can turn into tumor cells, growing out to solid tumors that invade healthy tissues and may spread throughout the body (metastasis)!

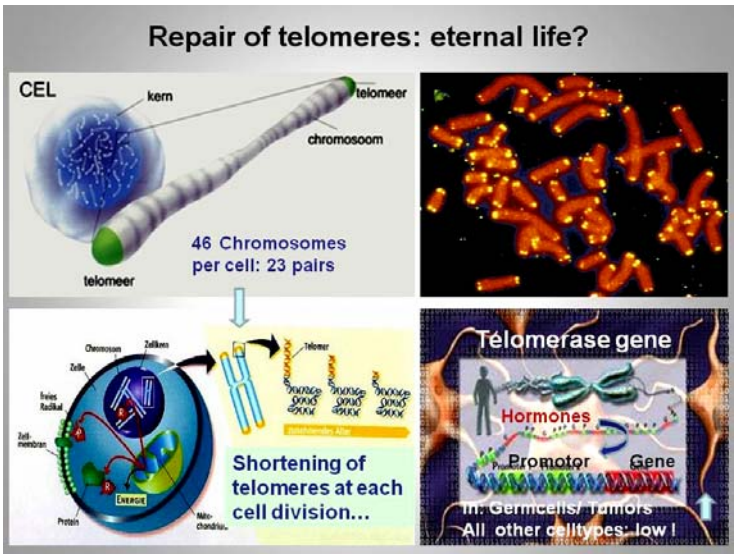

Fig. 12: Telomeres at the end of chromosomes (green, top left and fluorescent yellow, top right). At each cell division shortening of the telomere occurs, and the DNA chains will be less and less protected during each cell division.. The telomerase is coded by the telomerase gene, of which the expression is normally low, can be promoted through the influence of hormones like testosterone.

One of the processes that determine the life span of cells is the shortening of the so-called telomeres, located at the end of each chromosome in the cell nucleus, that is associated with each cell division (Fig. 12). Telomeres are repeated short strands of nucleotides at each end of the folded DNA chains which are necessary for the DNA chain to stay protected against damage during cell division (see links Telomere and Telomerase). At each division of the cell, this telomere becomes shorter, until the cell can no longer repair the damage done, and consequently dies. Only one catalytic protein, the enzyme telomerase, is able to rebuild their length. It is, except in our germ cells (egg and sperm cells), poorly expressed in other cells in our body. Thus, it seems obvious to bring (transfect), the gene encoding the telomerase artificially in our cells, or to activate the dormant gene in the cell in order to locally produce telomerase!

Activation of the gene for telomerase is realized via the associated promoter-gene (a type of on- and off- switch, see Fig. 12) so that the telomeres can be, at least partly, restored. Sex hormones such as estradiol and testosterone stimulate this promoter element, but the production of these hormones in our body is unfortunately reduced with age... Recent research in mice showed that the telomerase gene in that animal can be completely disabled by a technique called gene-knock out. These gene-knock out animals, already at very young age, show severe signs of aging, such as abnormal posture, hair loss, loss of sperm production, reducing the brain size, etc (see Fig. 13 and Jaskelioff et al, 2010). Mice live only about three years and have a genome that resembles that of humans, and are therefore very suitable laboratory animals for aging research, since in the relatively short life span all stages of life can be studied.

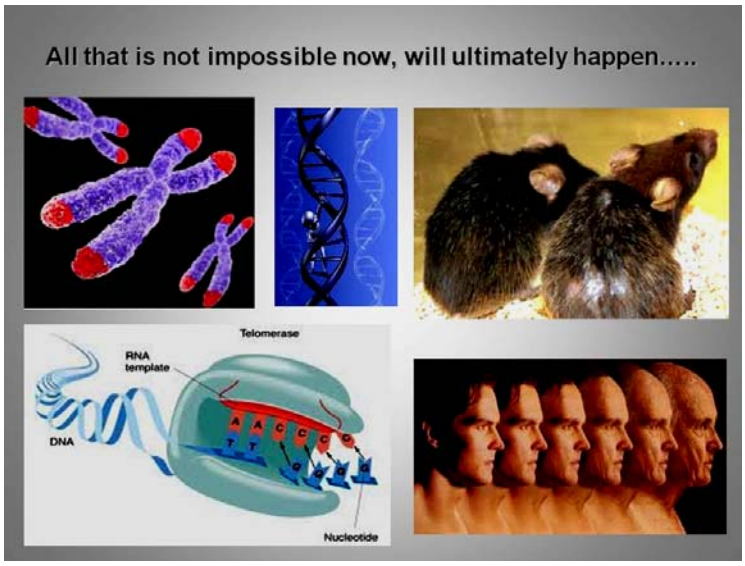

Fig. 13: The enzyme telomerase can maintain telomere length by the insertion of nucleotides (bottom left) at the distal end of chromosome. Mice lacking the gene for production of telomerase, or mice in which the gene is turned off, age abnormal rapidly. If telomerase in these animals is again reactivated, the enzyme is produced again and stops further aging and even induces rejuvenation (big mouse with a glossy coat, top right). The question is whether such a rejuvenation process may become feasible also in humans (bottom right).

If one now injects a chemical that activates the promoter of the telomerase gene into these artificially aged animals, telomerase enzyme is again produced, and the telomeres of the mice extended. This not only stopped the aging of these animals but, to the surprise of the scientists, led to a spectacular rejuvenation, with hairs and sperm coming back, while mobility greatly improved and the brain of the animals becoming anatomically more normal (see Fig. 13). This animal model demonstrates the importance of telomerase to counteract aging and even showed a major improvement in fitness of these animals. Of course the relevance of this artificial model for humans remains to be proven. Also it should be realized that there are multiple cellular mechanisms, other than telomere function, which influence the aging process.

The pharmaceutical industry is nonetheless actively searching for selective telomerase-activating agents and in fact there seems to be already one on the market (Fig. 14): an extract from the root of a plant that grows in China. Astragalus is the active component, which has been shown to cause an improvement of the immune system, which is probably linked to an extension of the telomeres in the immune cells. Incidentally, many of the recommended "lifestyle" measures mentioned in Fig. 5, have also be shown to produce a modest degree of telomere extension! Thus, telomerase activation seems to be a logical target to battle aging. Yet the risk of this therapy is still too large because such measures may also increase the chance of promoting tumors in the particular target tissues.The solution here lies in the fine regulation of telomerase expression so that telomere repair occurs without causing cancer! Proponents argue that activation of telomerase expression in the tumor cells is already naturally high and therefore will not be further increased by the treatment, while the positive effect of medicines such as Astragalus on the immune system even would improve cancer treatment. The above-mentioned research is promising but awaits further proof in humans, among others since laboratory animals have a genome that differs at least 20 % from humans (see Andrews, 2010).

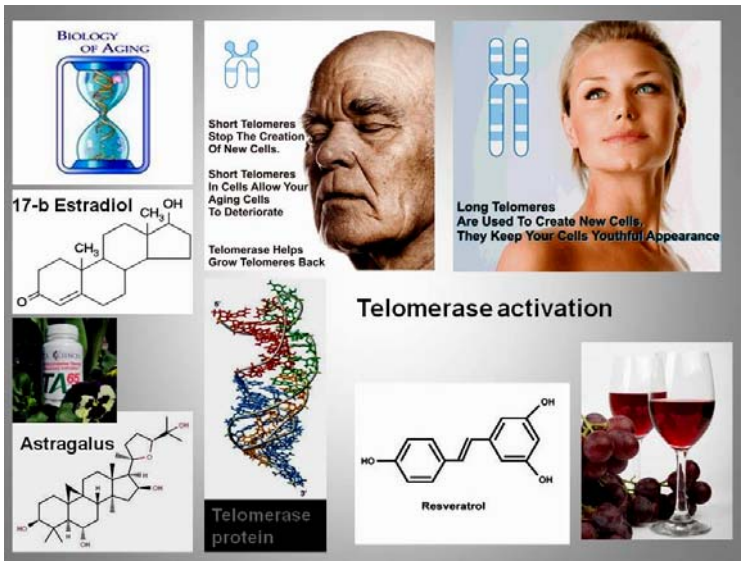

Fig. 14: Left: Extension of telomere length by sex hormones and by an extract of the plant Astragalus. Also the substance resveratrol, from red wine, may have a positive effect on telomere length, cellular repair and protective mechanisms.

Conclusion: It is not inconceivable that in the next 50 years innovative solutions will be found for increasing the life span of the human body and that in due course, by more sophisticated biotechnological interventions and novel therapies, it will become possible to even renew the organism to a significant extent (see links Biological Immortality, Life extension and Rejuvenation). Despite solid reserve and skepticism on this claim(Vijg, 2008, Post, 2004, Shapin, 2000 and Goldsmith, 2012), one could speculate that about a century from now, people may look back with pity on that dark period of humanity around the year 2000, when people still died at an age of about 80 years...

3. Do we live on through our offspring or can we survive in cyberspace?

Continuation of our individual life is not yet possible but what about living on in your children and their offspring? This is a popular, but not entirely correct, assumption. It should be realized that children bear only half of the genes that are specific for the father or the mother and that their descendants have, through the contribution of foreign partners, increasingly diluted genes (Fig. 15). People resemble genetically much more their brother or sister, because they have indeed the same genes from both the mother's and father's side. The genes and memes (personal mental properties), that are so specific to an individual, are slowly fading away with each generation...

Digital immortality?

In recent decades, through the global computerization, a new experience space was created: the colonization of everyday life with cyberspace. This development will inevitably change our biological and cultural identity. An alternative for living on in the other, is that you live on, with much of your personal information, in cyberspace. This is possible now by incubating yourself in the virtual worlds of computer gaming or make your expression on Internet as large as possible....: survival in cyberspace is up for grabs! (Kurzweil, 2005, De Mul,2002, Greenfield, 2003, Kaku, 2005 and 2007, and the link Second life).

Fig. 15: Continuing personal life in your children (left) or attaining digital immortality (right)

The degree of expression of an individual on Internet provides in fact a kind of digital fingerprint. A personal blueprint or autobiography is easily identified in this immense collective meme library (Fig. 15). This strictly personal information is not easily erasable and will ultimately survive our physical existence: digital immortality is, in this manner, indeed up for grabs (de Mul, 2006)!

Virtual reality fills our existence

Many, especially young, people have discovered the virtual world. Coming home from work with everyday chores, they prefer the virtual reality: they are "avatar" in their own world where life is good, human contacts satisfying and life more colorful and exciting. There they have a loved one, besides friends and extensive possessions (Fig. 16). They play these games according to the rules collectively agreed by the users: you can do almost everything but even here there are limits and responsibilities! Interactive games and virtual worlds are offered nowadays on a digital square with portals to practically any reality. Naturally, the world of flesh and blood is staying on, but the short life that we are awarded can be much more filled and concentrated: lifespan itself is not extended, but its intensity may at least be doubled! (see link Second Life).

Fig. 16: Double your life: dive in cyberspace!

Will our brains adapt to this colorful exhibition: yes, this will certainly be the case, just like any metaphor or story or image changes the wiring of ones overall neural network. Indeed, this intensely experienced virtual world changes the very wiring of our brains just like the input of walkmans, phones, television and the internet will do: all these peripheral apparatus are in fact extensions of our brain. All of this, per definition, also modifies our individual self-consciousness, because that arose through interaction of our brains with the environment: without such an interactions we would not develop self-consciousness anyway! Will cyberspace become a factor in the development of future human consciousness? The impact of these developments, on the long run, may be a much more drastic than we can foresee now...Extrapolations of current technological developments give clear indications for drastic changes in the evolution of future mankind. The flow of information that assails us every day is overwhelming, and according to many, even alarming!

Many parts of our bodies seem already replaceable by organ transplantation. Bio-chips that continuously monitor our metabolic status will support such a development. Is the present world conceivable without the computer, Internet and mobile telephone? We seem indeed to externalize increasingly more brain functions and it follows that our brain will undoubtly adapt to the situation! It has been claimed that we are already cyborgs (in silico bio-hybrids) (Clark, 2000, Fig. 17)! Will this technology be our salvation, because we can ultimately substitute our fragile organism by indestructible hardware?. In that case, there is no need at all to intervene in our genome in order to extend our life span! Anyway, a parallel development of cyborg -technology and gene manipulation seems obvious (Greenfield, 2003, Kaku, 2005 and 2007) and that these techniques may be finally combined into a novel species: our “mind children” that may become our successors in evolution (Kurzweil, 2005). It could be argued that the death of the individual organism is necessary so that evolution will continue refining and increasing the level of complexity and intelligence through the continual and progressive variability of the offspring. But it could also be argued that this may be true for any other organism except for humans. It may be the case that modern humans represent the highest point of procreative evolution, and that further refinement of intelligence through procreation is now becoming unnecessary. Intelligence can now reach higher hierarchical levels not through evolutionary variability (i.e. the evolution of the offspring through procreation) but through personal development, i.e. a personal, self-centered developmental singularity process. If we could indeed be programmed to live indefinitely, the hierarchical progress can develop through perpetual learning, experience and intellectual sophistication which can continue to evolve in the same individual. Organisms with lower intelligence must indeed follow the path of death/rebirth (as required by the Disposable Soma Theory) in order to attain higher complexity through natural selection, whereas such modern humans have now attained the highest possible intelligence level afforded by procreative evolution, and do not need further development through this particular route (Kyriazes,2013).

Fig. 17: Artificial intelligence and robot science: a necessity for mankind in the future to cope with an excess of information and technology!

It is important that we think thoroughly about these possible developments, in order to keep destiny in our own hands. For example, "science fiction" literature is a useful reflection of such projections of the future, because in this art the incredible becomes reality and a framework is created to analyze social developments in its ultimate consequences. These projections of the future, in turn, affect the existing science and art as they have done in the past. Who does not know the examples of visionaries like Leonardo da Vinci, Jules Verne, George Orwell and Isaac Asimov (the first robot laws). How strong is the influence of our projections of the future on actual development? Are the films Star Track, AI and I Robot interspersed with virtual images or do they represent a "self-fulfilling" prophecy of the future of humanity? Yet, the fear that robots will become conscious and will overpower a weakened mankind is a misconception: we will have to collaborate with artificial intelligence in order to cope with the many new challenges (see Fig. 17).

Is in the future the human organism replaceable?

Each human cell is, as mentioned earlier, in itself a complex machine that is programmed to a relatively short lifespan. In addition many imperfections have evolutionarily slipped into the human organism. Impressive is the sheer multiplicity and coherence of the hundreds of thousands of cellular responses in each of these cells. This also applies to our brain. In the 100 billion brain cells (neurons) in our brain self-awareness is manifested as a virtually unexplained phenomenon. Will it become feasible in the future to design a completely new organism on the basis of synthetic biology and / or cyber technology? Can our personal autobiography and self-awareness be "uploaded" in a less ephemeral hybrid life form or in advanced robots? (Kurzweil, 2005,Tipler, 1994, Moravic, 1999).

Depth scanning of the brain and "uploading" of brain activity patterns up to a complete memory in advanced computers can be an ultimate goal in the distant future. Would it be possible that our "mind" eventually will feel more at home in a reliable machine instead of the vulnerable and mortal human body? In particular for nanotechnology there could be a role here (see Fig. 18). It will, at least according to some experts, become reality in the coming 200 years that super small "sensors" injected into the bloodstream will be engineered to pass into the brain or other tissues and organs of

our body, with the aim to monitor relevant cellular functions. This, includes scanning of the whole circuitry in our brains. Such nanobots are instrumented to transmit this information to a remote machines that than maps our personal profiles at any time on a continuous basis. All of these points are seriously considered in the field of "Transhumanism" science. Robot technology and current research on artificial intelligence indicate that if this trend continues, within 50 years, home computers will be built with the capacity of the human brain and may easily contain the entire global bibliography, implying everything that ever have been written or printed!

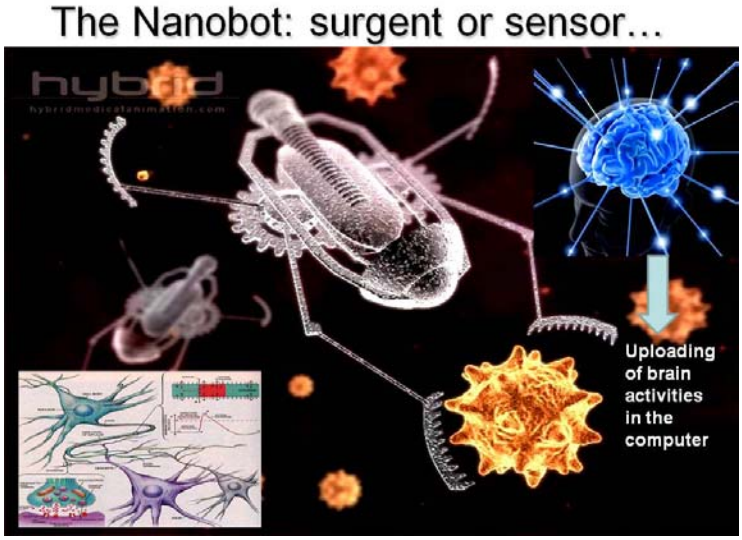

Fig. 18: Scanning of neuronal brain networks (inset below), using nano-sensor technology that enables uploading of individual information (inset top right). Here a so called nanobot is depicted that selectively attacks dangerous cancer cells in the bloodstream.

This will be combined with the building of self-learning computer systems, going through the same evolutionary process as the human brain, but in a fraction of the 100.000 years that the humans brain evolved. In this manner incredibly intelligent machines will be created (Kurzweil, 2005,Tipler, 1994, Moravic, 1999).

In general, the societal impact of this development will be astounding. If we realize that even a technical failure in the booking computer of an airport, nowadays poses a huge chaos, it is clear that to deal with the complexity of our society, our future world will be largely run by artificial intelligence. An interesting question is whether that kind of artificial brains will be aware of themselves and of the environment with which they interact. Will people become a kind of extended robots or will robots evolve to human-like machines? (Fig. 17). Will robots be able to develop empathy and be programmed to act as our best friends, or will they instead become a potential threat as pictured in well-known SF books such as “2001, A Space Odyssey” and movies like “I Robot “, and the "Terminator" series?

And how will the future world look like thousand years from now? It should be realized that this technological development exhibits an exponential nature: in the 20th century the knowledge doubled every 10 years, now it doubles each year! (Kurzweil, 2005) The conditions at the end of this millenium will greatly surpass our wildest dreams. Anyway, It may well be that the development of artificial intelligence will prove to be an ultimate resort in the cascade of information that will engulf us: the computer /robot may become even more than our best friend: an indispensable instrument in survival of the human race…

4. The physics of the future and its implications for immortality

In the foregoing it was assumed that the individual life is finite, in spite of the advanced measures to prolong life that will become available: death seems ultimately unavoidable. However, there are theorists, such as some quantum physicists, who at this point come to a very different conclusion: namely that dying, in fact, is impossible! Our body cannot escape its demise, but according to them, the information that determines our overall personality and continually reflects our lives, will remain: the law of conservation of information.

This idea is, as mentioned before, borrowed from modern physics, especially quantum physics. Although at first glance it seems an unreal idea, it is perhaps somewhat more compelling when one realizes that what we perceive of the world is likely very limited and forms a very inadequate representation of reality! In the underlying coherent reality (see Fig. 19), which is described by quantum physics, the preservation of information is a prerequisite. Therefore, in the framework of this essay, it makes sense to discuss these scientific developments in some detail (Forberg, 2006, 2007, Greenfield,2003, Capra, 1996, Lanza, 2012).

In the 20th century the standard model about the structure of matter and its building blocks, the elementary particles, was created. This model at the micro level and the accompanying quantum theory, however, were not consistent with the description of the macro world of the Universe as, in particular, is described in Einstein's theory of relativity. There are now desperate attempts to develop a "theory of everything", that should adequately describe both aspects. One example of this is the String theory or, even better, its successor: the M-theory. The basic idea of the String theory is, that not the real elementary particles, such as electrons. protons, photons and quarks, are the building blocks of matter, but rather much smaller elements that can best be described as a sort of strings that can vibrate at different, discrete, modes. Each of these different vibration patterns corresponds to a particular elementary particle. This implies that at the smallest physical level, even our brain, is an assembly of vibrations!

In addition, quantum physics tells us that particles may at the same time behave as oscillations (waves), by which they can interfere with each other and can produce a sort of mixed waves, called superpositions. The structure of reality therefore seems much more flexible than thought on the basis of solid particles. Moreover, particles that belong to each other, in term of their properties (e.g. their polarization and rotation or spin) are always linked even over huge distances: if you the change the spin of one particle the paired particle spin is altered too. This strange phenomenon was called “quantum entanglement”.

That such particles are somehow intertwined does not mean that they are exchanging signals, but that they, in one way or another, are correlated. This was for quantum physics such as David Bohm and many others, a reason to assume a "quantum wholeness" an idea that really means that everything in the universe is connected "entangled (Meijer, 2012, Meijer and Korf, 2013). This entanglement of everything cannot be detected directly or felt by us. Our individual consciousness is so dominated by the overwhelming sensory input from our senses that we are rarely really aware of this kind of connectedness. According to Bohm, such hidden phenomena are due to fact that they are part of an underlying quantum information field that is present always and everywhere (thus is non-local) and that, according to Einstein and Minkowsky, exhibits a four-dimensional structure since it contains a complete time dimension: past, present and future are represented in this domain.

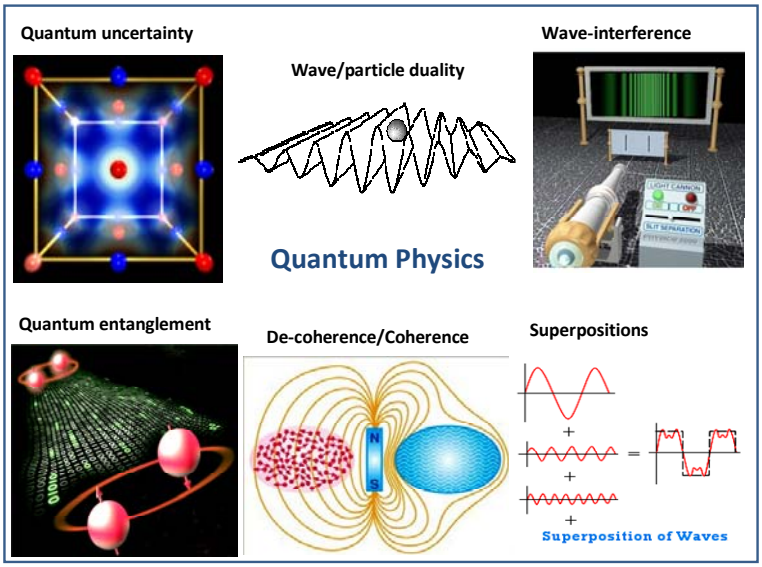

Fig.19: Elements of quantum physics: uncertainty of position of particles, wave / particle duality as demonstrated in the double-slit experiment (upper part),as well as entanglement (non-locality) of particles at great distances, the phenomenon of coherence/decoherence and superposition of waves (lower part).

Such a quantum field does not exercise influence through the use of forces, as is the case with electromagnetic fields, but does so through the exchange of energy that is continually reallocated in a dynamic process. Building and decomposition of matter are, in fact, caused by absorption and release of (virtual) photons and matter can thus, more poetically, be envisioned as "light captured by gravity." The virtual particles of the field can in this manner also provide an energy exchange between the physical reality and the non-zero local field to which they belong (Fig. 20). Even the force of gravity, a yet poorly understood phenomenon, may be related to this field, because it has a retarding effect on the movement of material: so-called inertia. Both aspects also underline the possibility suggested by Penrose that quantum gravity is instrumental in the capture of quantum information in our brain (Meijer and Korf,2013).

The infinite consciousness: an information field?

This particular quantum energy field is also seen as a giant hologram (see, for instance, Steven Hawkins and the Dutch scientist Gerard van 't Hooft) that permeates everything in the universe. It is considered by the physicist and systems theorist Laszlo as an universal information field (Laszlo, 2006). Consequently, each of us is supposed to be in contact with the field through wave interactions. So we are in fact connected to a general energy field, which penetrates our bodies constantly (Meijer, 2012). The information exchanged is not only used for a deeper form of coordination but probably also for the creation of meaning. A number of prominent scientists scientists who laid the foundations for the hypothesis of the quantum brain: the Nobel Prize winners Wigner (quantum physicist) and Eccles (neurologist), the quantum physicists Bohm, Stapp, Goswami and Wolf, the neurologist Pribram and mathematician Penrose, initiated the idea that our brain may functions as an interface between the individual and the collective consciousness that is stored in this quantum field.

Ervin Laszlo, 2006, states that the universe, in this way, exhibits a kind of universal memory and that all experiences are stored in, what he calls, the Akashi field, an term that is also encountered in

the Eastern religions. The basis for the existence of this field derived Laszlo from the, so called, torsion fields / vacuum domains previously by Russian researchers.

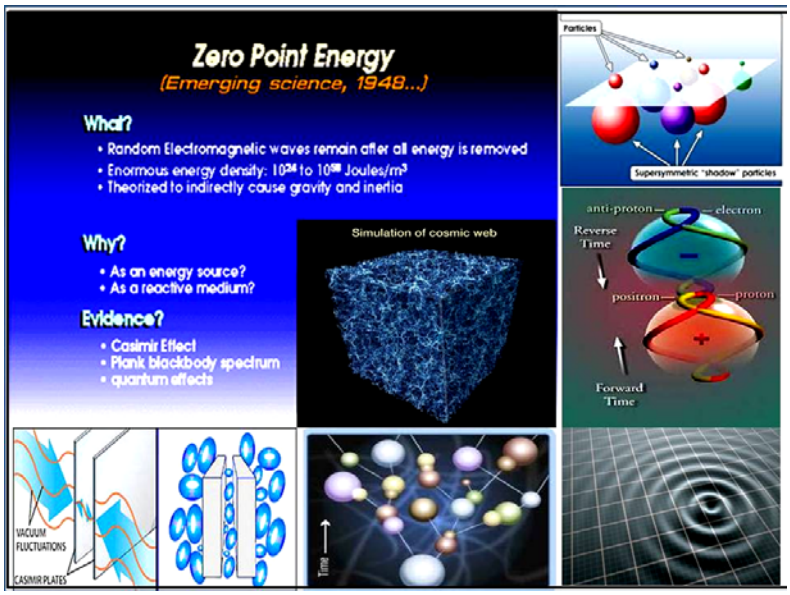

Fig. 20: Left: The universal, all pervading "zero energy field" as a vacuum with fluctuations of quantum waves or particle/antiparticles (insets right). Through superposition and photon polarization) information storage is possible. Two plates at a very narrow distance (left below) show attraction since the virtual particles outside can exert more pressure than the spatially expelled particles inside (the so called Casimir effect that demonstrated the universal presence of zero point energy). The anti-particles travel in a reversed time mode.

Recent experiments showed that teleportation of particles is based on sending complete information on that particle over a wide distance, by which at that distant site a solid particle is created: thus matter arises from information. The renowned scientist Anton Zeilinger therefore concluded that information is more fundamental than matter and energy. It became also clear that such an universal information field can also be seen as the source of the origin of the Universe (see also the link to" Information Universe", in the references).

In the next sections we will explore the possibility that also personal information is stored in this domain and can be instrumental in the realization of an fundamentally different modes of immortality. In other words immortality could be considered as the conservation of information.

5. Transcendence of the individual self

This section addresses the, so called, transcendental phenomena in human experience. Detailed investigation shows that also in this area scientific research of high quality has been done in Europe as well as a great number of top universities in the USA. With the term " quality research" we mean that it is properly designed research with sufficient built-in controls, professional statistical analysis of data as well as publication in peer-reviewed journals. Yet the recognition for this ground breaking work by "mainstream" science is often rather thin, because one tends to deal with the particular results in a rather conservative way on the basis of usual reductionist and materialist frameworks.

Fig. 21: Transpersonal experiences: the researchers (bottom right), the techniques for them to arouse or experience (top right) and the postulate of the internal filters in our brains (top left). Personal information from a supposed quantum field, is experienced as clairvoyance or described as an inner voice (called "Daemon" in classical Greece philosophy).

Scientists who upfront reject scientific results, that do not belong to the (temporary) consensus, are evidently counterproductive in the advance of science perse. When in this area "the wheat is separated from the chaff" (and that is needed in all areas of science), it is discovered that there is overwhelming evidence for the occurrence of so called extraordinary experiences (anomalies, see Jahn and Dunne, 2007 Radin, 2006, 1996). It is therefore worthwhile to keep these phenomena against the light, in the framework of modern physics, in order to see what they mean for our current view on the world and how we could get a finger behind the mechanisms that are in play here. It is also of great importance for science in general to seek the fringes of its disciplines, because historically it often appears that the real breakthroughs occur especially in these areas (Fig. 21). Of note, the scientific debate between materialistic and idealistic worldviews runs as a red thread through the history of science and philosophy, and, for example, is now prominent in the major discussions on the nature of consciousness, as well as in the dialogue on the relationship between science and religion.

Religions have had a very unbalanced role in the cultural evolution of mankind: useful unifying visions of society to the most horrific acts that humans have ever committed. Modern brain research indicates that religious and spiritual experience is associated with various brain structures and that immanent evolutionary spirituality is deeply embedded in human nature (Carter, 2013, Lanza, 2012, Wolf, 2008, Peake, 2008).

Whether individual consciousness is retained in any shape or dimension beyond death is currently intensively discussed in relation to various types of transpersonal experiences, in near-death experiences (NDEs), mystical experiences and in "channeling" (receiving very complex information, large texts or images from an unknown source). Is our brain somehow a signal receiver for information from a "superconscious" domain (Jahn and Dunne, 2007, Peake, 2008, Radin, 2006)?

Consciousness beyond space and time in the Near Death Experience

In line with other Near Death Experiece (NDE) investigators, particularly from England and the USA, the Dutch cardiologist van Lommel, 2001, 2007, proposed an own vision on consciousness. In his book 'Endless Consciousness', he argued that consciousness may not really an epiphenomenon of the brain, but is rather an autonomous phenomenon, independent of the physical body. In such phenomena as consciousness, we must also bear in mind that there is a continuous exposition of our individual consciousness to the outside world: without the imprint of the outside world, personal consciousness could not arise anyway. Our brain should therefore always be seen in relation to a flow of information from the other parts of our body and also the signals we receive from and send away to the world around us. This flow of information includes the interaction with the invisible, but ever-present, quantum wave world, that after all is as real as the material world of particles: matter and mind are complementary aspects of a unified reality.

Ultimately, all our senses are based on only electrical impulses propagated through the nerves to the brain, where they activate networks of neurons and then somehow are translated into a perceptions. Sight, hearing, taste, smell and touch are thus, in materialistic terms, fundamental similar, because all these different sensory experiences, arise from electrical stimuli. However, it is still entirely unclear how our individual consciousness and self-consciousness become manifest and what the basis is for our subjective feelings such as our individual perceptions of color, smell and sound (called qualia). Many scientists today support the hypothesis that this kind of experience is not merely based on the sum of neuronal activity, etc. Rather the required communication between brain areas (`binding`) is the result of quantum coherence and quantum entanglement in the brain and consciousness is, at least, partly caused by the so called wave / particle duality, implying that the elementary particles that constitute our brains are also part of a wave world as postulated in the quantum theory. Through this quantum wave aspect, according to this hypothesis, non-sensory information transfer to the brain can occur from a universal wave field. Recent research showed that the quantum world is not only relevant at the micro level, but also belongs to all of our everyday macro world (Fig. 26, 27). Quantum phenomena were recently shown not to be solely important for the atomic level. Quantum effects were demonstrated in living cells including the essential process of photosynthesis as well as in the brains of birds in the detection of geomagnetic fields during bird migration. Therefore it is quite well possible that quantum fields played a role in the becoming of living organisms, and are instrumental in the coordination of 100 trillion cells that constitute our bodies (Meijer and Korf, 2013)

Common features of NDEs

The research showed that about 20% of patients in cardiac arrest had a mild to profound near-death experience. The experiences during a near-death experience appear to be quite universal and have been reported worldwide. The experience seems only modestly dependent on age, gender, cultural background and religion of the people involved. It happens both to believers and atheists, and also to people who have no prior knowledge of the NDE phenomenon (Van Lommel, 2007, Carter, 2012, Elsaesser, 1997).

The common characteristics (Fig. 22) are: traveling through a tunnel toward the light, a retrospective view on the life and encounters with deceased loved ones. Most patients experience an expanded awareness: thoughts seem to go faster than during normal waking consciousness. It appears, in many cases that some kind of access is felt to an omniscient consciousness that answers every question that a person on earth has ever asked. It is scientifically proven by several researchers that these experiences occur during the period of cardiac arrest in which both brain

activity and the heartbeat are not measurable. The ECG and EEG of these patients do show a flat line on the monitor and activity in the cortex and brainstem are not detectable. According to current scientific knowledge, it cannot be explained that patients during a near-death experience can see and hear more clearly and apparently have an expanded consciousness. In contrast, one would rather expect a more limited consciousness. All conventional scientific explanations given for the near-death experience, such as oxygen deficiency in the brains, hallucinations, drug use that can be accessed from the recorded data can be altogether rejected.

For example the often raised argument that the loss of blood supply and a flat EEG does not exclude that somewhere there is still little brain activity, especially since an EEG is predominantly a recording of the electrical activity of the cerebral cortex, misses the whole essence. Because it's not about whether there might be some neuronal activity to measure, but whether there are specific forms of brain activity, that according to current neuroscience are considered necessary to experience such a clear consciousness. In vivid dreams of this type there are always intense brain activities that can be easily determined. And precisely these specific forms of brain activity in the EEG in patients with cardiac arrest totally disappear during a NDE experience.

Recent developments in physics in relation to NDE

The phenomenon of near-death experience also raises deep philosophical questions. This experience shows that consciousness, under those circumstances, apparently can observe a physical world without involvement of the normal senses. There are even documented cases in which during the near-death experience, observations were made by the patient at great distances from the body, that later were verified as being absolutely correct. The question arises whether our normal sensory perceptions act as a filter for this kind of conscious extra-sensory perceptions. From the testimony of persons reporting NDE, it is inferred that their perception during near-death experience is faster, broader, more realistic and more pure of nature than during an ordinary dream. Also during the use of certain drugs, meditation and rapid change of gravity (falling down and traffic accidents), "out of the body" and NDE-like experiences are generated, but they do not have the quality and character content of the expanded NDE experiences as they were in many cases reported (see Fig.22).

Recently an interesting study was presented (Venselaar, 2011), in which the NDE is described fully physically as a 5- stage process that includes a) separation of photonic consciousness from the body, b) a journey to a tunnel of light after strong contraction of the particular information, involving mini- black hole and wormhole modalities and observation of cosmic structures, c) being at the presence of light at a border, having a life review and experiencing specific light shifts, d) a subsequent return to the body and e) final unification with the physical body. Another recent study (Bokkon et al, 2013) confirms the potential role of bio-photons in several aspects of NDE, in relation to intrinsic visual perceptions and imageries as well as self-consciousness that may involve low-energy quantum entanglement of bio-photons in interaction with the photonic zero-point energy field (ZPE). Bio-photons are constantly produced in the entire organism at the cell membrane, and within the cell in mitochondria and DNA, including the brain, the latter due to Casimir-like conversion of virtual photons of the ZPE to real photons, at the synaptic cleft of neurons, providing an ultra-rapid communication system in the entire organism.

“Life after life” is pictured as a being of light, due to the fact that damaged or dying atoms of our physical body release countless photons (light energy). Since our daily consciousness is connected to the brain, these exotic photons, are supposed to be transformed into another broader transcendent consciousness, in which such photons are indestructible. The particular photonic body, in this theory, may be capable to 'carry' information about who we were and are.

The panorama of life: better than memory....

Impressive is that during a near death experience, the patient is confronted with a full and bright panorama of his/her entire life, in which he/she is not only relives the life from his/her own ego perspective, but also from the perspective of each person with whom one has been in contact during one's lifetime. This experience from the perspective of the other, according to many of the NDE patients is complete, including the thoughts and feelings of every person who crossed ones path in life. Of note, the majority of NDE witnesses, subsequent to their profound experience, live a more conscious life, being more open to others and more interested in the big questions of life (see Fig. 22).

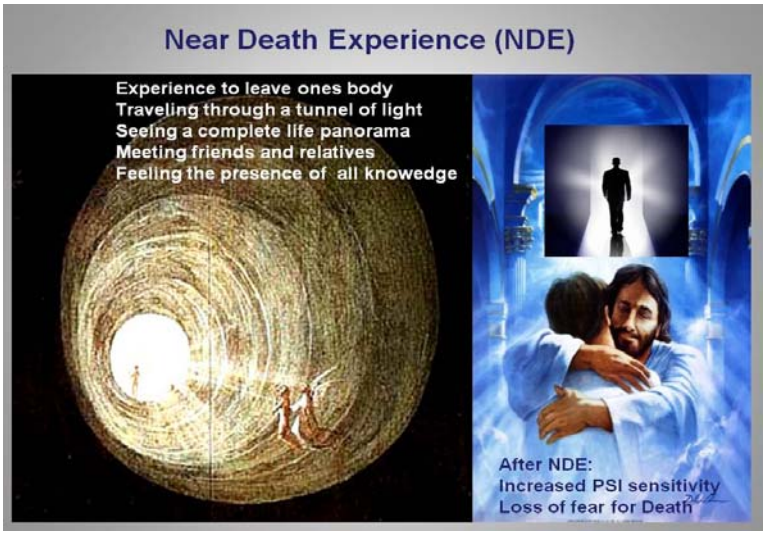

Fig. 22: The general components of a Neat Death Experience

Is a NDE only due to previously stored images in the brain?

The extraordinary near-death experience of Vicky Noratuk showed that even blind people can see again during a near death experience! From her birth she had a shrunken eyeball and optic nerve and an undeveloped visual cortex. So even if there would be a yet unknown activity of the brains during the near-death experience, she did not possess a healthy sense organ that could transfer her visual impressions to her consciousness through the brain, nor a memory for detailed images. After she had her experience, she described this as "it felt like the place where all knowledge is". A faithfully executed study with 31 similar cases of blind vision (Ring and Cooper, 1997), revealed that blind persons, including those blind from birth, do report classic NDEs of the kind common to sighted persons. Further citing the article: "Thus, what we have here is an adumbration of a process that begins with Mind, seemingly fully independent of brain becoming self-referential, that is, becoming identified with consciousness itself, and then converting this noumenal consciousness into a dualistic modality that generates the familiar phenomenal world. What we have called transcendental awareness is at least the beginning of the reversal of that process by which, even though the traces of an everyday dualism remain, the individual is enabled, however temporarily, to experience the world from a perspective independent of brain functioning and the operation of the senses. Each of these theories formally entails such a state of awareness, and specifically in blind persons, during NDEs or OBEs".

The modern NDE research thus leads, just as investigation of reincarnation (see below), to the hypothesis that consciousness continues to exist in some form after death. Death, according to this

hypothesis, is only an illusion. It is, in this consideration, only a transitional state to another form of conscious life, but without the experience of a physical body. According to some quantum physicists, such as Alan Wolf (1996,1999, and 2008), and Hameroff (2013), dying is, more precisely, not a transition to another phase, but rather every individual is at every moment of ones life already represented in the non-material dimension of the aforementioned quantum information field (Fig. 23). In other words, in this theory, conservation of individual information is a continuous process and is permanent.

Reincarnation: an indication for life after death?

For a possible survival of personal information after death, there are also indications in the many, now documented, reincarnation reports of children. Children from very different age, sketch spontaneously, without any special cause, life histories of people that have been proven to be completely unknown to them and about particular persons deceased long before their own birth, and that in a staggering detail. Globally ten thousands of well-documented cases have been thoroughly examined, often dealing with children at an age of 5-10 years who spontaneously explain that they have lived another life and have been another person. Such suggestions are always met with much skepticism and sometimes received with complete disbelief, which is obviously quite understandable (see links Reincarnation and link Ian Stevenson).

However it encompasses many cases with descriptions in an incredibly detail, outlining various aspects, such as the exact location of the residence of the deceased, the layout and decor of the house, hidden objects, knowledge of family of the deceased and personal characteristics thereof, including the character of the deceased. These stories were, inter alia, thoroughly verified by the renowned historical researcher Stevenson (see link Ian Stevenson) and in many cases found to be completely in line with historical reality (Phipps, 2012, Peake, 2008, Carter, 2012, Elsaesser, 1997, Fontana, 2005)! All this, even in cases where the child had never been in the described country and did not have any contacts with people out of the particular area nor with family members of the deceased. In some cases these stories also report the fluent speaking of a second language (of the deceased person) by the child or for example, without any exercise, playing a musical instrument. It is as if the skill of the deceased is directly transferred to the child.

A critical discussion of these puzzling phenomena are found in references of Braude, 2003 and Carter, 2012, and link to Reincarnation. There are, according to the authors, apart from fraud, that often can be simply excluded, two possibilities: either the child receives somehow exact information from another world in which the deceased in some modality mentally persists (survival hypothesis) or it is due to a telepathic transmission from a still living person, who in that case should have detailed information on the deceased and be able to transmit this telepathically (the PSI hypothesis). In the above mentioned, well referenced and well-researched, books, it is concluded that the survival hypothesis, as related to these reports, seems much more supported than the assumption of telepathic contact between the child and the particular person involved. It is hypothesized that a general information field may be instrumental in the reincarnation process due to storage of individual information and potential resonance with a future entity (Fig. 23).

The respective authors conclude, after really exhaustive and scrupulous research, that in a manner not understood, some people (or detailed data on them) persist, at least temporarily, after their death. This, in some way, leads to the transfer of personal information to young children that become beware of this information and interpret it as their former life (Braude, 2003 and Carter, 2012, and link to Reincarnation). It is clear that we arrive here at the borders of knowledge and that we experience something that is far beyond our human intellect. Nevertheless, the phenomenon of children report is, in itself, established in thorough research, and despite the absence of a

satisfactory explanation, is recognized as such in scientific circles, albeit without the notion that this represents a process of rebirth or reincarnation. An impressive report of a "skeptic" scientist is depicted in the link about reincarnation, that provides an interesting view on this possible modality of immortality (Phipps, 2012).

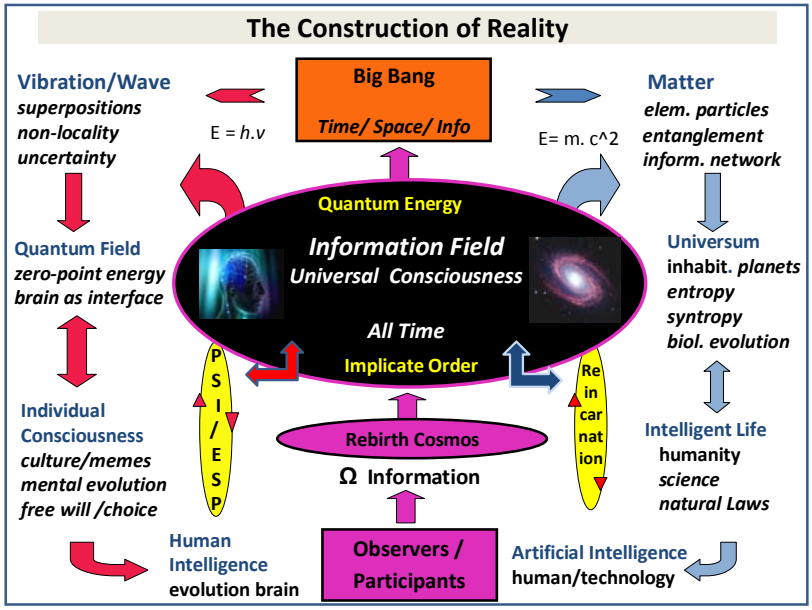

Fig.23: A tentative scheme to picture the construction of reality, with a central place for a Universal Consciousness, or Quantum Information field (black). in which all time is laid down and that is considered to be the source for and final destination of our Universe. The Big Bang gave rise to the material (right part) and mental (left part) unfolding of information. These complementary aspects of reality lead to human and machine intelligence, by which the Universe is able to observe itself in ever increasing detail. PSI, ESP as well as BDE/ reincarnation phenomena reflect the dynamic interaction of individual and universal consciousness with our brain as interfacing instrument. The collection and compression of all final information leads to rebirth of our Universe in a subsequent version at the omega point (see section 6 and 7).

The notion that can be inferred from the sections above, namely that consciousness of all living entities belongs to a collective "web of information", should implicitly be supplemented with the reverse side of this concept: that individual consciousness, through this interfacing, is just as much an expression of the universal (nonlocal) consciousness. In this respect we are, according to this quantum concept, truly part of the unity of nature, as Spinoza already postulated (Fig. 23).

Paranormal phenomena: extra-sensory perception of information from another domain?

The quantum consciousness models treated above may also be instrumental in the explanation of a number of so called transcendental experiences. Examples are, the fairly normal, (trans)-personal feelings of intuition, serendipity, synchronicity as well as feelings of "high", and dreams (Fig. 23 and 24). But also more "transcendent," or paranormal aspects such as channeling, out of body experiences and near death experiences (NDEs) might be discussed in this framework (Radin, 2006, Jahn and Dunne, 2006, Braude, 2003, Carter,2012).

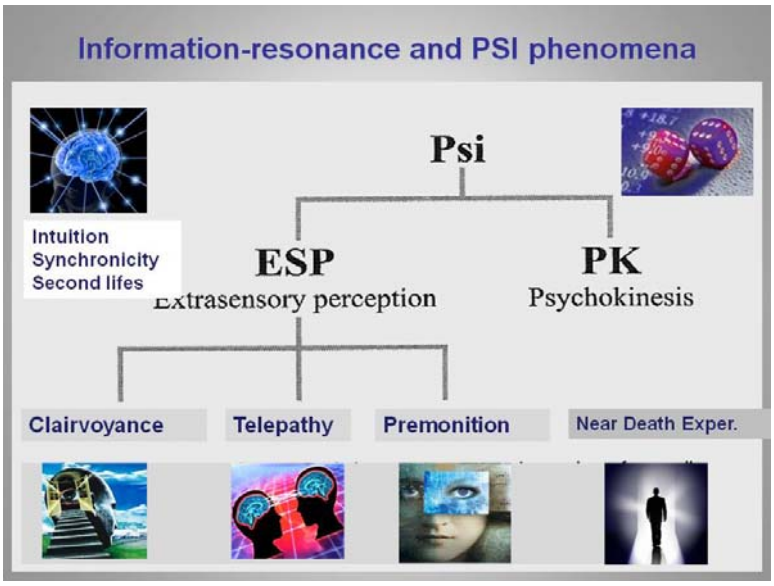

Fig. 24: Various forms of extra sensory perception

The general question here is whether the so called "normal" and "beyond normal" experiences are so sharply separated and whether they do not constitute a continuity of reality. Other non-local phenomena in this context, are called the PSI phenomena (see Fig. 24) such as clairvoyance, telepathy, remote viewing and psychokinetic. These phenomena could also be related an underlying non-local information field because they concern influences at a distance or messages from the future, experienced by people. The central question is how for the necessary information for these phenomena can reach the brain and how these extra-sensory communication / perception occur from a mechanistic point of view.

It is important to note that much of PSI / ESP research in this field is carried out at a scrupulously accurate manner, to exclude any form of statistical bias and misinterpretation. Yet, this research is often focused on the direct detection of paranormal phenomena and less on the underlying physical mechanisms of information transfer. The latter is of great importance for future investigation, because it may provide answers to study the well-known evading aspects at sequential PSI observations, as well how the signal strength of ESP experiences could be improved. Both aspects could be related to the inbuilt filters in our brain that should protect us against too much disturbing information (see Jahn and Dunne, 2007, Radin, 1996, 2006)

6. The significance of individual life in a fine-tuned Universe

The origin of life, and also the appearance of man appears to be due to fine-tuned construction: even tiny deviation in each of the 25 fixed constants in the laws of nature, would have been fatal for the emergence of biological life (Ross, 1989, Fig. 34). This picture is also true if one includes the macro parameters such as the distance from the planet Earth to its sun (determining density of light, free energy for life and temperature), the influence of the moon (influencing life cycles) and the place of our solar system in its galaxy (just far away from a huge big black hole in the center!). These conditions in our Universe provided that intelligent life was brought forth and that the Universe finally created its own observers: us humans! This consideration is called the anthropic principle: man formulated the laws of nature thereby unveiled the underlying processes of biological evolution. In fact one could say that intelligence is an essential part of a universal

program for the processing of information. Universal consciousness can therefore be seen as the program on which our Universe is running (Greene, 2011, Tipler, 1996, Vidal, 2012, Wolf, 1996,1999, 2006, Meijer, 2012).

Information may have already existed at or during the "Big Bang". Recent cosmology indeed indicates an initial scalar field exhibiting acoustic waves and fluctuation in a quantum vacuum, a process in which energy, matter and antimatter were created. Yet, the start of the universe did not really look like an explosion, but was, according to current cosmology, a highly fine-tuned expansion process. Even small deviations in the particular expansion rate would have made the creation of life impossible! For example, the formation of carbon from helium, a prerequisite for life, would not have occurred. Again, this gives the impression of well-defined start-information, already at the start of our Universe (Ross, 1989, Meijer, 2012).

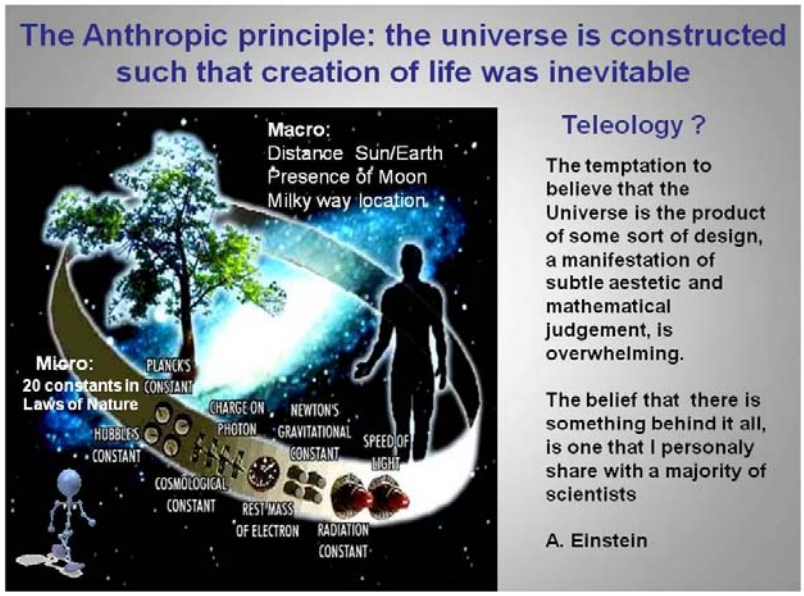

Fig. 25: The Anthropic Principle: micro- and macro- conditions seem fine tuned to the creation of life in our Universe

The logical question is: where did the information about the natural constants and the required expansion rate constants come from and how could a solar system with a structure exactly as that of ours be formed? (Fig.25). Some argue that millions of other universes exist (the multi-verse theory) and that perhaps only in our universe conditions were such that life could emerge. However, there is still no single piece of evidence for a multi-verse. Another hypothesis is that the constants of nature were not always constant but that they have been gradually converged to the values needed for the origin of life. In the aforementioned 4-dimensional domain, with all time layed out, life can even be a product of "backward causation" of future events on the primary conditions of the big bang. The information on advanced intelligent life in that domain could have had a time- reversed influence on the gradual molding of these constants (thus the necessary information came from our own future). A third hypothesis is that the information came from a previous version of our own universe, in which, in one way or another compressed information was used for the birth process: the process of time and history of the universe is then interpreted as circular (Gott, 1997, Penrose, 2012, Steinhardt, 2008).

What has this supposed architecture of reality to do with immortality? It is evident that our bodies are composed of atoms/ elementary particles that were formed 13.5 million years ago, we are,

indeed, quite old… At the end of our material existence, thus following our personal death, these building blocks stay manifest. Our organism may become decomposed or burned entirely, yet all of its atoms are retained. None of these building blocks become lost, they rather may reappear in other forms (that is in oxidized forms or becoming integrated in other organisms) or simply circulate in the atmosphere, but the atoms are still there. One could say that the specific atoms that form our body only become distributed over a larger area of our world, while gravity prevents diffusion away from our planet. Yet, it is clear that their functional organization of these building blocks, that is required for life, is completely lost.

But is this also true for the personal wave information, that is the non-material aspect of these atoms/elementary particles. In other words, is this information destroyed? Some quantum physics claim that information cannot be lost (the law of conservation of information) and that due to entanglement of the wave type of these building blocks, the personal structure and functional organization of individual life will survive bodily death (see the references of Wolf and Hameroff and Chopra). As the consequence of the persistent storage of this information in the universal quantum field, together with the total imprint of our personal experiences (our complete biography) in this domain, the personal profile would be retained and would also be available for resurrection (Tipler, 1996, Hameroff and Chopra, 2013) and, in principle, for reincarnation.

Citing the latter paper: “Recently two clinical studies used processed EEG brain monitors at the time of death in terminally ill or severely brain-damaged patients from whom support was withdrawn, allowing the patients to die peacefully. In both sets of patients, measurable EEG brain activity dwindled as blood pressure dropped and, eventually the heart stopped beating. But then, in each patient, there was an abrupt burst of brain activity lasting about a minute or more which correlated with gamma synchrony EEG, the most reliable marker of conscious awareness. Then, just as abruptly, the activity ceased. Because these patients died, we can’t know if they had NDE or OOB experiences, or if the activity actually marked the soul leaving the body – ‘giving up the ghost’. But regardless, the mystery is how the energy-depleted brain could muster synchronous neuronal EEG activity – whatever it was. One possible answer is that consciousness and gamma synchrony involve very low energy quantum entanglements which persist while other brain functions have run out of fuel.

Could consciousness exist outside the body after death? The particular authors believe it can: “According to the Orch OR consciousness model, under normal conditions in an intact, healthy brain, consciousness occurs as frames or snapshots extending through multiple spatiotemporal levels from networks to neurons to microtubules to quantum forces (see also Meijer and Korf, 2013), down to and including Planck scale geometry. When the blood stops flowing and metabolic energy can no longer drive microtubule quantum coherence, quantum information relating to the subject’s conscious experience and memory isn’t necessarily lost or destroyed, but may dissipate to the universe at large, remaining entangled as a unified soul-like entity grounded in Planck scale geometry. If the body is resuscitated, the quantum information can return, and the subject may report an NDE or OOB experience. If the body is not resuscitated and the patient dies, the entangled quantum information constituting the subject’s consciousness and memory may persist in spacetime geometry, perhaps entering an embryo in the context of reincarnation. Could the universe – empty spacetime geometry – conceivably host consciousness on the loose? There is ample energy in the form of zero point fluctuations, so the question is whether information can be registered in the nothingness of spacetime, and transcend from Planck scale to biological scale”. Many will see this daring hypothesis as an empty speculation or, at best, an understandable illusion, but for others it will provide wide perspectives for potential answers to an ancient quest of mankind, regarding individual survival and the reality of afterlife (Carter, 2012)

7. The distant future: death and rebirth of the Universe

Transhumanists (see internet link) look into the far future, beyond the current limits of our organisms, and especially to the technological potentials to drastically curtail the limitations of the human body. Some physicists like Frank Tipler and Ray Kurzweil, project that our "mind children", as very advanced, hybrid, (cyborg) machines, will ultimately travel to the boundaries of the universe, not restricted by the current limitations of the human body, and will eventually collect all the information about the universe and its total past history. Of note: the distances to other solar systems, let alone to other galaxies, are so immense that our human body, even if its lifespan might be stretched a thousand times, could never realize such extremely long journey. But intelligent human-related machines, that can repair and reproduce themselves, would be able to do so, provided that sufficient energy is available. As long as the universe does not die in a heating process (and this is estimated to occur only over billions of years), the universe will be gradually populated, and will finally become saturated with information (see Tipler, 1996 and Fig 37, Kurzweil, 2005, and epoch 6, in Fig. 26].

In this trans-humanist concepts, ultimately, a giant omniscience (quantum) computer, that contains a complete "database" of the past history of the universe may, according to Tipler, collect all the information about the history of our universe. Our successors in the far future will, like us, be curious about their origin, but their excavations will, in this case, not take place in a soil archive, but in a huge computer database (Lloyd, 2006, Bostrom, 2003). Because all the information necessary will be available at that time, one will be able to submit the total history of the universe to a perfect simulation. Through unimaginably advanced technology, this simulations can be performed with such high a quality that they will be indistinguishable from real. Such a perfect imagination was called, by the above-mentioned scientists, an “emanation” and is supposed to occur at the, so called, Omega point, as was earlier postulated by Teillard de Jardin (Intenet link, see also Fig.26 and 27).

Prof. Frank Tipler, 1996, a well-known American mathematician, but also a typical product of American-Christian progress thinking, speculates that such an event may represent the Day of Resurrection! We will all, according to this theory, experience this new life immediately after our death, since after death our kind of time no longer exists. We all will return as individuals with our own characteristics and live in our own (perfectly simulated) environment.... (Tipler, 1996).

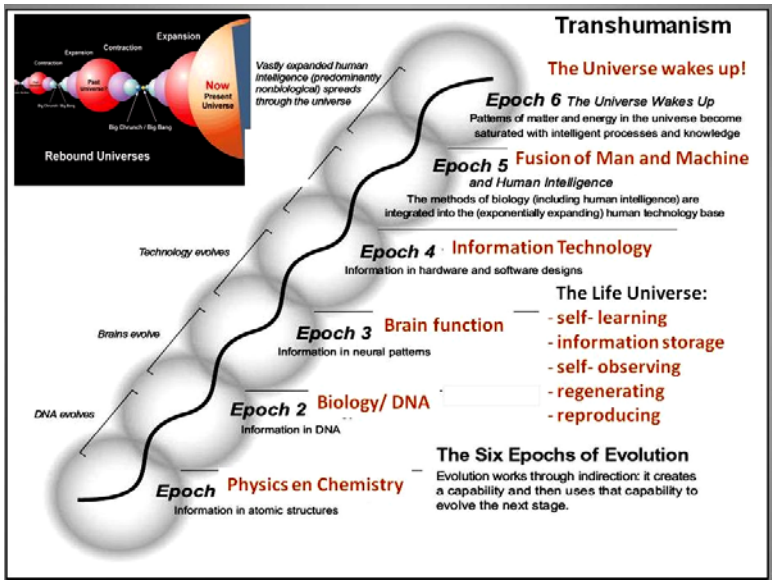

Fig. 26: The sequential epochs in the evolution of our universe, also depicting the very far future of a "living" Universe (see black box), in a cyclic time model (top left) in which the universe takes care of its own reproduction (after Kurzweil,2005)

However physics foretells that our world will not be everlasting…This is because our Universe is finally doomed to a heat death (by final contraction of the Universe) or destined for a cold death (by further expansion of the Universe). Consequently, due to the implicit destruction of the abovementioned omnipotent computer, even the resurrected beings in their simulated paradise, will not enjoy eternal life and thus another type of resurrection or recreation is needed (Vidal, 2012). Only a programmed transfer of the total, condensed, information of the dying universe into an adjacent new "baby universe" may enable such a recreation process. It is assumed in this theory that our descendents and/or other advanced forms of intelligence will master the physics of black holes or wormholes, seen as giant portals to other universes. These giant cosmological structure could be manipulated to pass the required information as a recipe for the birth of a new version of our universe (an engineered Big Bang)! Thus our successors, in the far future, may give a new start to our universe in a kind of circular evolutionary process (Gott, 1997, Steinhardt, 2008, Penrose, 2012, Vidal, 2012).

The projections of Gott, Penrose, Steinhart and many other scientist that have theorized on cyclic models of the Universe, can also be interpreted to mean that our own reconstructed Big Bang, that is often seen as the real start of the present cosmos, was rather a reflection of information transfer from a *previous version* of our Universe... (see Fig. 27). However, will each cosmic cycle encompass identical information, so that all of us will be reproduced, or will each rebirth also contain novel information and innovations, leading to ever growing complexity and intelligence of cosmic life?

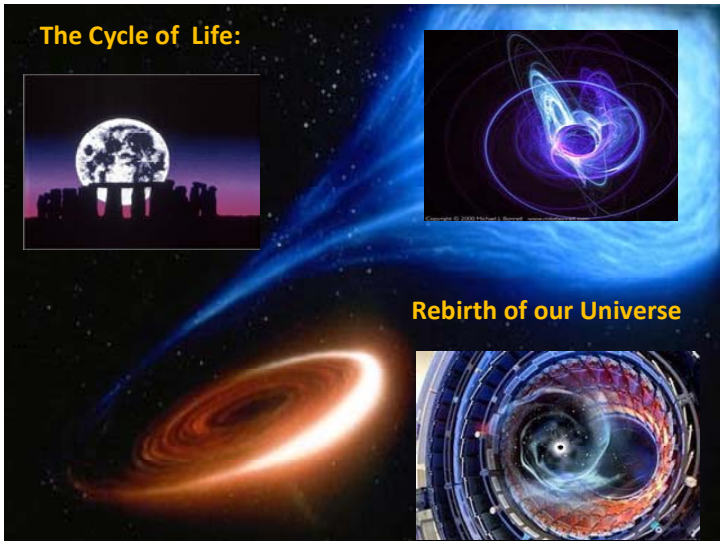

Fig. 27: Death and birth of the Universe: information is compressed by an advanced civilization as a recipe for the next universe. This transmission process may lead to a new version of our universe via a mastered technology of engineered black holes or wormholes (right below).

8. Final summary

The desire for immortality that, like a red thread runs through ancient myths, religions and wisdom traditions, in this manner obtains a cosmological outlet in a new human evolution.

Represent these thoughts just a curious kind of "Science Fiction" or do they perhaps relate to a veiled, reality? Anyway, current science often draws its inspiration from such images of the future, and at the same time these projections may serve to shape the future of mankind...

In his thesis on the beginning and end of our Universe, Vidal (2012) stated: “But how can we imagine to seriously care for such an issue as cosmological immortality? We can summarize five steps towards it. The first is to realize that your individual death is normal and inevitable in the long term. The second is to develop psychologically, and fulfill all your needs to grow the hierarchy of needs up to the need of self-transcendence. You then surpass yourself to become compassionate and identify with the process of cosmic evolution. Even if you accept individual death, you still refuse death as a whole, namely the idea that nothing would continue to evolve after the predictable death of your body, society, species, Sun, galaxy and universe. You then set the immortality of the evolutionary process as a goal”.

Immortality indeed represents a truly a multi-layered concept. Those who are interested in the various aspects of immortality, see the books of Van Bergen, Chown, Pickover,Weiner, and Cave.

Interested readers may share some frequently asked questions: are humans intrinsically immortal (see references of Carter, Phipps, Peake, Wolf, Hameroff, Van Lommel, Forberg, Braude and Fontana), or: will we, ultimately, become physically immortal either by advanced medical technology (see De Grey, Post, Shapin) or by becoming some modality of cyborg (Tipler, Greenfield, Kaku, Moravic, Kurzweil).

Alternatively, some claim that there is a perspective for immortality for all of us: through rebirth and eternal cycling of our Universe (Gott, Penrose, Steinhart, Vidal). Yet, all of these concepts can be viewed upon as a process of *conservation of information*.

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9. References

- Andrews W, (2010). Tuning on immortality: the debate over telomerase activation, in: Life Extension Magazine, August
- Best B, (2012). Mechanisms of aging: http://www.benbest.com/lifeext/aging.html
- Bishop N A, Lu T, Yankner B A, (2010). Neural mechanisms of ageing and cognitive decline: Nature. 2010 March 25; 464(7288): 529–535. doi: 10.1038/nature08983
- Bokkon I, Mallick B N, Tuszinsky J A (2013). Near death experience: a multidisciplinary hypothesis. Front Hum Neurosc. 7, 533. doi: 10.3389/fnhum.2013.00533
- Bostrom N (2003). Are You Living In a Computer Simulation? Philosophical Quarterly, Vol. 53, No. 211, 243-255.
- Braude S E, (2003). Immortal Remains. The evidence for life after death. Rowman & Littlefield, Boston
- Capra F, (1996). THE WEB OF LIFE. A New Scientific Understanding of Living Systems, Anchor Books, New York
- Carter C, (2012). Science and the Afterlife Experience. Evidence for the Immortality of Consciousness. Inner Traditions, Rochester
- Cave S, (2012). Immortality. The quest to live forever and how it drives civilization. Crown, New York
- Chown M, (2007). The Never Ending Days of Being Dead, Faber & Faber, London
- Clark A (2000). Natural born Cyborg. https://www.google.nl/#q=natural+born+cyborgs
- De Grey, A and Rae, M (2007). Ending Aging: The Rejuvenation Breakthroughs that Could Reverse Human Aging in Our Lifetime. New York, NY: St. Martin's Press, p. 416. ISBN 0-312-36706-6
- De Mul J, (2002). Cyberspace Odyssee, Klement
- Elsaesser V E, (1997). On the other side of Life. Exploring the phenomenon of Near-Death Experience. Perseus Publ. Cambridge, Mass.
- Fontana D, (2005). Is there an Afterlife? A comprehensive overview on the evidence. Books, London
- Forberg J L, (2007). Quantum physics and your immortality. http://homepages.ihug.co.nz/~sai/forbquco.html Free book: http://www.google.nl/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=8&sqi=2&ved=0CGMQFjAH&url=http%3A%2F%2Fhome.mindspring.com%2F~bayflower%2Fsitebuilderconte nt%2Fsitebuilderfiles%2FQuantumConsciousnessFullText.doc&ei=afyUUfixAoKx0QXxgoHABQ&usg=AFQjCNFS5YozxbrecQPS-TDMhlooluZwUw&sig2=_K-psnMFZDGL8jWauJhUPg&bvm=bv.46471029,d.d2k
- Forberg J L, (2006).Quantum Consciousness and your Immortality, Xlibris Corp
- Goldsmith T (2012). On the Programmed/ Non-Programmed Aging Controversy. Biochemistry (Moscow) Phenoptosis 77-7.
- Gott, J R and Li-X (1997) Can the Universe Create Itself? arXiv:astro-ph/9712344v1
- Greene B, (2011). The Hidden Reality. Parallel Universes and the Deep Laws of the Cosmos, Kindle edition
- Greenfield S, (2003). Tomorrow's People. How 21-st century technology is changing the way we think and feel, Penquin, London
- Hameroff S and Chopra D (2013). Can science explain the soul? http://www.beliefnet.com/columnists/intentchopra/2010/08/can-science-explain-the-soul-1.html
- Jablonka E, Lamb M J, (2006). Précis of: Evolution in four Dimensions. Behavioral and Brain Sciences, pp 1 – 26

- Jahn R G and Dunne B J (2007). A modular model of mind/matter manifestations. Explore, 3:311-24, reprinted from J. Scientific. Exploration, 2001
- Jaskelioff, M, Muller, Florian L. et al. (2010). "Telomerase reactivation reverses tissue degeneration in aged telomerase-deficient mice". Nature 469 (7328): 102–6. doi:10.1038/nature09603. PMC 3057569. PMID 21113150.
- Kaku M, (2005). Parallel Worlds. The science of alternative universes and our future in the cosmos, Penguin/Allen Lane
- Kaku M, (2007). Physics of the Impossible. A Scientific Exploration Into the World of Phasers, Force Fields, Teleportation, and Time Travel. Doubleday. ISBN 978-0-385-52069-0
- Kirkwood T, Melov S (2011). On the Programmed/Non-Programmed Nature of Ageing within the Life History. Current Biology 21, R701-7
- Kurzweil R, (2005). The Singularity is Near. When humans transcend biology, Viking
- Kyriazes M, (2013). Extreme Lifespans through Perpetual-equalising Interventions (ELPIs) http://www.elpistheory.info/ and http://www.elpistheory.info/index.htm Summary: http://www.elpistheory.info/page13.htm
- Lanza R L (2012). Does Death Excist? http://www.robertlanza.com/does-death-exist-new-theory-says-no-2/
- Laszlo E, (2006). Science and the Reenchantment of the Cosmos: The Rise of the Integral Vision of Reality, Inner Traditions
- Lipton B H, (2005).The Biology of Belief, Unleashing the Power of Consciousness, Matter and Miracles, Elite books, Santa Rosa
- Liu J, Killilea D W and Ames B N, (2002). Age-associated mitochondrial oxidative decay:Improvement of carnitine acetyltransferase substrate-binding affinity and activity inbrain by feeding old rats acetyl-Lcarnitine and_or R-_-lipoic acid. PNAS, vol. 99, nr 4
- Loyd S (2006). Programming the Universe: A Quantum Computer Scientist Takes On the Cosmos, Knopf Doubleday Publishing Group (Random House).
- Meijer D K F, (2012). The Information Universe. On the missing link in concepts on the architecture of reality. Syntropy Journal 2012, nr 1: pp 1- 64. http://www.sintropia.it/english/2012-eng-1-1.pdf
- Meijer D K F, Korf J (2013) Quantum modeling of the mental state: the concept of a cyclic mental workspace. Syntropy Journal 2013 nr 2: pp1-41: http://www.lifeenergyscience.it/english/2013-eng-1-1.pdf
- Moravic H, (1999). Robot. Mere machine to transcendent mind, (Oxford, London)
- Naylor R M, Baker D J and van Deursen J M, (2011). Senescent cells removal alleviates related pathologies, Clinical pharmacology & Therapeutics, doi:10.1038/clpt.2012.193 See also: Senescent Cells: A Novel Therapeutic Target for Aging and Age-Related Diseases http://mariakonovalenko.wordpress.com/2011/11/04/senescent-cells-removal-alleviates-age-related-pathologies/
- Peake A, (2008). Is there life after death? The extraordinary science of what happens when we die. Arcturus Publ., London
- Penrose R (2010). Cycles of Time. An Extraordinary New View of the Universe. London: Bodley Head.
- Phipps C (2012). Death, Rebirth and everything in between. A scientific exploration. http://integral-options.blogspot.nl/2009/06/carter-phipps-death-rebirth-and.html
- Pickover C A, (2007). Immortality. A Beginners Guide. Thunder's Mouth Press, New York
- Post S G and Binstock R H, (2004). The Foundation of Youth: Cultural, Scientific and Ethical Perspectives on a Biomedical Goal. Oxford Univ. Press
- Radin DI and Nelson R (2006). Entangled Minds. Extrasensory experiences in the quantum reality. New York: Simon & Schuster.
- Radin D (1997). The Conscious Universe. The Scientific Truth of Psychic Phenomena. New York: HarperEdge.

- Ring K and S Cooper (1997). Near-Death and Out-of-Body Experiences in the Blind: A Study of Apparent Eyeless Vision. J. Near Death Studies, vol. 16, pp 101-147
- Ross, H (1989). Design and the Anthropic Principle. http://www.reasons.org/articles/design-and-the-anthropic-principle
- Shapin S and Martyn C, (2000)."How to live forever: lessons of history", British Medical Journal, BMJ;321;1580-1582
- Steinhardt PJ and Turok N (2007). Endless Universe: Beyond the Big Bang, (Doubleday), London: Weidenfeld & Nicolson.
- Tippler F J (1994). The Physics of Immortality. MacMillan
- Treadwell B V, (2006). A New Lifespan Hypothesis. Juvenon, Cellular health supplement vol.5, pp 1-3
- Utts J (1995). AN ASSESSMENT OF THE EVIDENCE FOR PSYCHIC FUNCTIONING http://www.ics.uci.edu/~jutts/air.pdf
- Van Bergen C, (2002). Verlangen naar Onsterfelijkheid (in Dutch), Damon, Budel, Belgium
- Van Lommel P, (2007). Consciousness Beyond Life: The Science of the Near-Death Experience, HarperCollins. ISBN 978-0061777264.
- Van Lommel P, van Wees R, Meyers V, Elfferich I. (2001) "Near-Death Experience in Survivors of Cardiac Arrest: A prospective Study in the Netherlands", The Lancet, 358(9298):2039–45, doi:10.1016/S0140-6736(01)07100-8.
- Venselaar M (2011). The near death decoded in five phases theory. http://www.nderf.org/NDERF/Books/maureen_v_research.htm
- Vidal C, (2012).THE BEGINNING AND THE END. Meaning of Life in a Cosmological Perspective. Chapter 10.4: Voyage to five immortalities http://arxiv.org/ftp/arxiv/papers/1301/1301.1648.pdf
- Vijg J and Campisi J, (2008). Puzzles, promises and a cure for ageing. Nature. August 28; 454(7208): 1065–1071. doi: 10.1038/nature07216
- Weiner J, (2010). Long for this World. The Strange Science of Immortality, Ecco, New York
- West M D, (2013). How engineerd stem cells may enable youthful immortality. http://www.lef.org/magazine/mag2013/feb2013_otc_02.htm
- Wolf F A, (1999). THE QUANTUM PHYSICAL COMMUNICATION BETWEEN THE SELF AND THE SOUL Noetic Journal Volume 2, No. 2
- Wolf F A, (1996). The Spiritual Universe. How Quantum Physics proves the Existence of the Soul Simon and Schuster, New York
- Wolf FA (2008). Is the Mind of God Found in Quantum Field Theory? http://www.fredalanwolf.com/myarticles/Quantum%20Field%20Theory.pdf

Websites/Articles on Life extension and Immortality (general):

- Ageing: Wikipedia: http://en.wikipedia.org/wiki/Ageing
- Anti-Ageing medicine: http://en.wikipedia.org/wiki/American_Academy_of_Anti-Aging_Medicine
- Ben Best, 2012. Life Extension Writings: http://benbest.com/lifeext/lifeext.html
- Biological Immortality: Wikipedia: http://en.wikipedia.org/wiki/Biological_immortality
- Cryonics: Wikipedia: http://en.wikipedia.org/wiki/Cryonics
- Engineered negligible senescence: Wikipedia: http://en.wikipedia.org/wiki/Negligible_senescence
- Epic of Gilgamesh: Wikipedia: http://en.wikipedia.org/wiki/Epic_of_Gilgamesh
- Ian Stevenson: http://en.wikipedia.org/wiki/Ian_Stevenson
- Immortality: Wikipedia: http://en.wikipedia.org/wiki/Immortality
- Information Universe. http://www.sintropia.it/english/2012-eng-1-1.pdf

- Life extension: Wikipedia: http://en.wikipedia.org/wiki/Life_extension
- List of long living organisms: Wikipedia: http://en.wikipedia.org/wiki/List_of_long-living_organisms
- Maximum lifespan: Wikipedia: http://en.wikipedia.org/wiki/Maximum_life_span
- Rejuvenation: Wikipedia: http://en.wikipedia.org/wiki/Rejuvenation_(aging)
- Reincarnation: http://en.wikipedia.org/wiki/Ian_Stevenson
- Second Life: Wikipedia: http://en.wikipedia.org/wiki/Second_Life
- Strategies for Engineered negligible senescence: Wikipedia https://en.wikipedia.org/wiki/Strategies_for_Engineered_Negligible_Senescence
- Teillard de Jardin: http://en.wikipedia.org/wiki/Pierre_Teilhard_de_Chardin
- Telomerase: Wikipedia: http://en.wikipedia.org/wiki/Telomerase
- Telomere: Wikipedia: http://en.wikipedia.org/wiki/Telomere

Magazines/Institutes

- Life extension magazine: http://www.lef.org/magazine/index.htm
- Fight aging: http://www.fightaging.org/articles/
- Programmed aging: http://www.programmed-aging.org/
- Immortality institute: http://www.longecity.org/
- Mehthuselah Foundation: http://www.methuselahfoundation.org/
- American Academy of Anti- Aging Medicines: http://www.a4m.com/
- Sens research foundation: http://www.sens.org/research