GLOBAL FUTURE 2045
INTERNATIONAL CONGRESS

2013
NEW YORK

15/16 JUNE 2013 **NEW YORK**
LINCOLN CENTER

GF2045

DMITRY ITSKOV

Founder and chair, *2045 Initiative*.
President, *Global Future 2045* congress.

Dmitry Itskov co-founded a successful Internet business in 1999 and then evolved it into a diversified online media company, *New Media Stars*.

In 2005, Dmitry decided to dedicate his time and effort to a major social project, and in parallel, he began developing an interest in life-extension technologies.

In 2009, he started meeting with scientists and spiritual leaders and formed the idea of founding a public science project devoted to furthering human evolution – a social movement and online social network – focused on popularizing the idea and accelerating the realization of cybernetic immortality.

In 2011, he launched the non-profit organization *Russia 2045* and then expanded the organization to the international *2045 Initiative* and organized the first international *Global Future 2045 congress*, held in February of 2012 in Moscow. Aiming to identify global threats and opportunities related to the development of new technologies, the *GF2045* congress developed recommendations for realizing an optimal future with the Avatar science project as a key element.

To fully focus on realizing *2045 Initiative* projects, he stepped down from his CEO position with *New Media Stars* in the spring of 2012.

Dmitry received a degree in Corporate Management from the *Plekhanov University of Economics* in 2002.

ON THE PATH TO A NEW EVOLUTIONARY STRATEGY

Dear Friends and Colleagues,

Welcome to the Second International *Global Future 2045* Congress, which we hold under the motto "Towards a New Strategy for Human Evolution."

During the next two days, we will devote particular attention to enabling the fullest possible dialogue between scientists, prominent figures from society and industry and representatives of the world's major spiritual traditions in order to explore the prospects of android robotics; brain-computer interfaces; cognitive neuroprostheses; engineering of the human brain; human consciousness and more. The congress will discuss key topics such as the transformation of humanity; intelligent evolution; the emergence of an immortal meta-intelligence at the planetary scale; and much more.

In fact, the scientific and social technologies that will be discussed can form the basis for the next, and the first, self-directed evolutionary step of mankind. Will this next evolutionary step create new problems for humanity? Probably, but if we do not take it, will we be able to overcome today's existing crises?

I am certain that if we want to continue to develop and change civilization for the better, we should resolve this evolutionary dilemma and create a new evolutionary strategy taking us to a society based on the five principles of high spirituality, high culture, high ethics, high science and high technology.

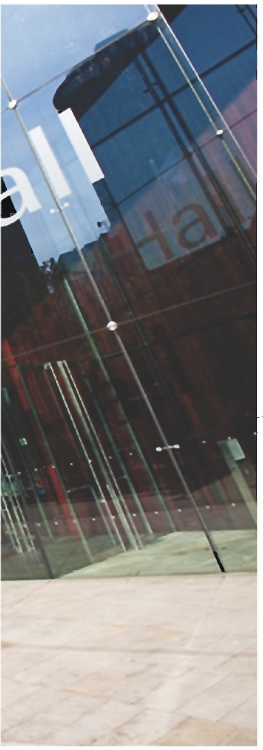
Guided by scientific expertise, we need to ensure that the objectives and deadlines of the scientific projects of this new strategy are realistic. Via the media and in public forums, we must make the compelling case for the necessity and benefits of future societal transformations and gain public support. We must lay the foundation for the openness and accessibility of future technologies, and make the idea of further self-directed evolution part of the new culture of society.

I believe that the new evolutionary strategy should be considered at the level of large public and transnational organizations and government leaders.

The *Global Future 2045* congress is dedicated to these issues... and more.

Welcome!


Alice Tully
Lincoln Center

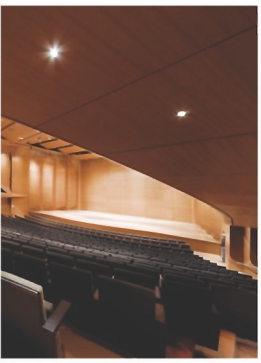


GLOBAL FUTURE 2045

Welcome to the Second International *Global Future 2045* Congress, taking place this weekend, June 15-16, 2013 at Alice Tully Hall, Lincoln Center, New York. During the next two days, we will discuss a new evolutionary strategy for humanity aimed at overcoming the major civilization challenges of the 21st century and beyond. The strategy is based on several evolutions: spiritual, scientific and technological. We believe that this is the only way to overcome existing crises.

The Avatar Project
During the congress, a vision will be presented for the spiritual transformation of humanity and new technologies will be demonstrated which are likely to form the basis of the coming sci-tech revolution. The congress will also showcase our Avatar science mega-project, aimed at accelerating the creation of technologies that will enable a gradual transition from our biological bodies to an increasingly advanced artificial carrier of the human self.

The First Congress
The first *Global Future 2045* congress took place in Moscow in February of 2012. Its main goal was a discussion of global threats and opportunities arising from the development of new technologies and the formulation of recommendations for the realization of an optimal scenario with regard to the expected usage of these technologies. In the world of international science, this was the first time at this level, and in this form, that not only the key directions of innovations in the coming decades were examined, but also the ethical and philosophical implications. More than 1,500 participants and 50 speakers from around the world began the dialogue that we continue today.



THE 2045 INITIATIVE

Founded by Russian entrepreneur Dmitry Itskov in February 2011 with the participation of leading Russian specialists in the field of neural interfaces, robotics, artificial organs and systems.

The main goals of the *2045 Initiative* are the creation and realization of a new strategy for the development of humanity which meets global civilization challenges; the creation of optimal conditions promoting the spiritual enlightenment of humanity; and the realization of a new futuristic reality based on 5 principles: high spirituality, high culture, high ethics, high science and high technologies.

The main science megaproject of the *2045 Initiative* aims to create technologies enabling the transfer of an individual's personality to a more advanced non-biological carrier, and extending life, including to the point of immortality. We devote particular attention to enabling the fullest possible dialogue between the world's major spiritual traditions, science and society.

A large-scale transformation of humanity, comparable to some of the major spiritual and sci-tech revolutions in history, will require a new strategy. We believe this to be necessary to overcome existing crises, which threaten our planetary habitat and the continued existence of humanity as a species. With the *2045 Initiative*, we hope to realize a new strategy for humanity's development, and in so doing, create a more productive, fulfilling, and satisfying future.

SUPPORT THE 2045 INITIATIVE

Dear Friends and Colleagues,

You have the opportunity to help fund the development of avatar technologies through the *Foundation 2045* organisation, which has applied for 501(c)(3) status. All funds received through the Foundation are used exclusively to finance science & technology work to achieve our goals.

If you would like to finance a specific project of the *2045 Initiative* or commission an individual project to be custom-developed for you, please contact us at info@2045.com, with "Project Financing" in the subject line. We will respond to requests as they come in.

Additional documents and information concerning the financing of individual projects and other Initiative activities will be published on 2045.com.

Sincerely, Maria Volkova,
Executive Director *Foundation 2045*

Checks can be made out to Foundation 2045 and mailed to:
Foundation 2045, Inc.
Attn: Maria Volkova
273 Orchard Street
Elmwood Park,
NJ 07407

Our Bank Information for Donations:
Our Wire Transfer Information:
Wire Routing Transit Number (RTN/ABA) – 121000248
International Wires only – SWIFT BIC – WFBIUS6SBank
Name – Wells Fargo Bank, N.A.
Bank Address – 420 Montgomery, San Francisco, CA 94104
Account Name – Foundation 2045, Inc.
Account Number – 3115250015

FUTURE PROSPECTS OF 2045 INITIATIVE FOR SOCIETY

2015-2020

The emergence and widespread use of affordable android avatars controlled by a brain-computer interface. Coupled with related technologies avatars will give people a number of new features: the ability to work in dangerous environments, perform rescue operations, travel in extreme situations etc. Avatar components will be used in medicine for the rehabilitation of fully or partially disabled patients giving them prosthetic limbs or recover lost senses.

2020-2025

Creation of an autonomous life-support system for the human brain based on a full-body prosthesis (artificial body) which will save people whose bodies are completely worn out or irreversibly damaged. Any patient with an intact brain will be able to return to a fully functioning bodily life. Such technologies will greatly enlarge the possibility of hybrid bio-electronic devices, thus creating a new IT revolution and will make all kinds of hybrids of electronic and biological systems possible.

2030-2035

Creation of a computer model of the brain and an understanding of the basic principles of human consciousness with the subsequent development of means to transfer an individual consciousness onto an artificial carrier. This development will profoundly change the world: it will not only give everyone the possibility of cybernetic immortality but will also create a friendly artificial intelligence, expand human capabilities and provide opportunities for ordinary people to restore or modify their own brain multiple times. The final result at this stage can be a real revolution in the understanding of human nature that will completely change the human and technical prospects for humanity.

2040-2045

This is the time when minds will become substrate-independent and will receive new bodies with capacities far exceeding those of ordinary humans. A new era for humanity will start! Changes will occur in all spheres of human activity – energy generation, transportation, politics, medicine, psychology, the sciences, and so on. Today it is hard to imagine a future when bodies consisting of nanorobots will become affordable and capable of taking any form. It is also hard to imagine body holograms featuring controlled matter. One thing is clear however: humanity, for the first time in its history, will make a fully managed evolutionary transition and will eventually become a new species. Moreover, prere-quisites for a large-scale expansion into outer space will be created as well.

THE PROGRAM OF THE INTERNATIONAL **GLOBAL FUTURE 2045 CONGRESS**

15/16 JUNE 2013 **NEW YORK LINCOLN CENTER**

15 JUNE | Saturday

8.00 – 9.00	**REGISTRATION**
9.00 – 9.15	**Dmitry Itskov** — GF2045: On The Path to A New Evolutionary Strategy
9.15 – 10.15	**Dr. James Martin** — The Transformation of Humankind — Extreme Paradigm Shifts Are Ahead of Us
10.15 – 10.40	**Dr. Akop Nazaretyan** — The Mid-21st Century Puzzle: On the Cosmic Perspective of Mind
10.40 – 10.55	**Dr. David Dubrovsky** — Human Nature, The Anthropological Crises and the Global Future
10.55 – 11.25	**Dr. Peter H. Diamandis** — Intelligent Self-directed Evolution Guides Mankind's Metamorphosis Into An Immortal Planetary Meta-intelligence
11.25 – 11.55	**COFFEE BREAK**
11.55 – 12.25	**Dr. Hiroshi Ishiguro** — The Future Life Supported by Robotic Avatars
12.25 – 13.15	**Roundtable:** Life-extension of the Brain in a Full-body Prosthesis with Biological Blood Substitutes and Brain-Computer Interfaces with Optional Neuroprostheses — **Dr. Alexander Kaplan moderates Dr. Mikhail Lebedev and Dr. Theodore Berger**
13.15 – 13.30	**Nigel Ackland** — Ordinary... Extraordinary — Life With A Bionic Arm
13.30 – 13.55	**Dr. Jose Carmena & Dr. Michel Maharbiz** — Brain Control of Prosthetic Devices: The Road Ahead
13.55 – 15.05	**LUNCH**
15.05 – 15.35	**Dr. David Hanson & Dr. Ben Goertzel** — Anthroids (Humanlike Robots) for Telepresence, Mind Uploading and General Intelligence
15.35 – 16.00	**Dr. Alexander Panov** — The Technological Singularity and the Penrose Theorem on Artificial Intelligence
16.00 – 16.20	**Dr. Marvin Minsky** — Facing the Future
16.20 – 16.50	**Dr. Martine Rothblatt** — The Goal of Biotechnology is the End of Death
16.50 – 17.15	**Dr. Anders Sandberg** — Making Minds Morally: the Research Ethics of Brain Emulation
17.15 – 17.40	**Dr. Natasha Vita-More** — Substrate Autonomous, Networked Avatar Bodies by Design

16 JUNE | Sunday

8.00 – 9.00	**REGISTRATION**
9.00 – 9.55	**Ray Kurzweil** — Immortality By 2045
9.55 – 10.25	**Dr. Theodore Berger** — Engineering Memories: A Cognitive Neural Prosthesis for Restoring and Enhancing Memory Function
10.25 – 10.55	**Dr. Ed Boyden** — Tools for Analyzing and Engineering the Brain
10.55 – 11.25	**Dr. George Church** — Bionanotech for Extending Moore's Law, the BRAIN Project I/O & Human Genome Engineering
11.25 – 11.45	**COFFEE BREAK**
11.45 – 12.25	**Dr. Randal Koene** — Whole Brain Emulation: Reverse Engineering A Mind
12.25 – 12.50	**Dr. Ken Hayworth** — Preserving and Mapping the Brain's Connectome
12.50 – 13.15	**Dr. Witali L. Dunin-Barkowski** — Current state of Russian Project on Brain Reverse-engineering REBRAIN 2045
13.15 – 14.25	**LUNCH**
14.25 – 14.55	**Dr. Stuart Hameroff & Sir Roger Penrose** — How Human Consciousness Could Be Uploaded Via Quantum Teleportation
14.55 – 15.35	**Dr. Amit Goswami** — Consciousness and the Quantum: Science, Psychology and Spirituality
15.35 – 16.20	**Swami Vishnudevananda Giri** — Mankind's Desirable Future According to Vedic culture and Cybernetic Technologies. The Evolution of Consciousness in Vedanta Philosophy
16.20 – 17.40	**Roundtable:** Interfaith Dialogue about Science, Spirituality, Evolution of Humanity and the Avatar Project **— Phakyab Rinpoche, Swami Vishnudevananda Giri , Rabbi Dr. Alan Brill, Mahayogi 'Pilot' Baba, Dr. Robert Thurman, and Archbishop (Ret.) Lazar Puhalo, with the participation of Dmitry Itskov. Moderated by religious anthropologist Dr. William Bushell.**
17.40 – 17.50	**CLOSING WORDS — Dmitry Itskov**

James Martin

THE TRANSFORMATION OF HUMANKIND – EXTREME PARADIGM SHIFTS ARE AHEAD OF US

Visionary futurist tech entrepreneur. Science sponsor: *Oxford University*'s largest benefactor in 900 years.

The 38 institutes of the *Oxford Martin School* form an interdisciplinary research community addressing global challenges and opportunities, from the governance of climate change and the possibilities of quantum physics, to the future of food and the implications of our aging population. His book *The Meaning of the 21st Century* was made into a film narrated by Michael Douglas.

A pioneer in the automation of software development, he ranked 4th in *Computer World's 25th Anniversary Edition's* of most influential people in computer technology.

It is often said that if you are in the middle of a revolution you can't see the overall picture of what is happening. We are now in the middle of the biggest revolution ever. Around 1750 AD, something extraordinary began to happen on Earth – the beginning of a massive transformation of humankind. Since life began, evolution has occurred at a glacial pace, but now explosive change is happening. It is enabled by technology, but many other factors are part of its driving force.

Nature corrects mistakes in brutal ways, and we are making massive mistakes now. However, humanity is the first species in Earth's history that can think about what is going wrong and try to correct it. This is the first time there have been highly intelligent creatures that can study their situation and devise powerful ways to deal with the problems.

Our future could be magnificent, but time is short. In our near future there is a need for extreme paradigm shifts, diverse in nature, and for which we are almost totally unprepared.

Akop Nazaretyan

Big History Forecaster.

Director of the *Eurasian Center for Big History and System Forecasting*. Senior Research Fellow of the *Oriental Institute* of the *Russian Academy of Sciences*. Full Professor at *Moscow State Uni*. Editor of academic journal *'Historical Psychology & Sociology'*.

Author of over 300 scholarly publications, including books: *'Intelligence in the Universe'* (1991); *Civilization Crises within the Context of Big History. Self-Organization, Psychology, and Forecasts* (2004); *'Essays on evolutionary historical psychology'* (2008); *'Evolution of Non-Violence: Studies in Big History, self-organization and historical psychology'* (2010).

THE MID-21ST CENTURY PUZZLE: ON THE COSMIC PERSPECTIVE OF MIND

A series of independent calculations undertaken by various authors show that nature, and then human society, have been developing in accordance with general vectors, and that this development has been successively accelerating for billions of years: the interval between phase transitions in biospheric, pre-social and social evolution has decreasing in a logarithmic fashion. Having extrapolated the hyperbolic curve, the researchers found that the speed of global transformations will reach infinity, and that the interval between the phase transitions will reach zero by the middle of the 21st century.

Does this imply that an unprecedented turning point in the development of humanity, the biosphere and perhaps the cosmos is expected in the observable future? What alternative scenarios are there? Is an irreversible collapse or a crucial change of vectors to be expected? How might the prospects of world civilization depend on our thoughts and activities?

I argue that after having become a planetary factor, intellectual activity is apt to become a factor of cosmological significance. What might become a decisive obstacle to such developments are not the limits of the mind's ability to control mass and energy, but its suicidal inability to cope with its own growing power. The new perspective in worldviews and the meanings of life are discussed, which could promote an effective breakthrough for planetary civilization, and minimize potential menaces to its viability.

David Dubrovsky

Cognition Theorist. Chief scientist since 1988 at the *Cognition Theory Department* of the *Russian Academy of Sciences' Institute of Philosophy*. Co-chairman of the *Russian Academy of Sciences' Scientific Council* for the *Methodology of Artificial Intelligence*. Authored 7 books and 280 articles.

Interests concern consciousness; analysis of the structure of subjective reality; issues of cognition theory and science methodology; issues of the correlation between the conscious and the unconscious; biological and social, philosophical aspects of psycho-regulation, self-awareness, self-improvement, artificial intelligence, and problems of (self-)deception.

HUMAN NATURE, THE ANTHROPOLOGICAL CRISES AND THE GLOBAL FUTURE

The continual escalation in the ecological crisis and other global problems of our civilization are the path to an anthropological catastrophe. In order to avoid this, the consciousness of the mass person must be changed. And this is equivalent to a change in what is called human nature. It is a set of stable qualities of the social individual, which is reproduced in all eras and among all peoples, which shows its biological causality. The main issue is how to change its negative qualities: unbridled consumption, aggression towards fellow human beings, excessively selfish aspirations. I examine the main features of the anthropological crisis, and against this background, issues of transhuman evolution as a process of the transformation of corporality and consciousness, the formation of a human of a new type, which has overcome its biological nature and earthly limitation.

Peter H. Diamandis

Abundance Engineer. Physician, entrepreneur, founder of the *X PRIZE Foundation* – known for its $10 million Ansari private spaceflight *X PRIZE* – which organizes large-scale global competitions solving market failures.

Co-founded *Singularity University*, a *Silicon Valley institution* that studies exponentially growing technologies, their ability to transform industries and solve humanity's grand challenges.

Co-founded *Planetary Resources*, a company designing spacecraft to mine asteroids.

Author of *Abundance*. Diamandis' mission is to open the space frontier for humanity. Personal motto: "The best way to predict the future is to create it yourself."

INTELLIGENT SELF-DIRECTED EVOLUTION GUIDES MANKIND'S METAMORPHOSIS INTO AN IMMORTAL PLANETARY META-INTELLIGENCE

We are extraordinarily fortunate to be alive on this planet during a period of unprecedented, exponentially accelerating, self-directed evolutionary change. We humans have begun to incorporate technology inside ourselves. Humans themselves are becoming an information technology. Over the last decades mankind has suddenly started changing from a loose collection of 7 billion individuals to a new kind of perpetually morphing non-physical social tissue woven from densely interconnected arrays of mobile person-nodes.

In this process we – humanity – are becoming a new organism: a meta-intelligence. As a species, as this new organism, we are becoming conscious on an unprecedented new level, in a new cosmic-scale realm.

As we are going through the metamorphosis process of becoming this new meta-intelligence organism, we are going from evolution by natural selection – Darwinism – to evolution by intelligent direction. We are starting to direct the evolution of our biology and of our minds ourselves. Before long, this will result in our minds becoming independent from their original biological substrate – the biological human brain – the evolution speed of which has become far too slow to keep up with our exponentially increasing pace of innovation and invention. As we begin to liberate our thoughts, our memes, our consciousness from the biological constraints that we presently have, this will allow us to evolve far faster and ever faster.

Beyond the great personal benefit of immortality, the species-level benefits of making our minds and bodies substrate-independent and non-biological include becoming a truly spacefaring species thanks to gaining the ability to travel near the speed of light while also remaining alive for far longer than the currently normal human lifespan. This will free us from the shackles of Earthly gravity and enable us to go explore and populate our solar system, our galaxy, our universe and what may be an infinite number of universes.

Persons are now empowered more than ever before. As an individual I can now already tap into 'global genius' anywhere in the world. This trend is accelerating at an exponential rate and will result in us – jointly and severally – to become quite god-like with 'life-everlasting'. We will no longer have to die a physical death, enabling who we are – our mission, our purpose, our consciousness – to continue for a far longer time.

When we – mankind – will become fully conscious and self-aware as a planetary-scale meta-intelligence ourselves, we will be able to look out into the universe in new ways, with new kinds of 'eyes', and see thousands or millions or billions of similar conscious planet-level entities that have come into being all around us in our galaxy and the myriad galaxies beyond our own.

That all of this is happening during our lifetimes is powerfully extraordinary. That makes it so exciting to be alive right now.

Hiroshi Ishiguro

THE FUTURE LIFE SUPPORTED BY ROBOTIC AVATARS

Genius Android Creator. Director of the *Intelligent Robotics Laboratory*, Osaka. Developed many highly photorealistic, lifelike humanoids and androids, *includingRobovie, Repliee, Geminoid, Telenoid,* and *Elfoid.* Won *Best Humanoid* Award 4 times. *Synectics Survey of Contemporary Genius 2007* selected him among top 100 geniuses alive today.

D. Eng. in *Systems Engineering* from *Osaka University.* Currently leads the *Hiroshi Ishiguro Lab* at the *Advanced Telecommunications Research Institute* researching distributed sensor systems, interactive robotics, android science.

Over 300 papers in major Robotics Research journals and conferences like *IEEE PAMI.*

Robotic avatars or tele-operated robots are already available and working in practical situations, especially in USA. The robot society has started. In our future life we are going to use various tele-operated and autonomous robots. The speaker is taking the leadership for developing tele-operated robots and androids. The tele-opereated android copy of himself is well-known in the world. By means of robots and androids, he has studied the cognitive and social aspects of human-robot interaction. Thus, he has contributed to establishing this research area. In this talk, he will introduce the series of robots and androids developed at the Intelligent Robot Laboratory of the Department of Systems Innovation of Osaka University and at the Hiroshi Ishiguro Laboratory of the Advanced Telecommunications Research Institute International (ATR).

Nigel Ackland

ORDINARY... EXTRAORDINARY. LIFE WITH A BIONIC ARM

Bionic Arm Man.

Former precious metals smelter. Pioneering user of the world's most advanced artificial arm.

Crushed by an industrial blender, Nigel's right forearm was replaced by a *Bebionic* 3 artificial hand.

Having a bionic hand is like being human again. Psychologically I wouldn't be without it. I can hold the phone, shake hands and wash my left hand normally. I'm back to being a two finger typist and can even do hand signals. Not particularly functional, but the psychological benefit is immense! It has a great impact on my life: not only does it look more like a human hand but it also functions more like a human hand.

ROUNDTABLE ON LIFE-EXTENSION OF THE BRAIN IN A FULL-BODY PROSTHESIS WITH BIOLOGICAL BLOOD SUBSTITUTES AND BRAIN-COMPUTER INTERFACES WITH OPTIONAL NEUROPROSTHESES

Dr. Alexander Kaplan moderates Dr. Mikhail Lebedev and Dr. Theodore Berger

The human brain is the last organ in the body to die. This happens because the organs—heart, kidneys, liver etc.—which enable the activity of the living brain malfunction. From this arises a purely medical situation where the life of the brain must be supported without the natural organs which carry out this function. Scientists have not yet determined the possible life expectancy of the brain under the condition where its biochemistry, nutrition and energy are supported at the optimum level by artificial systems using the latest technologies. However, the science and technology to solve this problem are ready today. Nerve cells have unique features compared with all the other cells of the human body: 10 times more genes are activated in them; they do not accumulate copying mistakes when multiplying; they live by close interaction with each other; and are capable of rearranging intercellular connections when damaged. All of this would allow them to live for a very long time, were it not for malfunctions in the working of other bodily organs.

Modern technologies already make it possible to replace any organ in the human body other than the brain, without adversely affecting its functions, and thus giving the brain itself the possibility of living for a long time. There are no serious fundamental restrictions to stop the nerve cells from existing in an artificial environment, for example for 5 to 10 times longer than they live, on average, in the human body. Modern achievements in neural science show that in terms of longevity, nerve cells can even overcome the species barrier, for example when they are transplanted from the brain of an animal of one species into the brain of an animal of another species which has a longer lifespan. The goal of the Russian project is to extend the lifespan of the brain by many times, and at the same time create highly advanced technologies for supporting the full existence of the brain and of the human personality beyond the lifespan of the biological organs of the human body, by means of a full-body prosthesis.

Key technologies in this project include: improving surgical equipment, creating biological blood substitutes with the necessary hormonal-biochemical and energetic substrate; development of multi-channel brain computer interfaces with two-way information exchange; and development of neural prostheses to repair structures of the brain itself that have malfunctioned.

This project is to be realized in collaboration with several US neuroscience laboratories, which have been highly successful in creating multi-channel systems to interface with the brain, and in the development of neural prostheses.

Alexander Kaplan

Brain-Machine Interface Developer. Psychophysiologist, founder of first Russian BCI laboratory.

A leading expert in Russia and abroad in the area of the development of the brain-computer interface technologies: his first article in this area (published in 2005) was about the possibility of creating interfaces based on the unconscious part of the brain to communicate with the external environment.

Presently works on the project of creation of the manipulators and robotic systems, controlled by EEG in his laboratories of neurocomputer interfaces at *MSU* and cognitive processes and interfaces in the *National Science Center "Kurchatov Institute"*.

Mikhail Lebedev

Neuroengineering Expert. Senior Research Scientist at the *Duke University Center for Neuroengineering* Dr. Mikhail A. Lebedev obtained an M.S. in physics from the *Moscow Institute of Physics and Technology* in 1986 and a Ph.D. in neurobiology from the University of Tennessee, Memphis, in 1995.

He is a Senior Research Scientist at the *Duke University Center for Neuroengineering*, in Durham, NC. He has held research appointments at the *Institute for the Problems of Information Transmission*, Moscow (1986-1991), the *International School for Advanced Studies*, Trieste, Italy (1995-1997), and the *U.S. National Institute of Mental Health* (1997-2002).

His research interests include primate neurophysiology and brain-machine interfaces.

Theodore Berger

Neuroprosthetics Pioneer; Brain prosthesis technology developer at the *USC Center for Neuroengineering*.

First to replace rat brain hippocampus function with a chip. Develops "neuron-silicon interface" tech using multisite electrode arrays and tissue culture methods for implantation of hardware models into the brain to replace dysfunctional nerve tissue. Co-develops implementations of experiments-based models of hippocampal neurons and neural networks and researches biology-based mathematical models of the functional properties of the hippocampus by combining experimental studies of fundamental electrophysiological properties of hippocampal neurons.

Jose Carmena

Neuroprostheticist researching brain-machine interfaces, neural ensemble computation and computational biology.

Professor of *Electrical Engineering and Neuroscience* at *UC Berkeley*. Co-Director of the *Center for Neural Engineering & Prostheses at UC Berkeley and UCSF*.

His neural engineering and systems neuroscience research aims to understand the neural basis of sensorimotor learning & control, so as to build the science and engineering base enabling reliable neuroprostheses for the severely disabled.

M.S. in AI and Ph.D. in robotics from *Uni. of Edinburgh*. Postdoctoral Fellow at the *Dept. of Neurobiology* and *Center for Neuroengineering at Duke Uni.*

BRAIN CONTROL OF PROSTHETIC DEVICES: THE ROAD AHEAD

Significant progress has occurred in the field of Brain-Machine Interfaces (BMI) since the first demonstrations with rodents, monkeys, and humans controlling different prosthetic devices directly by means of neural activity. The goal is to reliably, accurately, and robustly convey enough motor control intent from the central nervous system (CNS) to drive multi-degree-of-freedom (DOF) prosthetic devices by patients with amputated, paralyzed, or otherwise immobilized limbs for long periods of time – decades. To achieve this goal, two main challenges remain: 1) how to make viable neural interfaces lasting a lifetime, and 2) skillful control and dexterity of a multi-DOF prosthetic device comparable to natural movements. The first challenge is to have a neural interface which is viable for a lifetime. In the front end, the physical substrate should be able to withstand a variety of biotic and abiotic effects that presumably lead to performance degradation at the electrode-tissue interface. In the back end, the system should be wireless, require minimum power, and support bidirectional dataflow, i.e., "reading" and "writing" from/to the brain. In this talk we will introduce Neural Dust, a radical technology developed at UC Berkeley that will perform near-simultaneous recording of >10^4 neuronal firing events measured with free floating 'nodes' embedded into the mammalian brain. The second challenge is to achieve a quantum-leap increase in neural controllable degrees of freedom that should allow a patient to effortlessly perform tasks of daily living. This will entail synergizing two different types of adaptation processes: natural (brain plasticity) and artificial (decoder adaptation), as well as providing realistic sensory feedback from the prosthetic device. We will postulate that BMI systems capable of exploiting both neuroplasticity and decoder adaptation will be able to boost learning, generalize well to novel movements and environments, and ultimately achieve a level of control and dexterity comparable to that of natural arm movements.

Michel Maharbiz

An Associate Professor with the *Department of Electrical Engineering and Computer Science* at the *University of California*, Berkeley.

Ph.D. from *Uni. of California* at Berkeley on microbioreactor systems, which led to the foundation of Microreactor Technologies, Inc. which in turn was acquired in 2009 by Pall Corporation. Assistant Professor, 2003 to 2007, at *Uni. of Michigan*, Ann Arbor. Co-founder of *Tweedle Technologies, Cortera Neurotech* vice-president, 2010 to 2011, for product development at *Quswami*, Inc.

Bakar Fellow and recipient of *2009 NSF Career Award* for developing microfabricated interfaces for synthetic biology. His group also developed the world's first remotely radio-controlled cyborg beetles, which was named one of the top ten emerging technologies of 2009 by *MIT's Technology Review* and was in *Time Magazine's* Top 50 Inventions of 2009. Also a *GE Scholar* and an *Intel IMAP Fellow*. Current research interests include building micro/nano interfaces to cells and organisms and exploring bio-derived fabrication methods. Long term goal is to understand developmental mechanisms as a way to engineer and fabricate machines.

David Hanson

ANTHROIDS (HUMANLIKE ROBOTS) FOR TELEPRESENCE, MIND UPLOADING AND GENERAL INTELLIGENCE

Android Tech Innovator & Robotics Researcher-designer.

Via integrated research in cognitive AI, material science, sculpture and animation, expressive robotic faces and walking robot bodies, Hanson strives to bring robots to life, literally. *WIRED* called the resulting walking, animated, conversational robots "genius".

Invented lipid-bilayer nanotech simulating skin and expressive face mechanisms. *Former Disney Imagineer*. Founded Hanson Robotics and *RoboKind* to do character robot research. Released numerous products for research. Ultimately strives to realize '*Genius Machines*' with greater than human intelligence, creativity, wisdom, and compassion.

We believe that highly realistic humanoid robots – 'anthroids' – could greatly benefit humanity: in the short term by enabling an incomparably compelling telepresence experience; and in the medium term by providing an infrastructure for mind uploading and artificial general intelligence.

In this talk, we describe how anthroid telepresence robots could significantly reduce carbon emissions and lost work hours by reducing the need for physical travel, and could open new markets for virtual tourism, remote business activities, and new ways to distribute skilled labor around the world. We describe a practical strategy by which we can converge Cognitive, Neural and Robotics technologies, with the goal of enabling true teleportation experience by means of anthroid robot avatars. We envision the massive deployment of such telepresence avatars, harnessing a hybrid of AI, machine perception, biped robotic bodies, and expressive robot face technologies, combined with telecommunications and mass-manufacturing.

We also explore visionary future possibilities for such robots, including strategies for uploading human minds into such machines, and the prospects for genius-level AI, both of which could use such robot bodies to transform the world in fantastic, radical ways. The availability of high-quality, highly-configurable anthroid robots for R&D could accelerate our progress toward mind uploading and AGI. Compared to other possible paths to these scientific goals, the use of emotionally and socially sophisticated anthroids appears likelier to lead to a Friendly Singularity.

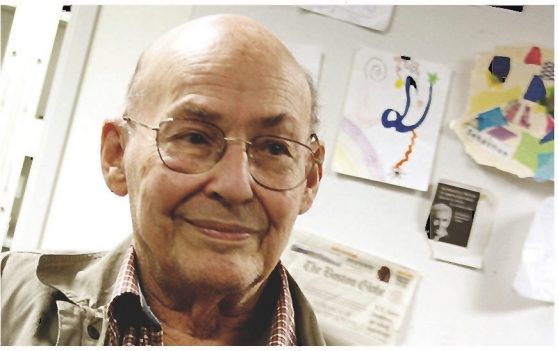
Ben Goertzel

AGI Researcher – Founder, OpenCog Foundation. Chairman, Biomind LLC.

Interests include A.G.I., cognitive science, computational neuroscience, data mining, bioinformatics.

Authored 12 science books, 100+ papers, many journalistic articles, and edited several journal special issues, including the first-ever journal issues on *Mind Uploading*.

Chairman of AI software company *Novamente* and bioinformatics company *Biomind*; Chairman of *A.G.I. Society* and *OpenCog Foundation*; Vice Chairman of *Humanity+*; Advisor to *Singularity University*; Research Professor at *Fujian Key Lab for Brain-Like Intelligent Systems*; General Chair of the *A.G.I. conferences*.



Marvin Minsky

AI Pioneer, Mind Theorist. Widely recognized as a key pioneer of *Artificial Intelligence*. His research led to advances in computer science, physics, psychology, computer graphics, symbolic mathematical computation, knowledge representation, computational semantics, machine perception, symbolic learning and connectionist learning.

Built first *Neural Network Learning Machine* and first *Confocal Scanning Microscope*, enabling unprecedented resolution and image quality. Pioneered robotics and telepresence. Authored *The Society of Mind*, in which 270 interconnected 1-page ideas reflect the structure of the theory itself. Sequel: *The Emotion Machine* (2006).

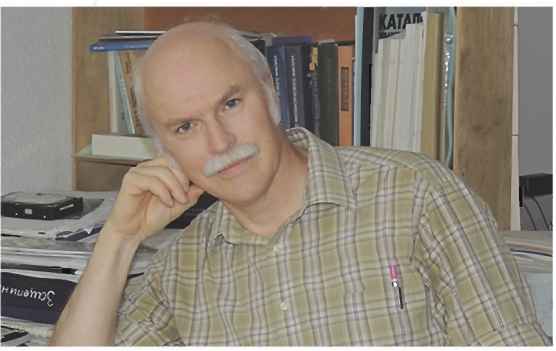
FACING THE FUTURE

As soon as we understand how the human brain works, we should be able to make functional copies of our minds out of other materials. As everything is made of atoms, any machine is made of the same kinds of materials as brains but organized either in very different ways or fundamentally the same ways.

When will these great things happen of people living forever, making people more intelligent and turning ourselves into machines with replaceable parts so that suffering will disappear? As we still do not know exactly how the brain represents knowledge and does reasoning, predictions are very hard. Sooner or later, though, we will do these things. Given that no known laws of physics need to be broken, it is a matter of time.

However, science progress relevant to creating functional copies of minds has been slowing down rapidly in the last few decades. In contrast to the early days of cybernetics, from 1940 to 1980, we are now learning less and less because people are trying to understand the brain itself rather than make good theories of how brains might work. Looking at a brain does not help unless your head is full of powerful ideas about what might be going on there.

On that basis, I doubt that very much of this will happen by 2045, but who knows.



Alexander Panov

Astrophysicist, conceiver of the *Snooks-Panov Curve* which describes the coming technological singularity.

Graduated from *Moscow State University (MGU)* in '82. At *Kurchatov Institute of Atomic Energy* until 2000. Since then Senior Research Fellow at *Physics Department* of *MGU*. Defended his PhD in Physics and Mathematics in 1997.

Panov is the author of over 150 articles in scientific periodicals and one book: *Universal Evolution and Challenges in SETI* (2007). His primary academic interests include astrophysics of cosmic rays, dimensions in Quantum Mechanics, cosmology and gravity, universal evolutionism and problems of macroevolution.

THE TECHNOLOGICAL SINGULARITY AND THE PENROSE THEOREM ON ARTIFICIAL INTELLIGENCE

I present a critique of the technological singularity. The technological singularity is understood to result from the emergence of strong artificial intelligence. The technological singularity concept assumes that strong AI will arise when the computational capacity of personal computing exceeds the capacity of all human brains of mankind. It has been predicted – on the basis of Moore's law – that this event should occur near the year 2045. I propose 4 key critical arguments: 1) The computational capacity of the human brain may be strongly underestimated due to neglect of the inter-neuronal processes; 2) Any computational capacity of computers does not guarantee an understanding of the way to simulate human thinking; 3) The brain's low-level computational processes may have a quantum nature which cannot be compared with or simulated by usual computers; 4) Penrose's theorem forbids the simulation of all human capabilities by any classical computer. I further discuss the meaning and the consequences of Penrose's theorem. I argue that Penrose's conclusion that the operation of the human brain is related to as yet unknown incomputable physics is based on arguments which are too formal. A more physical consideration suggests that regular quantum physics might be sufficient to explain the incomputable activity of the brain, and that therefore quantum computers can, in principle, simulate the human brain completely.

Martine Rothblatt

Visionary IT & Bio-entrepreneur.

American lawyer, author, and life sciences entrepreneur. Founding CEO of *United Therapeutics*, which pioneers 3D bio-printed replacement lungs for transplantation.

Launched 1st nationwide vehicle location system (*Geostar*, 1983), 1st private int'l space communications project (*PanAmSat*, 1984), 1st global satellite radio network (*WorldSpace*, 1990), and 1st non-geostationary satellite-to-car radio broadcasting system (*Sirius*, 1990).

Authored books on satellite communications tech, gender freedom, xenotransplantation. Produced 2009 sci-fi film 2B and R. Kurzweil's 2010 documentary *The Singularity Is Near*.

THE GOAL OF BIOTECHNOLOGY IS THE END OF DEATH

Biotechnology creates some of mankind's most remarkable and much loved products, from treatments to forestall blindness to cures for several cancers. Described broadly biotechnology is the creation of medical tools to enhance life processes. What is rarely even whispered, though, is that the real goal of biotechnology is the end of death. This is taboo because it is politically incorrect at best, and Galilean in its challenge to established theology and moral philosophy. Nevertheless, because biotechnologists undertake to cure diseases, and because death is generally the victory of disease over life, the ultimate goal of biotechnology is in fact the end of at least unwanted, non-violent and non-accidental death.

Biotechnology need not be limited to tissue and cellular focused technologies. The definition of biology is the study of life defined as things that are organized exchangers of matter and energy, and that react to stimuli, reproduce, develop and adapt. However, software code such as the **Avatar Project** of the *2045 Initiative* can also be designed to exchange matter and energy with the environment, and to react to stimuli, replicate, develop and adapt. I distinguish this kind of "dry biology" with the latin-rooted neologism "vitology," and I believe the field of biotechnology will increasingly embrace both biology and vitology.

Biotechnologists labor to forestall death through multiple avenues. Most biotechnologists work on creating molecular tools to engage in hand-to-hand battle with molecular-scale diseases. Other biotechnologists are working on macro-scale solutions to disease, such as replacing diseased vital organs with regenerated or mechanical substitutes. The vanguard of biotechnology is in the digital domain where preparations are being made for transplanting the mind from a diseased brain, or an end-stage diseased body, to a computational substrate. I call this process creating a mindclone, and it enables effective immortality for a person's consciousness. The individual remains vitologically alive as a software-based being, a process well exemplified by the **Avatar Project** of the *2045 Initiative*.

I will describe the critical skills the technology entrepreneur needs based on my experience in satellite communications and life science companies to achieve living mindclones in the decades ahead. Closely related to these entrepreneurial skillsets are the social and policy interactions needed with governments and NGOs to help ensure the **Avatar Project** of the *2045 Initiative* is welcomed as a positive contribution to building the world as it should be.

Anders Sandberg

MAKING MINDS MORALLY: THE RESEARCH ETHICS OF BRAIN EMULATION

This talk will outline some of the ethical considerations that will need to go into any project aiming at creating brain emulations. In the near future the main issue is the ethical treatment of virtual experimental animals under profound uncertainty about their true moral status. Applying a cautious approach suggests to use methods similar to existing animal welfare methods, but adapted to the peculiarities of software entities. In the mid-term, the case of human emulations raises a number of other ethical challenges, including informed consent, handling of flawed versions, time rate rights, vulnerability, and the change of identity and death. Finally, the long-term effects and importance of brain emulation will be discussed: are there ethical reasons that strongly speak against pursuing it at all, or equally strongly favor a push towards it?

Cognitive Enhancement Theorist. Philosopher at the *Future of Humanity Institute*. Editor of the *Whole Brain Emulation Roadmap*. Investigates socio-ethical impacts of cognitive enhancement; feasibility of whole brain emulation; human enhancement, emerging technologies, global catastrophic risks and applied epistemology.

Computational Neuroscience degree from *Stockholm Uni.* on memory systems modeling. Joined *Oxford Uni.* in 2006 in the *ENHANCE* project investigating human enhancement. Research Associate with *Oxford Uehiro Centre for Practical Ethics*, the *Oxford Martin Programme* on the *Impacts of Future Technology* and the *Oxford Neuroethics Center.*

Natasha Vita-More

SUBSTRATE AUTONOMOUS, NETWORKED AVATAR BODIES BY DESIGN

What if we could build platform diverse bodies that could be mind-driven avatars for parlaying our personas within computational systems and telepresence? Streamlined and adaptive, the platform-diverse body design meets the needs of users who enjoy material embodiment and virtual embodiment. This design system supports linear and non-linear time and interfaces with biospheric and cybernetic environments. Our users are persons who need whole body prosthetics that perform like a docking system for uploading. With this in mind, this body design's apps and internal and external devices perform as a historical human system, yet provide a seamless connection with cyberspace. Because of its multi-level usability, the design specifies a smooth transition from human to transhuman avatar by adjusting to diverse social behaviors of a connective society. Further, its safeguarding of the continuity of identity is captured in moment-to-moment experiences that form narrative memory and behavioral patterns.

Human Enhancement Trailblazer specialized in sci-tech of emerging technologies of human-interface design.

Author of *Body by Design: An Innovative Platform Diverse Body*. Co-editor & contributing author of *The Transhumanist Reader: Classical and Contemporary Essays on the Science, Technology, and Philosophy of the Future Human.* Numerous contributions to books and journals such as *Technoetic Arts, Evolution haute couture, Metaverse Creativity, Beyond Darwin.*

WIRED called her *"early adopter of revolutionary changes". Village Voice: "a role model for superlongevity".*

Exhibited at *London Contemporary Art Museum, Niet Normaal,* and *Moscow Film Festival.*

Ray Kurzweil

Director of Engineering at *Google*. Inventor-futurist, "the restless genius" (WSJ) points to 2045 for the technological singularity when A.I. surpasses human intelligence in his best-selling *The Singularity is Near*.

Predicts imminent physical immortality and explains why and how in his books *Fantastic Voyage: Live Long Enough to Live Forever* and *Transcend: Nine Steps to Living Well Forever*. Details how to engineer synthetic minds in latest book *How to Create a Mind*.

Ranked #8 US entrepreneur by *Inc. magazine*, calling him "*rightful heir to Thomas Edison*". Named by *PBS* as one of 16 "*revolutionaries who made America*".

National Medal of Technology recipient.

IMMORTALITY BY 2045

The onset of the 21st century will be an era in which the very nature of what it means to be human will be both enriched and challenged, as our species breaks the shackles of its genetic legacy, and achieves inconceivable heights of intelligence, material progress, and longevity. The paradigm shift rate is now doubling every decade, so the twenty-first century will see 20,000 years of progress at today's rate. Computation, communication, biological technologies – DNA sequencing, for example – brain scanning, knowledge of the human brain, and human knowledge in general are all accelerating at an ever faster pace, generally doubling price-performance, capacity, and bandwidth every year. Three-dimensional molecular computing will provide the hardware for human-level 'strong' AI well before 2030. The more important software insights will be gained in part from the reverse-engineering of the human brain, a process well under way. While the social and philosophical ramifications of these changes will be profound, and the threats they pose considerable, we will ultimately merge with our machines, live indefinitely, and be a billion times more intelligent... all within the next three to four decades.

Theodore Berger

ENGINEERING MEMORIES: A COGNITIVE NEURAL PROSTHESIS FOR RESTORING AND ENHANCING MEMORY FUNCTION

Neuroprosthetics Pioneer; Brain prosthesis technology developer at the *USC Center for Neuroengineering*.

First to replace rat brain hippocampus function with a chip. Develops "neuron-silicon interface" tech using multisite electrode arrays and tissue culture methods for implantation of hardware models into the brain to replace dysfunctional nerve tissue.

Co-develops implementations of experiments-based models of hippocampal neurons and neural networks and researches biology-based mathematical models of the functional properties of the hippocampus by combining experimental studies of fundamental electrophysiological properties of hippocampal neurons.

Dr. Berger leads a multi-disciplinary collaboration with Drs. Marmarelis, Song, Granacki, Heck, and Liu at the *University of Southern California*, Dr. Cheung at City University of Hong Kong, Drs. Hampson and Deadwyler at *Wake Forest University*, and Dr. Gerhardt at the *University of Kentucky*, that is developing a microchip-based neural prosthesis for the hippocampus, a region of the brain responsible for long-term memory.

Damage to the hippocampus is frequently associated with epilepsy, stroke, and dementia (Alzheimer's Disease), and is considered to underlie the memory deficits characteristic of these neurological conditions. The essential goals of Dr. Berger's multi-laboratory effort include: (1) experimental study of neuron and neural network function during memory formation – how does the hippocampus encode information?; (2) formulation of biologically realistic models of neural system dynamics – can that encoding process be described mathematically to realize a predictive model of how the hippocampus responds to any event?; (3) microchip implementation of neural system models – can the mathematical model be realized as a set of electronic circuits to achieve parallel processing, rapid computational speed, and miniaturization?; and (4) creation of conformal neuron-electrode interfaces – can cytoarchitectonic-appropriate multi-electrode arrays be created to optimize bi-directional communication with the brain?

By integrating solutions to these component problems, the team is realizing a biomimetic model of hippocampal nonlinear dynamics that can perform the same function as part of the hippocampus. Through bi-directional communication with other neural tissue that normally provides the inputs and outputs to/from a damaged hippocampal area, the biomimetic model can serve as a neural prosthesis.

A proof-of-concept is presented using rats that have been chronically implanted with stimulation/recording micro-electrodes throughout multiple regions of the CA3 and CA1 hippocampus, and that have been trained using a delayed, non-match-to-sample task. Normal hippocampal functioning is required for successful delayed non-match-to-sample memory. Memory-behavioral function of the hippocampus is blocked pharmacologically, and then in the presence of that blockade, hippocampal memory/behavioral function is restored by a multi-input, multi-output model of hippocampal nonlinear dynamics that interacts bi-directionally with the in vivo hippocampus. The model is used to predict output of the CA1 hippocampus in the form of spatio-temporal patterns of neural activity – hippocampal memory codes; electrical stimulation of CA1 cells is used to "drive" the output of hippocampus to the desired (predicted) state.

Using the same procedures in implanted animals with an intact, normally functioning hippocampus substantially enhances memory strength and thus, learned behavior is improved. An analogous system has been demonstrated to interact with prefrontal cortical memory function in monkeys when transmitting between layers 2/3 and 5 of that brain structure. These results show for the first time that it is possible to create "hybrid electronic-biological" systems that mimic physiological properties, and thus, may be used as neural prostheses to restore damaged brain regions – even those regions that underlie cognitive function.

Ed Boyden

MIT Optogenetics Neuroengineer. Prof. of Biological Engineering and Brain and Cognitive Sciences. Leads *Synthetic Neurobiology Group*.

Develops optogenetics to activate and silence neural circuit elements with light; 3D microfabricated neural interfaces; robotic methods to record intracellular activity and perform single-cell analyses in living brains.

Researches how cognition and emotion arise from brain networks, enabling systematic repair of epilepsy, Parkinson's disease, PTSD, and chronic pain. *Stanford* Ph.D. discovered molecular mechanisms storing memory are determined by the content. Optogenetics lecturer at *TED & Davos World Economic Forum*.

TOOLS FOR ANALYZING AND ENGINEERING THE BRAIN

The brain is a complex, densely wired circuit made out of heterogeneous cells, which vary in their shapes, molecular composition, and patterns of connectivity. In order to help discover how neural circuits implement brain functions, and how these computations go awry in brain disorders, we invent technologies to enable the scalable, systematic observation and control of biological structures and processes in the living brain. We have developed genetically-encoded reagents that, when expressed in specific neuron types in the nervous system, enable their electrical activities to be precisely driven or silenced in response to millisecond timescale pulses of light. I will give an overview of these "optogenetic" tools, adapted from natural photosensory and photosynthetic proteins, and discuss new tools we are developing, including molecules with novel color sensitivities and other unique capabilities. Often working in interdisciplinary collaborations, we have developed microfabricated hardware to enable complex and distributed neural circuits to be controlled and observed in a fully 3D fashion, as well as robots that can automatically record neurons intracellularly and integratively in live brain. These tools, which are in widespread use to enable systematic analysis of neural circuit functions, are also opening up new frontiers on the understanding and treatment of brain disorders, and may serve as components of new platforms for diagnosing and repairing the brain.

George Church

Genomics Pioneer. Molecular geneticist, pioneer in personal genomics and synthetic biology.

1984 *Harvard* PhD introduced first methods for direct genome sequencing, molecular multiplexing & barcoding. These lead in 1994 to the first commercial genome sequence of the Helicobacter pylori pathogen.

His innovations in next generation genome sequencing and synthesis & cell/tissue engineering resulted in 12 companies in medical genomics *(Knome, Alacris, AbVitro, GoodStart, Pathogenica)*, synthetic biology *(LS9, Joule, Gen9, Warp Drive)* as well asnew privacy, biosafety & biosecurity policies. Director of the *NIH Center for Excellence in Genomic Science*.

BIONANOTECH FOR EXTENDING MOORE'S LAW, THE BRAIN PROJECT I/O & HUMAN GENOME ENGINEERING

We have developed a variety of CRISPR devices – protein-RNA-DNA complexes – enabling human genome – and epigenome – engineering with 20-fold higher efficiency and >100-fold easier programming than previous methods. To test these devices, PersonalGenomes.org provides the world's only biobank of human cell lines consented for fully open access sharing – and already outfitted as a sophisticated human synthetic biology chassis. We have designed and tested the first nanorobots made from hybrid materials – DNA, proteins and inorganic – which have sensors, logic & actuators capable of distinguishing subtle differences among various cancer, normal and immune cell types. We are exploring the use of similar hybrid nanostructures for manufacture of ultra-fast and complex electronic, optical and quantum computing and have demonstrated bionano storage a billion times more compact and with lower copying energy than conventional digital media. Such nanodevices offer significant advances in our ability to perform highly parallel input and output in animal and human neural systems.

Randal Koene

WHOLE BRAIN EMULATION: REVERSE ENGINEERING A MIND

Computational neuroscientist, science curator in the whole brain emulation field, pioneering development of substrate-independent minds. Focuses on functional reconstruction of neural tissue since 1994. Introduced the multi-disciplinary field of *Whole Brain Emulation*. Lead curator of the roadmap for its technological development.

Founder of *Carboncopies.org* and *NeuraLink Co*. Chief Scientist of the *2045 Initiative*.

Was director of Analysis at Halcyon Molecular, a director of the *Department of Neuroengineering at Tecnalia*, and a research professor at *Boston University's Center for Memory and Brain*. Ph.D. on memory mechanisms at *McGill University*.

We have developed a variety of CRISPR devices (protein-RNA-DNA complexes) enabling human genome (and epigenome) engineering with 20-fold higher efficiency and >100-fold easier programming than previous methods. To test these devices, PersonalGenomes.org provides the world's only biobank of human cell lines consented for fully open access sharing – and already outfitted as a sophisticated human synthetic biology chassis. We have designed and tested the first nanorobots made from hybrid materials (DNA, proteins and inorganic), which have sensors, logic & actuators – capable of distinguishing subtle differences among various cancer, normal and immune cell types. We are exploring use of similar hybrid nanostructures for manufacture of ultra-fast and complex electronic, optical and quantum computing – and have demonstrated bionano storage a billion times more compact and lower copying energy than conventional digital media. Such nanodevices offer significant advances in our ability to perform highly parallel input & output in animal and human neural systems.

Witali Dunin-Barkowski

CURRENT STATE OF THE RUSSIAN PROJECT ON BRAIN REVERSE-ENGINEERING REBRAIN 2045

Neuroinformatics Pioneer. Professor, Honorary President and Founder of the *Russian Association of Neuroinformatics.*

Head of the *Neuroinformatics Department* at the *Center for Optical-Neural Technology of the Scientific Research Institute for Systems Analysis* with the *Russian Academy of Sciences.*

Has been director and board member at numerous Russian and international scientific institutes.

Interests include neuroinformatics and the theoretical and experimental biophysics of the nervous system.

Director, as of August 2011, of the *David Marr Internet Lab for Reverse Engineering of the Human Brain*, organized by the *2045 Initiative*.

We are planning to get the basic set of data for a technical project for the elaboration and implementation of an artificial working prototype of the human brain by the beginning of the year 2016.

The project team thoroughly analyses the available experimental data and theoretical and computational models of all brain structures and prepares schemes for each of the latter, endowing the schemes with highly detailed and well-justified descriptions of the functions and mechanisms of their implementation in each particular case.

The results of the work on the project will be prepared for defense in front of any professional body of the highest degree of competence in neuroscience and neuroengineering.

During 2013 the project is focused on the clarification of the set of concrete principles of work of neuronal systems and on initial estimates of mechanisms of work of particular brain structures and their assembly into the complete and unique informational device of the brain.

By June 2013 we have significant progress in understanding the plausible data formats in neural systems. The basic principles of information processing in the neocortex and cerebellum have also been initially formulated.

Ken
Hayworth

Connectomics Pioneer. Founding president of the *Brain Preservation Foundation*. Senior scientist, *Howard Hughes Medical Institute's Janelia Farm Research Campus*, the world's leading connectomics research institution.

Researches ways to extend *Focused Ion Beam Scanning Electron Microscopy* (FIBSEM) imaging of brain tissue to encompass much larger volumes than currently possible.

Co-inventor of *Tape-to-SEM* process for high-throughput volume imaging of neural circuits at the nanometer scale.

BPF calls for the development of a whole brain embedding procedure towards demonstrating perfect ultrastructure preservation across an entire human brain.

PRESERVING AND MAPPING THE BRAIN'S CONNECTOME

Every memory, skill, and personality trait that makes you a unique individual is structurally encoded in your brain's neural connectivity, i.e. your "connectome". This is the overwhelming consensus view of those working in the cognitive and neural sciences. I will review technologies available today to preserve and map the connectome of small animals and how these technologies are quickly progressing to the level where they could be applied to humans. I will present the latest results in my foundation's Brain Preservation Prize contest including preliminary evidence that it is now possible to chemically preserve an entire mouse brain in a block of inert plastic such that today's electron imaging technology can image any region of it at the nanometer scale – i.e. sufficient resolution to perfectly extract its preserved connectome. From a technical perspective, it is quite possible that such a perfected, reliable, and relatively inexpensive chemical brain preservation procedure could be made widely available to human patients in hospitals within the next 5 years. Extrapolating today's progress in electron imaging technologies, it is quite possible that the ability to map the entire connectome of such a preserved human brain could be available within a few decades.

I will also consider key implications. We can now sketch out a scientifically sound, technological roadmap that would make human mind uploading possible by midcentury. More amazingly, anyone reading this abstract today could personally experience such mind uploading if they are able to secure a quality chemical brain preservation prior to their natural death. It is imperative that over the next few years we muster the scientific, medical, social, and political resources necessary to transition today's successful laboratory brain preservation techniques into an elective surgical procedure which can be performed on human patients in a hospital setting.

The biggest obstacle to this is not technological. It is the persistent refusal by many to accept what cognitive science tells us about the nature of the human 'soul'. Daniel Dennett, the great American philosopher who has done more than anyone to popularly explain how the results of science demystify consciousness, put it this way: "Yes, we have a soul, but it's made of lots of tiny robots. It's made of neurons. And we can actually explain the structure and operation of that kind of soul, whereas an eternal, immortal, immaterial soul is just a metaphysical rug under which you sweep your embarrassment for not having any explanation." We need to start accepting what science has told us about the nature of the human soul, that it is analogous to software running on the computing hardware of our brain, and that this software 'soul' is encoded in our brain's structural connectome. Once we accept this scientific viewpoint we can begin to see how truly liberating it is, for it means that the future is not just something that our grandchildren will experience, it is something we could personally experience with greater physical and mental health than is even imaginable today.

Stuart Hameroff

HOW HUMAN CONSCIOUSNESS COULD BE UPLOADED VIA QUANTUM TELEPORTATION

Quantum Consciousness Theorist. Anesthesiologist and professor at the *University of Arizona* in Tucson.

Researches consciousness, anesthesia and microtubules, i.e. protein structures which organize living cells including brain neurons.

His 1987 book *Ultimate Computing* suggested downloading consciousness into microtubule arrays. Developed with British physicist Sir Roger Penrose the controversial *Orch OR theory* in which consciousness derives from quantum computations in microtubules inside brain neurons. *Orch OR* has major implications for the nature of our existence, place in the universe, and future of consciousness.

Research website: www.quantum-mind.org

The dream of uploading depends on how consciousness occurs in the brain. AI/Singularity/Neuroengineering approaches based on complex computation among bit-like neurons will fail because neurons are far more than bits, and consciousness far more than computation. Brain information processing, and the roots of consciousness, extend inside neurons to finer scale cytoskeletal structures. The Penrose-Hameroff 'Orch OR' model suggests conscious awareness is due to quantum computations in cytoskeletal microtubules inside brain neurons. Self-assembling polymers of 'tubulin' – the most prevalent brain protein – microtubules regulate synapses, encode memory and process information. Microtubule unraveling causes cognitive defects in Alzheimers disease. Recent research shows microtubule quantum resonances and that anesthetics erase consciousness by acting in brain microtubules (Emerson et al, J Am Chem Soc, 2013). In principle, consciousness as quantum information in microtubules could be uploaded by quantum teleportation to dense arrays of self-assembled microtubules or suitable substitutes (e.g. fullerenes).

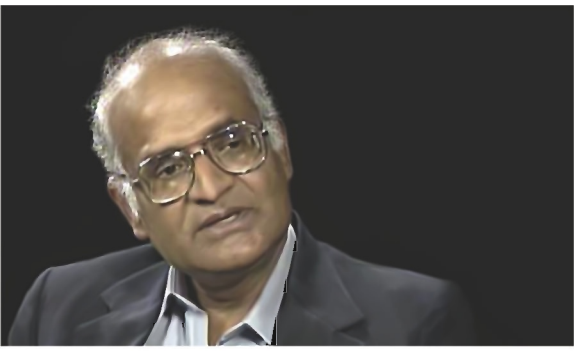
Sir Roger Penrose

Quantum Consciousness Theorist – Co-creator of the *Orch OR* model of the quantum nature of consciousness and memory.

Knighted in '94 for contributions to science, Sir Roger Penrose OM FRS, is a mathematical physicist and philosopher.

Extraordinary scope of work ranging from quantum physics and theories of consciousness to relativity theory and observations on the structure of the universe. Internationally renowned for work in mathematical physics, particularly general relativity and cosmology.

Won the 1988 *Wolf Prize for Physics*, shared with Stephen Hawking. Emeritus Rouse Ball Professor of Mathematics at *Mathematical Institute* of Uni. of *Oxford*.



Amit Goswami

CONSCIOUSNESS AND THE QUANTUM: SCIENCE, PSYCHOLOGY AND SPIRITUALITY

Present presentation will discuss how quantum physics and the primacy of consciousness leads to an integration of science, psychology and spirituality. It will also discuss a new vision of a quantum society and how to evolve it.

Professor Emeritus at the *Theoretical Physics Department* of the *University of Oregon*. Leads a revolutionary new non-materialist science paradigm based on the primacy of consciousness. His "science within consciousness" posits the unlimited potential of consciousness as the ground of all being: we are all one.

Appeared in documentaries *What the Bleep Do We Know, The Dalai Lama Renaissance*, and the award winning *The Quantum Activist*, which demonstrates how mistaken views of reality led to current crises, and how to correct this.

Authored the highly successful textbook *Quantum Mechanics* used in universities throughout the world.

Swami Vishnudevananda Giri

MANKIND'S DESIRABLE FUTURE ACCORDING TO VEDIC CULTURE AND CYBERNETIC TECHNOLOGIES. THE EVOLUTION OF CONSCIOUSNESS IN VEDANTA PHILOSOPHY

What is consciousness? Is it possible to transfer it to an alternative carrier? What are the prospects for the evolution of transhumanism and are there analogs of it in the Vedic culture? How likely it is that humanity will transition to Neohumanity? Is it possible to combine cybernetic evolution with the traditional teachings of Yoga and Vedanta? What does the Yoga teaching tradition say about human evolution? These and many other issues will be the subject of the presentation by Swami Vishnudevananda Giri at the GF2045 congress.

Swami will also address the evolution of consciousness, the deepening of awareness, the development of energy, as well as the outlook for life in a cybernetic body and the connection of a mind to an alternative non-protein cybernetic body. Finally, Swami will present examples of the transfer of consciousness into another body in traditional yoga.

Spiritual Transhumanist. Mahamandaleshwar of the *Juna Akhara Order* of *Hindu Monks*. Russian yoga master. Studied with 10+ masters. 20 yrs. spiritual experience. Founded Russia's only advanced yoga education center: *Yoga Monastery-Academy* (Advaita-Yoga Ashrama). Authored 90 books and many articles on philosophy, theory and practice of Yoga and Tantra, such as *Collection of Secrets*, a unique system of study and practice.

Founded Worldwide *Society of Laya Yoga*; of *The Immortals*, i.e. the *Worldwide Transhumanist Movement of Immortalists*, and a new direction in Russian transhumanism and immortalism called Transcendental Transhumanism.

ROUNDTABLE: INTERFAITH DIALOGUE ABOUT SCIENCE, SPIRITUALITY, EVOLUTION OF HUMANITY AND THE AVATAR PROJECT

Phakyab Rinpoche, Swami Vishnudevananda Giri, Rabbi Dr. Alan Brill, Mahayogi 'Pilot' Baba, Dr. Robert Thurman and Archbishop (Ret.) Lazar Puhalo, with the participation of Dmitry Itskov. Moderated by religious anthropologist Dr. William Bushell

William Bushell

Religious Anthropologist & Science-Spirituality Bridge-builder. Co-directed several multidisciplinary conferences on science and spirituality with Robert Thurman and His Holiness the Dalai Lama, including the Menla 2006 Conference on Longevity, Regeneration, and Optimal Health. Authored *Integrating Eastern and Western Perspectives*, published in the Annals of the *New York Academy of Sciences*. Spent over 30 years on the scientific study of spiritual traditions around the world, including Native American and other forms of shamanism, Afro-Caribbean religion, Sufism, Jewish mysticism, and especially the Asian yogic traditions.

Phakyab Rinpoche

Science-Spirituality Bridge-builder.

Ranking Tibetan Buddhist lama in the *Gelugpa Order*. Ordained at 13. Recognized in '94 as 8th reincarnation of Buddhist teacher Phakyab Lama. Powerful example of the potential of all to cultivate the life of the Bodhisattva or spiritual hero. Steadfast advocate of non-violent resolution of conflict, he brings humility and great compassion to his teachings.

Astonishing doctors, his radical self-healing from severe medical conditions shows our inherent potential to heal ourselves physically, mentally and emotionally. Vivid reminder that we have the ability to transform obstacles into resources for spiritual awakening.

Swami Vishnudevananda Giri

Spiritual Transhumanist. Mahamandaleshwar of the *Juna Akhara Order* of Hindu Monks. Russian yoga master. Studied with 10+ masters. 20 yrs. spiritual experience. Founded Russia's only advanced yoga education center: *Yoga Monastery-Academy* (Advaita-Yoga Ashrama). Authored 90 books and many articles on philosophy, theory and practice of Yoga and Tantra, such as Collection of Secrets, a unique system of study and practice.

Founded Worldwide Society of Laya Yoga; of The Immortals, i.e. the *Worldwide Transhumanist Movement* of Immortalists, and a new direction in *Russian transhumanism and immortalism* called Transcendental Transhumanism.

Mahayogi 'Pilot' Baba

Self-realized Siddha Master. Mahamandale-shwar of the *Juna Akhara Order* of *Hindu Monks*. Yoga master. Raising the consciousness of all people is the life mission he is fulfilling. M.A. in Organic Chemistry. Highly decorated Lieutenant Colonel and Wing Commander in the *Royal Indian Air force* in 1972. Deeply moved by the effects of war and human strife he resolved to find true peace by living as an ascetic. With guru Hari Baba, he discovered and achieved Samadhi: a state of consciousness when one is beyond body and mind and in complete spiritual unity with the cosmos. He let go of the ego and attained a supreme sense of oneness with the absolute.

Robert Thurman

Spirituality Researcher. Scholar, author and tireless proponent of peace. Renowned American writer and public figure. First American to be ordained, at age 24, a Tibetan monk by His Holiness the Dalai Lama. Professor of *Indo-Tibetan Buddhist studies* at *Columbia University*, and co-founder of *Tibet House US* dedicated to preserving and promoting Tibetan civilization.

Focused on the balance between inner insight and cultural harmony. interpreting the teachings of Buddha, he argues that happiness can be reliable and satisfying in an enduring way without depriving others.

Translated many Buddhist Sutras (teachings). Podcasts on Buddhist topics.

Alan Brill

Jewish Mystical Meditator. Rabbi Dr. Alan Brill is the Cooperman/Ross Endowed Professor in *Honor of Sister Rose Thering* at *Seton Hall University*.

He is the author of several books, including *Thinking God: The Mysticism of Rabbi Zadok of Lublin* (2003), *Judaism and Other Religions: Model of Understanding* (2010), and *Judaism and World Religions* (2012).

Specialized in contemporary Jewish thought, interfaith dialogue, and Jewish meditation and mysticism. Conducts comparative research on Jewish and Hindu forms of meditation.

His next book will be on *Varieties of Modern Orthodoxy*.

Lazar Puhalo

Archbishop of Ottawa (Ret.) of the *Orthodox Church* in America. Fellow of the *Chester Ronning Centre* of the *Uni. of Alberta*. Formal studies include physics and neurobiology.

Authored over 38 books. Signature work is Culture, *Commonwealth* and *Personhood*. International lecturer on social justice, human rights, ecology and the clash between commonwealth and corporatism, as well as science and culture.

Founder and abbot of All Saints Monastery near Vancouver, he is a retired hierarch of the *Orthodox Church* in America.

Consistent advocate for broader and deeper education in the sciences, ecological responsibility, and the welfare of the mentally handicapped.

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