Chapter 1

Anti-Aging Medicine: Present and Future Developments

Ronald Klatz, M.D., D.O.

President, American Academy of Anti-Aging Medicine (A4M; www.worldhealth.net)

ABSTRACT

For the last 14 years, I have been talking about the future of healthcare, and the next generation of healthcare. Well not any more. We have state of the art healthcare right here and now. And this is not something that is just for far-forward pioneers. This is for practicing clinicians who want to be at the top of their field. We have now reached the cusp of immortality. We are on a cusp of technology, which will take us to life spans of 100 years of age and beyond. And perhaps very far beyond, because old age simply is not what it used to be. This paper will consider these technologies and future technologies.

INTRODUCTION

For the last 14 years, I have been talking about the future of healthcare, and the next generation of healthcare. Well not any more. We have state of the art healthcare right here and now. And this is not something that is just for far-forward pioneers. This is for practicing clinicians who want to be at the top of their field.

The aim of this paper is to provide the reader with a short overview of stem cells and regenerative medicine. We have now reached the cusp of immortality. What I mean by "immortality" is "practical immortality." I am not suggesting that we are on a cusp of living forever and ever and ever. What I am suggesting is that we are on a cusp of technology, which will take us to life spans of 100 years of age and beyond. And perhaps very far beyond, because old age simply is not what it used to be.

Norman Vaughan who was born in 1905 was part of the Byrd expedition to Antarctica. They actually named a peak in Antarctica after Mr. Vaughan and on his 100th birthday in 2005, he climbed that peak in Antarctica. Not bad for a 100-year-old. Sydney Platt, born in 1905, I think might be even more significant. At age 100, he is taking college level courses in computer science. Hulda Crooks born in 1896 at an age 91 successfully climbed Mount Fuji in Japan. And Mushiro Neurom, born in 1932 at age 70 is the oldest person to climb Mount Everest.

Now these are amazing physiological feats and things that are not associated with 70-year-olds, 90-year-olds, and 100-year-old. But the reality is that it is possible and these people are showing us the way to a new definition of aging. A definition that I think we can truly call the *new aging* or *anti-aging medicine.*

THE HISTORY OF THE MODERN ANTI-AGING MEDICAL MOVEMENT

In 1981, Dr. Robert Goldman, co-founder and Chairman of the American Academy of Anti-Aging Medicine (A4M) and I became involved in anti-aging medicine. We started doing research together and we gravitated towards the direction of elite sports performance research. This created the foundations of the National Academy of Sports Medicine, which created the specialty of personal sports trainers in sports medicine. And this evolution from elite sports medicine became the concept for the American Academy of Anti-Aging Medicine – the A4M.

In 1990, the *New England Journal of Medicine* published Dr Daniel Rudman's seminal paper on the use of human growth hormone, in which he stated that human growth hormone therapy could induce changes of 10 to 20 years in physiologic parameters of aging. Rudman's paper really was a breakthrough paper, and it further substantiated the establishment of the American Academy of Anti-Aging Medicine in 1993.

In 1996 the Food and Drug Administration (FDA) approved human growth hormone for use in adults, specifically for the treatment of somatomedin deficiency syndrome. In other words, the FDA did not approve growth hormone for aging, but they instead approved its use for deficiency of human growth hormone, which is a universal event in all people over the age of 60.

This led the A4M to establish the American Board of Anti-Aging Medicine (ABAAM). There are now over 1,000 physicians who are involved with the Board. It is truly an international board of physicians who serve as the vanguard of the new specialty of anti-aging medicine.

In 1999, the A4M created the American Board of Anti-Aging Health Professionals (ABAAHP) to support licensed, degreed health professionals seeking Board recognition in the anti-aging medical specialty.

As of 2006, the A4M membership is composed of 16,500 physicians, health practitioners, scientists, and researchers from 85 nations worldwide.

PRACTICAL IMMORTALITY

If we are talking about practical immortality life spans in excess of 100 years of age, then what will we die off? Heart disease, cancer, diabetes, infectious disease, and AIDS, are certainly horrible scourges right now. If you take a sampling of the medical pundits that are out there from publications such as *Time*, *Popular Science, Scientific American,* and *Nature* magazine, the best estimates of these people, if you average them out, is that we will eliminate most of these major causes of disease sometime before the year 2020. And so that is why I submit that by the year 2029, we are going to be able to deploy major breakthroughs with regard to extension of the healthy human lifespan.

Stem Cell Therapeutics for Anti-Aging

We are seeing amazing breakthroughs and amazing technology that is in the pipeline right now in human research. We are seeing technologies that can potentially cure a whole range of diseases and repair damage caused by heart attack or trauma. Once such example is the Edmonton Protocol, where diabetics are given pancreatic cell transplants. The Edmonton Protocol has reversed diabetes for hundreds of people to date.

Advancements in stem cell technology continue steadily. One article published in the *Lancet* concerned a Japanese woman almost cured of diabetes via transplant of insulin-producing cells from her mother in the form of stem cells. In *Nature Medicine*, a research team reported on a follow-up study of eight Alzheimer's patients who received genetically modified stem cells. The stem cells were found to boost nerve growth factor within the brain, and results showed that six of eight of the subjects responded very favorably with cognitive tests and memory tests. One patient died shortly after the end of the study, and on autopsy they found that in the area in the brain where the stem cells had been injected, local tissue regeneration was occurring.

Stem cells seem to find their way specifically to the target organ. And they seem to have a beneficial effect in either rescuing cells that are in the resting stage or in helping to regenerate new cells all together. I think it is interesting to note that human growth hormone has that same effect in boosting nerve growth factor, which is an important cytokine in the modulation and the remodeling of brain tissue and the plasticity of the brain tissue. And perhaps, that is why human growth hormone therapy has been reported to be beneficial in some cases of Alzheimer's disease.

Researchers from University College London in the UK have reported in clinical trials that cosmetic applications of fibroblast injections can be very effective – to the point that the researchers can grow a patient's own facelift. These fibroblasts are now being injected directly into wrinkles, to re-grow the subcutaneous tissue and to fill out wrinkles. It is also believed that these fibroblast stem cells may make it possible to help regenerate lost hair as well by stimulating hair follicle re-growth.

In published reports in the *Lancet,* researchers from the University of Hanover, in Germany, reported that stem cell transplants into the myocardium improved heart attack damage. Meanwhile, results of a study published in *Cell Transplantation* revealed that stem cells obtained from human umbilical cord blood reduced heart attack damage in rats. This, of course, suggests that umbilical cord blood stem cells could be used to repair heart attack damage in humans. The versatility of stem cells does not, it appears, stop at treating damage caused by heart attack. It has been reported that stem cells may be able to repopulate regions of the brain damaged by ischemic injury, and therefore stem cells may be of great benefit to stoke victims. It has also been reported that stem cell transplants have led to as much as a 7% increase in the ejection fraction of heart attack patients. In Germany, researchers are commonly and routinely injecting stem cell into coronary artery bypass grafts, with great success. Stem cell injections have also been shown to improve cardiac function.

In the future, stem cells may be able to treat people with kidney failure. Researchers at Washington School of Medicine reported that they were able to grow human kidneys in rats by using human stem cells. Now, admittedly the kidneys that these researchers grew were tiny, but these kidneys were grown in as little as 7 to 8 days. Now, this is not clinically significant for people right now, but perhaps the same technology can be applied for use in pigs or in cows, where it would be possible to grow adult-sized human kidneys. Such a breakthrough would obviate the need for kidney transplant or kidney donors.

Researchers at Hadassah University in Israel have reported that patients with Parkinson's disease showed significant improvements after receiving stem cell treatment. Study results showed that shuffling, gait and involuntary movements were markedly diminished after human stem cell injection.

There is tremendous potential for stem cells in these applications, and there are clinical trials that are ongoing right now in neurodegenerative diseases such as Lou Gehrig's disease, Parkinson's disease, muscular dystrophy, Guillain-Barre syndrome, spinal cord injury, ocular degeneration, blood dyscrasias, blood cancers, and viral conditions. Stem cells are also showing promise in clinical research in regenerating the immune system itself and in regenerating immunity that is lost in youth.

There appears to be a broad and vast application potential for stem cell therapeutics. The application of stem cells across the board is turning out to be almost without limit. We now know that these therapeutic applications do not require use of embryonic stem cells. Research has shown that we can get the same results from stem cells taken from the placenta, from stem cells derived from fat, and from stem cells derived from other tissues within the body. Therefore, there is absolutely no need to use embryonic stem cells for all the research that is necessary.

Perhaps the most startling reports on stem cells come from the Hospital Moniz in Lisbon, Portugal in February where 41 paralyzed patients have had stem cells obtained directly from their own nasal cavities injected into the site of injury. The researchers were able to reverse paralysis in four of the 41 (10%) participants. Almost all of the people reported improvements in regard to their sensation and other aspects of their paralysis, but four of them can now walk.

Stem cells can also been used to create a human embryo. On May 20th 2005 the *Journal of Reproductive and Biomedicine* reported that human stem cells were used to clone the UK's first human embryo at Newcastle University in the UK. Therefore, the first human clone in the UK was created in 2005, however I believe that the Koreans have to be given credit for cloning the first-ever human embryo.

Future Technologies

Ian Pearson is Britain's leading futurologist. He believes that the next phase of progress is "Ambient Intelligence," where things like video tattoos impregnated in the skin will monitor health. According to Pearson, developments in semi-conductor chips and sensors will make this possible by 2013. Pearson believes that the next age will be one of "Simplicity", and that this will occur around 2013 to 2015. This technology will be self-directing and will actually fix things (including problems within the human body) without being asked to. Therefore, it looks like we are going to have very smart computers and very smart chips very shortly. Pearson is also predicting the third age of "Virtual Worlds" will arrive around 2020. The is the era where people will actually be able to spend significant amounts of time in a virtual environment. Pearson is predicting that by 2050 we should be able to download our consciousness, our memories, our thoughts, our feelings, and our experiences into a computer. And to be able to have a dual consciousness, not just your own existence, but also an exact duplicate of yourself within the machine. And this certainly would be a form of personal immortality, would it not?

Researchers are currently working on the ability to actually weave and print off, on something akin to a desktop inkjet printer, biological cells that are grown on a 3D-matrix and that will approximate the function of the human organs. So, there are already researchers in laboratories who are looking to essentially print out an organ and grow it up in the petri dish or in a culture medium. And this new technology of bio-regeneration or regenerative medicine is moving along very rapidly with new developments routinely reported in the scientific literature.

CONCLUDING REMARKS

Technological knowledge has exceeded Moore's Law projections. Since 1965 computers have doubled in processing power every 12 to 24 months, and have dropped in cost every 18 months or so. Right now that explosion in computer processing power is going off the charts to well surpass Moore's Law projections. With DNA computing, quantum computing, protein computing, and nanotechnology, the next generations of computers are evolving every eight months or less. We are also seeing that same accelerating growth occur in biomedical technology every 3 1/2 years. This means that the knowledge we had in the year 2000 about how and why we age, doubled by the year 2003, by the year 2013 our knowledge base will be16-times greater than it was in the year 2000, by 2016 it will be 32-times greater, and by 2020, we are going to know 64-times more about how and why we age than we did in the year 2000. And with all this knowledge it is very likely that we will see enough major breakthroughs to push average life expectancy beyond 100 years of age.

Members of the A4M are the leaders and gatekeepers of the anti-aging medical movement, paving new ground in the application of the new clinical medical specialty of anti-aging medicine around the world. You are to be commended on your foresight and vision in embracing this innovative medical paradigm.

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ABOUT THE AUTHOR

Ronald Klatz, M.D., D.O., is a long-time scientific pioneer and innovator. Dr. Klatz originated the term "anti-aging" and is regarded as the movement's first physician and chief champion. Dr. Klatz serves as President of the American Academy of Anti-Aging Medicine (A4M; www.worldhealth.net), the world's largest and fastest growing new clinical medical society dedicated to the advancement of technology to detect, prevent, and treat aging related disease and to promote research into methods to retard and optimize the human aging process. Dr. Klatz is a best-selling author of 32 books with over 2 million copies in print and a world recognized innovator of new medical treatments, technologies, and therapeutics focused on forestalling the diseases of aging.