Smart Life Forum

SmartLifeForum.org Presents

Aubrey de Grey, Ph.D.

on

Human Regenerative Engineering

Thurs, May 21, 2009, 7 PM
LOCATION: Cubberley Community Center – Room H1
4000 Middlefield Rd
Palo Alto, CA

FUTURE SPEAKERS

June 18, Len Saputo, MD
July 16, James Wilson, ND
Aug 20, F. Shallenberger, MD
October 15, Gary Taubes

Short Presentation: Steve Wm Fowkes will speak on "How to Deal with Short-Term Memory Problems." Steve will be emphasizing the role of methods and attitudes in dealing with these problems. If you missed his Alzheimers and Dementia talk in January, or if you need reinforcement, come to this one
FMBR: Leonard Orr, founder of rebirthing breathwork, will speak on spiritual purification.

Meet Aubrey de Grey, Ph.D.

Dr. Aubrey de Grey is a biomedical gerontologist based in Cambridge, UK, and is the cofounder and Chief Scientific Officer of the SENS Foundation, a medical charity dedicated to the development, promotion, and widespread accessibility of a new class of regenerative medicine solutions to the disabilities and diseases of aging: the SENS ("**S**trategies for **E**ngineered **N**egligible **S**enescence") platform of biotechnologies to remove, repair, replace, or render harmless the cellular and molecular damage of aging, so as to restore tissue structure and function and return the biologically aged body to youthful vigor and health. He is Editor-in-Chief of the peer-reviewed scientific journal Rejuvenation Research, which ranks amongst the highest impact-factor (IF) journals in biogerontology and is the sole such publication devoted specifically to research advancing biomedical intervention in biological aging. He is also the author of 47 articles in peer-reviewed journals, excluding his lead editorials in Rejuvenation Research itself. In 2007, Dr. de Grey (with research assistant Michael Rae) put the core ideas and science behind this platform into Ending Aging, an accessible layperson's guidebook to SENS.

The SENS Foundation is the natural vehicle for this work, having outgrown its previous place as a branch of the Methuselah Foundation, the 501(c) (3) non-profit charity dedicated to combating the aging process that Dr. de Grey cofounded and from which he recently moved on as Chair and Chief Science Officer. The Methuselah Foundation now stands on its own, spurring progress toward medical therapies for aging through scientific prizes such as the Methuselah Mouse Prize (Mprize) for the extension of lifespan in the laboratory mouse, while the SENS Foundation is focused on the direct pursuit of critical-path scientific research to accelerate progress toward the mature SENS panel of rejuvenating biotechnologies.

This key science is now carried out in labs spread out across the globe, both internally through the nascent Institute for Biomedical Gerontology (IBG) in Tempe, Arizona, and externally through funding of academic researchers with expertise in the relevant disciplines – from the bypassing of mitochondrial mutations at the Fondation Voir et Entendre in Paris, to the abrogation of cancer cell proliferation at the University of Ulm in Germany, to challenging the role of epimutations in the cell nucleus of the aging brain at the Albert Einstein College of Medicine in New York.

In addition to his scientific work, Dr. de Grey is a tireless public educator, presenting the science of SENS in forums as diverse as scientific conferences; high-level lecture symposia such as TED, PopTech, and IdeaCity; policy think-tanks such as Demos and Oxford's Future of Humanity Institute; and centers for public engagement with science such as the Darwin Centre. His

pursuit of the biomedical cure for aging has been featured in media outlets including 60 Minutes, the New York Times, the BBC, Fortune Magazine, the Washington Post, Popular Science, MIT's Technology Review, The Colbert Report, New York Public Radio's Leonard Lopate Show, Wired Magazine, and New Scientist, and was the subject of feature documentaries for the UK's Channel Four and an episode of France 2's Envoyé Spécial.

Dr. de Grey earned his BA in Computer Science in 1985 from the University of Cambridge, from which in 2000 he was also awarded a Ph.D. in biology for the work published in *The Mitochondrial Free Radical Theory of Aging* – a root-and-branch refinement of previous thinking on the subject that resolved paradoxes in the data and has been widely influential.

Main Presentation---- Human Regeneration

Every man desires to live long; but no man would be old
–Jonathan Swift

Our lives are a paradox. To live long is a universal human desire, but the longer we are alive, the more our lives are taken from us. Each passing year enriches our lives with accumulating experience, intellectual and emotional growth, and life wisdom. Yet each of those years brings with it a toll, etched into the bodies and brains that are the biological basis of that life: a progressively-accumulating burden of cellular and molecular damage that gradually, inexorably strips that life from us. This process of decay of the structured order that was built into our tissues in our youth is the core of biological aging.

Life is not a thing, but a process: a dynamic, self-correcting, interlocking web of carefully-orchestrated biochemical reactions that allow the body to continue to function in the face of an ever-changing environment. The biochemistry of life is based on harnessing and directing the power of wildly-reactive chemical molecules, and the sum of these guided processes is metabolism. But such reactions can only be optimized so far: just as the burning of fuels produces noxious wastes, even in the most efficient of furnaces, so it is inevitable that a small percentage of those reactions run imperfectly or run foul, generating toxic byproducts that damage the structures of our cells and essential biomolecules, hampering their ability to carry out their life-giving functions.

To ensure our survival, evolution has equipped us with a variety of maintenance and repair systems to shield us from these toxic byproducts, keep essential structures from being lost, and preventing the spinning of such reactions off into out-of-control chain reactions. But building increasingly-robust maintenance systems requires the body to make increasingly-expensive investments of limited biological resources into them – investments that must be balanced against their availability for equally-critical evolutionary priorities: bodies that are swift of foot, sharp of claw, cunning of mind, and prolific in the riotous competition that imposes the pressure of natural selection.

So our inbuilt defenses against aging damage are not designed to be perfect, but good enough: the best tradeoff between short-term and long-term functions. A small percentage of the total biochemical onslaught inflicts harm to essential biological structures in our tissues that goes unrepaired.

The accumulation of this damage in our bodies over time is the physical basis of biological aging. And as our tissues become increasingly riddled with defective and dysfunctional components, their ability to support youthful health, function, and vigor is progressively impaired, leading to a self-reinforcing process of degeneration of the body. Subtle at first, these deficits begin to appear in increasingly-undeniable form over time: the body becomes more brittle, challenges are not met, frailty progresses, and we slowly slide into age-related disease, disability, dependence, dementia, and ultimately, death.

From Diagnosis to Cure
The last century and a half of scientific investigation has not only revealed this broad picture of the process of biological aging, but has identified its actual molecular substrates: not only why we age, but the details of how. Seven broad classes of aging damage have been identified in the body that contribute to its age-related decay, ranging from the accumulation of mutations in the specialized DNA of cellular "power plants," to the molecular cross-linking of long-lived structural proteins, to the loss of cells intended to last a lifetime, to the accumulation of other cells that are defective and dysfunctional. In fact, all of these lesions were identified in aging tissues by the mid-1980s, and despite years of increasingly-intense research into the biology of aging, bringing increasingly-sophisticated tools and probes to bear on the question, no major new forms of aging damage have been identified. This strongly suggests that we have now cataloged all of the key molecular contributors to biological aging and decay over the course of our lifetime. The question is: ***what can be done about it?***

Intuitive, Appealing … and Wrong
As aging researchers began to understand the metabolic

basis of biological aging, their first thoughts about how to treat it were modeled on the medical treatment of other diseases: either prevent it from happening, or patch it up when it breaks down. In the first approach, gerontologists propose to tease apart the metabolic pathways whose reactive byproducts cause aging damage to our bodies. Once fully understood, gerontologists propose to use drugs and other manipulations to fine-tune such metabolic processes to make them produce less of their damaging products, so that less damage accumulates over time – a strategy similar to our use of statin drugs to turn down production of LDL ("bad") cholesterol to prevent heart disease.

The other approach is that of contemporary geriatric medicine: starting from the reality of the need for specialized care for a body that has been ravaged by the damage of aging, this is an entire discipline of medicine devoted the specific medical challenge of keeping a frail body alive in the face of progressively-declining biological robustness, and ultimately, to ensuring patient and family alike that death will be as painless and dignified as possible.

But precisely because metabolism is the finely-regulated web of biochemical processes that support our very lives, it cannot be manipulated with impunity or in ignorance. Perturbing the body's normal metabolic regulation puts one at risk of unanticipated consequences: our bodies are designed to operate as finely-balanced homeostatic systems, and interfering with the basic pathways underlying our normal functionality inevitably causes undesired side-effects. And despite their medical expertise, tireless efforts, and sincere compassion, the well-intentioned efforts of geriatricians are in the end a confession of futility: an extended program of palliative medicine.

The Breakthrough Alternative

Dr. de Grey has pioneered a new "engineering" approach to the biomedical cure of biological aging, severing the Gordian knot that unites the conventional gerontologist's focus (on the metabolic processes that cause aging damage) with the geriatrician's efforts (to sustain life and dignity in the face of the age-related pathology that flows out of that same damage.) The new "engineering" approach is based on attacking the damage of aging itself.

The key insight, realized by Dr. de Grey in 2000, is that by repairing, removing, replacing, or rendering harmless the molecular and cellular lesions of aging, we could restore the structural integrity of our tissues to that which we enjoy in youth. Metabolism would be allowed to carry on as it has always done, including the laying down of aging damage – just so long as we periodically removed that damage, keeping it down to levels compatible with youthful function. After all, even the muscles of twenty-year-old Olympians produce and harbor some aging damage – just at such low levels that it does not meaningfully hold them back from the winners' platform.

Where the damage-mitigation approach of the "gerontologist" could only slow a rising tide of aging damage, the repair strategy would allow us to drain the stagnant pool. With each new plank added to the platform – with each new refinement – our bodies would draw ever nearer to the underlying order of youth. And from such repaired youthful structure can only flow renewed youthful function.

With that insight in hand, Dr. de Grey reached out to colleagues in all the relevant fields of biomedicine – telomere biologists, tissue engineers, mitochondriologists, medicinal chemists, specialists in cellular garbage disposal, immunologists – to identify a panel of biotechnologies that either exist today in prototypical form, or are clearly foreseeable from existing developments, that could accomplish this radical goal from the bottom up: to engineer an end to aging, restoring aging bodies to the health and vigor of youth – not just in appearance, but down to the granular level of the molecular structures of every cell and every tissue, leading to a future of indefinite youth and health.

Human Regenerative Engineering

In his presentation, Dr. de Grey will outline the project at hand: the damage of aging; the biotechnologies required to repair it; and the work of the SENS Foundation to open up the bottlenecks in the pipeline leading toward a comprehensive panel of such rejuvenating biotechnologies.

Further Reading

Accepted manuscripts of nearly all of Dr. de Grey's scientific publications are available online at the SENS Foundation Website:
http://sens.org/index.php?pagename=mj_sens_scientific

An accessible introduction

de Grey ADNJ, Rae MJ. *Ending Aging: The Rejuvenation Breakthroughs That Could Reverse Human Aging in Our Lifetime*. New York, NY: St. Martin's Press, 2007. ISBN 0-312-36707-4

Overviews of SENS

de Grey ADNJ, Ames BN, Andersen JK, Bartke A, Campisi J, Heward CB, McCarter RJM, Stock G. *Time to talk SENS: critiquing the immutability of human aging.*

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