Conference Programme

Do we need to reconsider our understanding of life and what it means to be human? Meet us at the crossroad of technology and biology. www.rathenau.nl/makingperfectlife

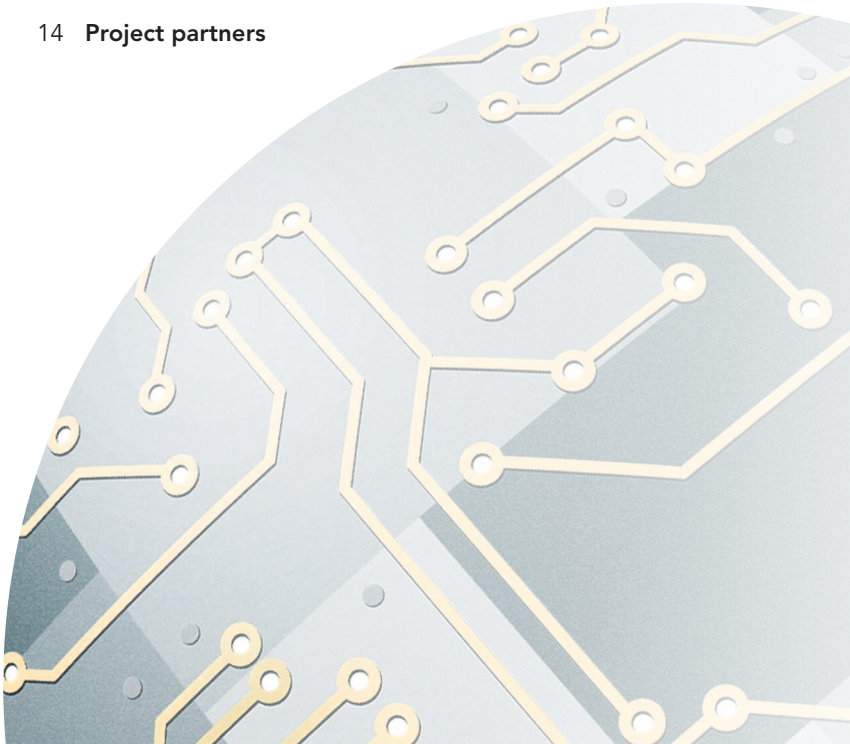
Making Perfect Life

Bio-engineering in the 21st century

STOA

STOA conference Wednesday 10 November 2010, 1-6 pm, European Parliament, Brussels, room PHS 1A002. Chaired by Members of Parliament Malcolm Harbour and Vittorio Prodi.

Contents



Foreword

A living cell with synthetic DNA is already a reality. Smart implants and stem cells are on their way to the clinic. Scientists also work on other cutting edge technologies, from robots that can act like humans to building supercomputers resembling the human brain. In many ways, technology and biology are increasingly intertwined.

What is the impact of these developments and our vision of the ideal future of Europe? Can the EU foster innovation in these fields while at the same time managing social and ethical concerns in our society? These and other questions are addressed during the conference "Making Perfect Life", hosted by STOA on the 10th of November 2010 in the European Parliament in Brussels.

"Making Perfect Life" provides the ultimate platform for Members of Parliament to discuss the challenges arising from fast-paced developments in bio-engineering fields as broad as regenerative medicine and brain research, and from synthetic biology to artificial intelligence. Participants are given a head start in the state of the art and the social and ethical issues surrounding these innovations. Of course there's ample of room for discussion about implications and policy options.

We welcome you to discuss how we can Make Perfect Life for Europe!

Mr Malcolm Harbour and Mr Vittorio Prodi

Programme

Malcolm Harbour

Malcolm Harbour was elected to the European Parliament in June 1999, and re-elected in June 2004 and 2009. He is Chairman of the Internal Market and Consumer Protection Committee and is a Member of the European Conservatives and Reformists Group. He is Vice-Chairman of STOA.
He is Chairman of the European Manufacturing Forum, the Ceramics Industry Forum and the Conservative Technology Forum. He is a Governor of the European Internet Foundation. He has been the lead MEP (rapporteur) for major legislation on Telecoms, the Single Market and Motor Vehicle standards. Before his election to the Parliament, Malcolm Harbour spent 32 years in the motor industry, as an engineer, a senior commercial executive, a consultant and a researcher. Malcolm Harbour was born in February 1947. He is graduated in Engineering at the Trinity College, Cambridge and at the University of Aston where he gained a Diploma in Management Studies. He received an Honorary DSc from Aston in 2008.

12.30 **Registration**

13.00 **Welcome address** by Malcolm Harbour (MEP, STOA Vice Chairman)

13.15 **Introduction: Bio-engineering in the 21st century** by political scientist Rinie van Est (Rathenau Instituut)

13.30 **Roundtable 1: How biology is becoming technology**, chaired by Malcolm Harbour

On stage interviews by Frans Brom (Rathenau Instituut) with neurosurgeon Veerle Visser-Vandewalle (University of Maastricht), stem cell expert Stephen Minger (GE Healthcare), social scientist Andrew Webster (University of York) and synthetic biologist Antoine Danchin (University of Hong Kong), followed by discussion with MEPs and broader audience.

14.15 **Roundtable 2: How technology is becoming biology**, chaired by Malcolm Harbour

On stage interviews by Frans Brom (Rathenau Instituut) with computational neuroscientist Anders Lansner (Royal Institute of Technology, Stockholm), philosopher Marc Bedau (Portland State University and Reed College), AI expert Brigitte Krenn (Austrian Research Institute for Artificial

Intelligence), and philosopher Jutta Weber (Technical University Braunschweig), followed by discussion with MEPs and broader audience.

15.00 **Coffee break**

15.45 **Short presentations of EU funded research projects on bio-engineering**, introduced by Bernd Beckert (Fraunhofer ISI)

16.30 **Panel discussion**: **political and policy implications of bio-engineering in the 21st century**, chaired by Vittorio Prodi (MEP, STOA Panel Member)

Discussion moderated by Bernd Beckert with ethicist Inez de Beaufort (European Group on Ethics), law expert Judit Sándor (Central European University), philosopher of science Roger Strand (University of Bergen) and economist Andrea Bonaccorsi (University of Pisa), followed by discussion with MEPs and broader audience.

17.15 **Q&A,** moderated by Vittorio Prodi

17.45 **Closing remarks** by Vittorio Prodi

18.00 **Reception**

Vittorio Prodi

Vittorio Prodi, born in Reggio Emilia on 19 May 1937, is a physicist by education (B.A. and PhD at Bologna University) and researcher for National and International Institutes in the occupational and environmental protection area. Author of more than 100 papers and of 5 international patents related to aerosol particles sampling and characterization.
In 1995 he was elected President of Bologna Province. As an elected Member of the European Parliament in 2004 he has been Vice president of the temporary Committee on Climate Change, member of the environmental committee and substitute member of the industry committee and shadow rapporteur for the 7th FP. He has been re-elected in 2009. He is full member of ENVI committee and of the sub-committee on human rights, substitute member of AFET committee, member of the delegation with Mercosur, substitute member of the delegation with China and Eurolat.

Introduction: Bio-engineering in the

Presentation by Dr. Rinie van Est, Rathenau Instituut

Dr. Rinie van Est

Rinie van Est is research coordinator and 'trendcatcher' with the Rathenau Instituut's Technology Assessment (TA) division. He has a background in applied physics and political science. At the Rathenau Instituut he is primarily concerned with emerging technologies such as nanotechnology, cognitive sciences, persuasive technology, robotics, and synthetic biology. In addition to his work for the Rathenau Instituut, he lectures Technology Assessment and Foresight at the School of Innovation Sciences of the Eindhoven University of Technology.

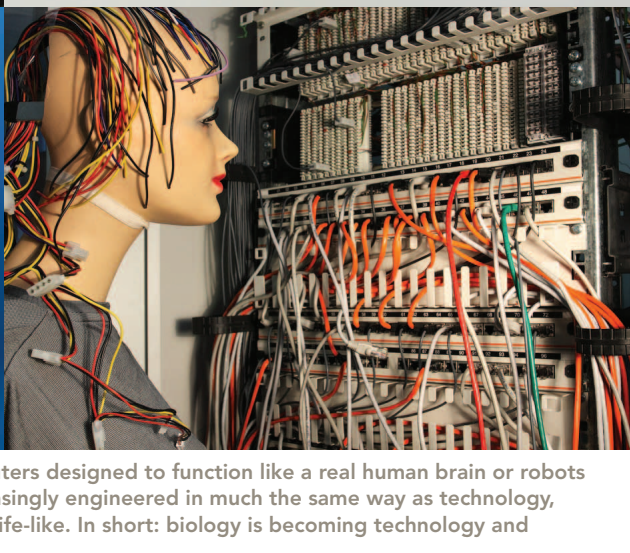
The project "Making Perfect Life" aims to inform the European Parliament about ethical, legal and social issues arising from the emergence of new bio-engineering possibilities.

This project studied the state of the art in four domains of bio-engineering: body, brain, intelligent artefacts and living artefacts. Moreover, it investigated to what extent the European Commission is stimulating developments in these fields and the ethical questions and socio-political aspects they raise.

During the conference the first results of the Making Perfect Life project will be presented and discussed. The four domains of bio-engineering show two engineering megatrends: biology is becoming technology and technology is becoming biology.

In his introduction, Dr. Rinie van Est will provide a general outline of the main project themes and why we need to address these today. Furthermore, he will shed light on the social meaning of the two bio-engineering trends to set the stage for an in-depth discussion of the ethical, legal and social implications for the European Union.

21st century



Living bacteria with artificial DNA, supercomputers designed to function like a real human brain or robots showing human-like emotions. Biology is increasingly engineered in much the same way as technology, while technology is becoming more and more life-like. In short: biology is becoming technology and technology is becoming biology.

Roundtable sessions: How biology is technology is becoming biology

Prof. Dr. Frans Brom
(moderator roundtable sessions)

Frans Brom is Head of the Department of Technology Assessment at the Rathenau Instituut and Professor of 'Ethics of Technology Assessment' at Utrecht University. His current research focuses on the societal significance of scientific and technological advances, with a particular focus on the interaction between Technology Assessment, ethics and political philosophy. He is also active in several societal organisations, including chairman of the Committee on Ethics and Societal Aspects of Genetic Modification (COGEM).

Do we need to reconsider our understanding of life and what it means to be human?

During two round table sessions these two trends at the crossroads of biology and technology are discussed with experts and Members of European Parliament. Chaired by MEP and STOA Vice Chairman Malcolm Harbour, both the state of the art in distinctive research fields and their societal impact are presented.

What does it mean when parts of the human body or brain can be engineered and modified outside of the body? When tissues, cells and neurons become products? Or synthetic substances create a life of their own?

Roundtable 1: How biology is becoming technology

In the first round table, focussing primarily on how biology is becoming technology, we further investigate the trend where human life is increasingly seen as an instrument and living organisms understood in mechanical terms. Complex living systems, like human genes, cells, organs and even our brains are engineered like non-living systems such as bridges and electronic circuits. Examples of such include cultured cell lines used in research, existing outside the human body, living tissues such as skin and bone manufactured on demand and electronic stimulation of brain cells to suppress tremors or treat depression.

becoming technology and how

Prof. Dr. Veerle Visser-Vandewalle

Veerle Visser-Vandewalle is Professor of functional neurosurgery at Maastricht UMC, where she heads the Maastricht Institute for Neuromodulative Development. Functional neurosurgery aims at alleviating symptoms that are a consequence of a functional disturbance of the nervous system, an example of which is deep brain stimulation (DBS) in Parkinson disease. She is considered a pioneer in the field and was the first to perform DBS in Tourette syndrome sufferers.

Dr. Stephen Minger

Stephen Minger is Global Director of R&D for Cell Technologies at GE Healthcare. As leading researcher into human embryonic stem cells, he previously held positions as Director of the Stem Cell Biology Laboratory and as Senior Lecturer in the Wolfson Centre for Age-Related Disorders at King's College London. He received his BA in Psychology from the University of Minnesota and his PhD in Pathology (Neurosciences) in 1992 from the Albert Einstein College of Medicine.

Prof. Dr. Andrew Webster

Andrew Webster is Director of the Science and Technology Studies Unit in the Department of Sociology at the University of York and Director of the UK Innovative Health Technologies Programme and Stem Cell Initiative. He is a member of the UK Stem Cell Bank Steering Committee and was Specialist Advisor to the House of Commons Health Select Committee. He is currently coordinating a new European (EC) grant on Regenerative Medicine (REMEDiE).

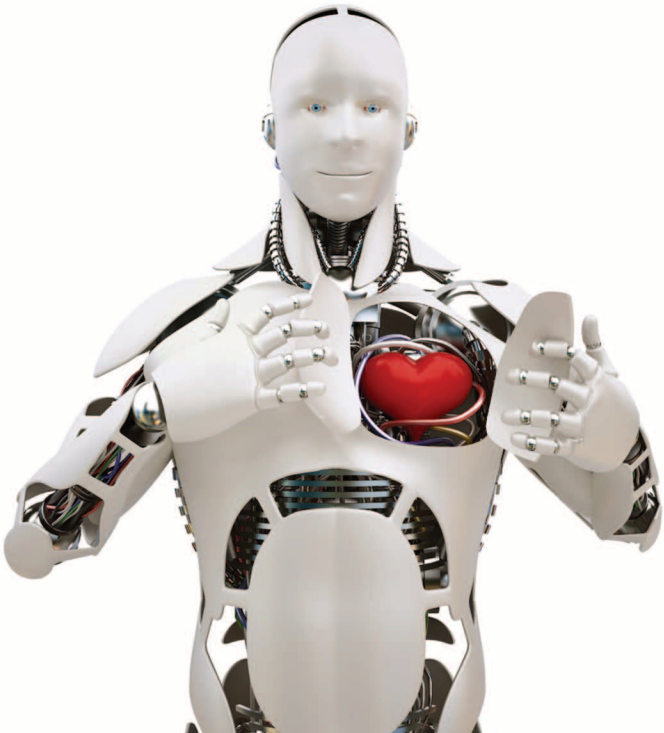
Prof. Dr. Antoine Danchin

Antoine Danchin is Honorary Professor at the Li Ka Shing Faculty of Medicine of the University of Hong Kong, CEO of AMAbiotics SAS and Scientific Advisor at the Commissariat à l'Energie Atomique et aux Energies Alternatives. He is also a specialist in genomics and genetics of bacteria and in synthetic biology. He is a member of the FP7 EU Consortium Microme, former creator of the HKU-Pasteur Research Centre in Hong Kong, China and author of The Delphic Boat (Harvard University Press, 2003).

Roundtable sessions: How biology is technology is becoming biology

Roundtable 2: How technology is becoming biology

The second round table, following the same format, focuses primarily on the trend of technology becoming biology. From this perspective, life is seen as the perfect model for designing and building technologies. Technologies are acquiring properties which we associate with living organisms such as reproduction, cognition, self-healing and self-assembly. Now that we are better able to understand the mechanisms of life, we are able to emulate nature or even release nature from its slight imperfections. Examples of this include patients controlling a wheelchair by thought through a brain computer interface and designer algae as bio-solar systems that work more efficiently by absorbing not only blue and red light – as found in nature – but also green light.



becoming technology and how

Prof. Dr. Anders Lansner

Anders Lansner holds a PhD in Computer Science from the KTH Royal Academy in Technology. Anders Lansner is currently Professor of Computer Science at the department of Computational Biology at Stockholm University and KTH and has 30 years of experience in computational neuroscience, neural computation, cognitive neuroscience and psychology, neuromorphic engineering, and supercomputer brain modelling. He is a member of the Royal Swedish Academy of Engineering Sciences (IVA) and partner in EU research projects such as FACETS (recently finished), BrainScales (new), Neurochem, and Select-And-Act.

Prof. Dr. Mark Bedau

Mark A. Bedau is Professor of Philosophy at Reed College, Portland, Oregon, USA, Director of the Initiative for Science, Society, and Policy in Denmark and Editor-in-Chief of the journal *Artificial Life*. He has published and lectured extensively on issues concerning emergence, evolution, life, and the social and ethical implications of creating life from nonliving materials. Mark Bedau participated in the FP-6 PACE Integrated Project, and the FP-7 TARPOL Coordination Action.

Mag. Dr. Brigitte Krenn

Brigitte Krenn is head of the Interaction Technologies Group at the Austrian Research Institute for Artificial Intelligence (OFAI). Her current research interests are: Companion systems including Embodied Conversational Agents, cognitive agents and multimodal interactive systems; semantic systems including semantic profiling and semantic search, and systems for Ambient Assisted Living in particular technologies to support active, self-determined and socially integrated ageing. She is the coordinator of projects NECA (FP5) and RASCALLI (FP6), member of networks HUMAINE (FP6) HUMAINE Association, euCognition (FP6) and EUCogII (FP7).

Prof. Dr. Jutta Weber

Jutta Weber is philosopher, media theorist and STS scholar. She is visiting Professor at the Centre for Gender Studies at the TU Braunschweig, Germany. Her research focuses on epistemological, ontological and socio-political dimensions of technoscientific knowledge production (robotics, ICT. AI/AL) and technoscience as culture. She held visiting Professorships in Uppsala, Duisburg-Essen and Freiburg. She was a fellow of the research group *Science in the Context of Application* at the Centre for Interdisciplinary Studies ZIF, University Bielefeld as well as part of the EU-project *Ethicbots (*http://ethicbots.na.infn.it/). Currently she is finalising a book on the philosophy of technoscience. See www.juttaweber.eu

Panel discussion: Political and policy bio-engineering in the 21st century

Bio-engineering trends at the crossroads of biology and technology intensify current debate about the desirability and acceptability of genetic engineering and human enhancement. They also raise novel issues, such as who is in control of machines with a life of their own?

So far public debate has focused largely on the instrumentalisation of life – biology becoming technology. The global debate on genetically modified food being one example in place, more recently discussions on human enhancement have similarly questioned the human body as subject. These issues are to be intensified now that engineers are able to manipulate and even imitate the essential building blocks of life – like DNA (in synthetic biology) and atoms (through nanotechnology). What are the ethical, legal and political consequences of this increasing ability to control nature? For example, who is the intellectual owner of a cell with synthetic DNA?

Meanwhile, discussion about technology becoming biology is still under the public radar. This trend goes beyond controlling nature. Nowadays we are purposefully building technology that is more autonomous and therefore out of the immediate control of the engineer, resulting in unforeseen effects and unpredictable behaviour. This urges important issues of liability, safety and reliability. For example, do we grant the same rights – and duties – to life-like machines as we do to humans?

This final session gives Members of Parliament the opportunity to once again engage with scientists and with experts in ethics and law to think through the potential implications of bio-engineering for politics and policy. The panel discussion is chaired by STOA Panel Member Vittorio Prodi and the discussion moderated by Bernd Beckert from Fraunhofer ISI. This session is followed by a Q&A for Members of European Parliament and the broader audience.

implications of

Dr. Bernd Beckert
(moderator panel discussion)

Bernd Beckert is the Deputy Head of the Competence Center Emerging Technologies at the Fraunhofer Institute for Systems and Innovation Research ISI. His fields of expertise, among others, include ICT, converging technologies, governance of new technologies and foresight methods. Bernd Beckert is involved in the EU-project "Converging technologies and their impact on the social sciences and humanities". He is also involved in the development of a new field of research – human-machine cooperations – and is active in researching trends in neuroscience including consequences for research policy.

Prof. Dr. Inez de Beaufort

Inez de Beaufort is Professor of health care ethics at the Erasmus Academic Hospital in Rotterdam. She is member of the European Group on Ethics in Science and New Technologies. She is an honorary member of the Dutch Health Care Council. She is, among others, a member of the International Board of Bioethics, a Euthanasia Review Committee, and the Appraisal Committee for the Health Care Insurance of the Dutch Organisation for Health Care Insurance. She has written on personal responsibility for health, the end of life, research ethics, ARTs, beauty and ethics, and ethics and obesity. She was the coordinator of EU projects on Medical Ethics in Fiction, Beauty, and Eurobese. She has a special interest in the role of fiction for ethics teaching.

Prof. Judit Sándor

Judit Sándor is a Professor at the Central European University (CEU), Budapest. In 2004-2005 she worked as the Chief of the Bioethics Section at the UNESCO. She published seven books in the field of human rights and biomedical law. Her special research interests include the ethical and legal questions of assisted reproduction, genetic and stem cell research. Since September 2005 she is a founding director of the Center for Ethics and Law in Biomedicine (CELAB).

Prof. Roger Strand

Roger Strand is Professor in philosophy of science and is currently the Director of the Centre for the Study of the Sciences and the Humanities, University of Bergen, Norway. His main research focus is uncertainty and complexity in the governance of emerging science and technology, an example of which is the FP7 project TECHNOLIFE (www.technolife.no), which he coordinates.

Prof. Andrea Bonaccorsi

Andrea Bonaccorsi is Professor of Economics and Management at the School of Engineering, University of Pisa. His recent research interests cover the dynamics of knowledge in emerging fields, the economics of universities, and the design of innovation policies. He is member of the editorial board of *Minerva*. In the last years he has been involved in five High Level Expert Groups at the European Commission, and has collaborated with OECD, national and regional governments on innovation policies.

Project partners

STOA > Today many of the issues coming before the European Parliament have a scientific or technological dimension to them. STOA is an official body of the European Parliament with the mission to:

- provide Parliament's committees and other parliamentary bodies concerned, with independent, high-quality and scientifically impartial studies and information for the assessment of the impact of possibly introducing or promoting new technologies and shall identify, from the technological point of view, the options for the best courses of action to take;
- organise forums in which politicians and representatives of scientific communities or organisations – and of society as a whole – shall discuss and compare scientific and technological developments of political relevance to civil society;
- support and coordinate initiatives to strengthen parliamentary technology assessment activities in the Member States of the European Union, including creating or enhancing parliamentary technology assessment capacities in European countries, especially New Member States.

Rathenau Instituut

Rathenau Instituut > The Dutch Rathenau Instituut encourages public debate and assists political decision-making with regard to the social, ethical and political impact of modern science and technology. It further studies the organisation of the science system and how that system responds to scientific, social and economic developments.

INSTITUTE OF TECHNOLOGY ASSESSMENT

The Institute of Technology Assessment > The Austrian Institute of Technology Assessment (ITA) is an interdisciplinary research institute for the analysis of technological change, focusing on societal conditions and shaping options and impacts. Scientific technology assessment applies a broad array of methods stemming from a multitude of fields. An essential element of technology assessment methodology is the inclusion of various bodies of knowledge, values and interests via participatory procedures. Internal project teams, often in collaboration with external partners, carry out interdisciplinary and transdisciplinary scientific analyses.
The aim of applied and scientifically-oriented technology assessment is to generate knowledge relevant for decision-making and to identify intended and unintended consequences of development options. This knowledge is targeted at supporting politics

and administration, on the one hand, and at the general public on the other hand. Our academic work seeks to better understand the societal relevance of technology and to develop further the methodological basis of technology assessment.

Fraunhofer ISI > The German Fraunhofer Institute for Systems and Innovation Research ISI analyzes the framework conditions for innovations. We explore the short- and long-term developments of innovation processes and the societal impacts of new technologies and services. On this basis, we provide our clients from industry, politics and science with recommendations and perspectives for key decisions. Our expertise lies in a broad scientific competence as well as an interdisciplinary and systemic research approach.

Karlsruhe Institut für Technologie, Institut für Technikfolgen-abschäbschatzung und Systemanalyse (ITAS) > ITAS creates and communicates knowledge on the impacts of human action and their evaluation in view of the development and use of new technologies. Its work focuses on environmental, economic, social and political-institutional issues. Alternative options for action and design are developed and assessed. In this way ITAS supports politics, science, business and the general public in future decision-making on the basis of the best available knowledge and rational assessments. The production of knowledge on consequences meets a social demand for advice, and concrete advice is based on scientific knowledge. For this purpose, ITAS applies and upgrades methods of technology assessment and systems analysis.

European Technology Assessment Group (ETAG) > Since October 2005 a group of European scientific institutes active in the field of Technology Assessment – with the Institute for Technology Assessment and Systems Analysis (ITAS), Karlsruhe Institute of Technology (KIT), as the leading partner – has been providing scientific services for the European Parliament on social, environmental and economic aspects of new technological and scientific developments.
Like many other parliaments in Europe (www.eptanetwork.org) the European Parliament at the end of the 1980s set up an institution for scientific advice regarding complex social, ecological and economic implications of modern technology and scientific research.

ETAG
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Programme

STOA conference: Making Perfect Life. Bio-engineering in the 21st century

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17.45	**Closing remarks**
18.00	**Reception**