1

# HPC System Disruptions

Current patterns of high performance computing (HPC) are challenged by a number of disruptive technologies such as Quantum Computing, Non-volatile Memory (NVM) technologies (including spintronics), Photonics, Resistive Computing, Neuromorphic Computing, Quantum Computing, Nanotubes, Graphene and Diamond Transistors but also Biocomputing approaches. At the same time also computing *practices* may bring about changes. Research could explore radically novel HPC concepts in an integrated vertical approach.

**Related OBSERVE Radar Elements**

Plasmonics T3
Photonic crystals for optical computers T15
Neuromorph computing T20
Spintronics: New principles for new, ultra-high capacity storage devices T26
Combination of scientific advances in nanotechnology, optics and spintronics with conventional electronics T29
Combining quantum technology and photonics to realize a quantum computer T33
Quantum computing challenges cryptography N&T8
Biomanufacturing C4
Distributed collaboration platforms H9
DIY printing of circuits SP&T3
Universal software bug N8

**Related FET Proactive Consultation Contributions**

Impact of Disruptive Technologies on High-Performance Computing in Next Decade
SPIN COMPUTING: ultrafast, ultralow power, highly endurant and radiation hard
Spin-orbitronics and topology for a new generation of low power reconfigurable spintronic devices
Spin Orbit Effects for ultimately efficient spin dynamics/structures; Magnon Computing
Spintronics and Nanomagnetism for Brain-Inspired Computing
Hybrid organic/inorganic spintronics; Spin: Advancing the art of electronics
Developing the synergy between magnetism and light
Exploring magnonics and spin charge conversion



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2

# Game Change Enabling Materials

Several of the most dynamic research fronts with highly recognized scientific publications are located in material sciences. While some of these present basic research on synthesis and properties of new materials, many focus on specific game changing applications especially in energy storage but also health, robotics, environmental technologies and ICT. In many cases sustainability considerations are an important aspect of the research.

**Related OBSERVE Radar Elements**

Emerging research front: Analysis of dynamic and static behaviour of functionally graded material S1
Research front: Graphene and graphene oxide in biomedical application S11
Emerging research front: Synthesis of functional gold nanorods (applications: biomedical, spectroscopies, optoelectronics) S13
Nanolattices S20
Plasmonics (light-matter interaction) T3
Self-Propelled particles to treat severe bleeding T12
Autonomous and soft materials for robot parts T22
Use recently discovered graphene characteristics in novel applications T32
Smart materials for shape-changing mobile devices and other interfaces T34

**Related FET Proactive Consultation Contributions**

Molecular Materials in Spintronics and other Magnetic applications
Magnetic Nanohybrids: Nanomagnets and nanomagnetic devices for energy conserving applications
Functionalized Magnetic Nanoparticles for Bio- and Biomedical Technologies (drug delivery)
Next generation smart textiles
Soft Robotics: the way for bringing science-based robotics to Society
New materials for life
Supramolecular chemistry and mesotechnology



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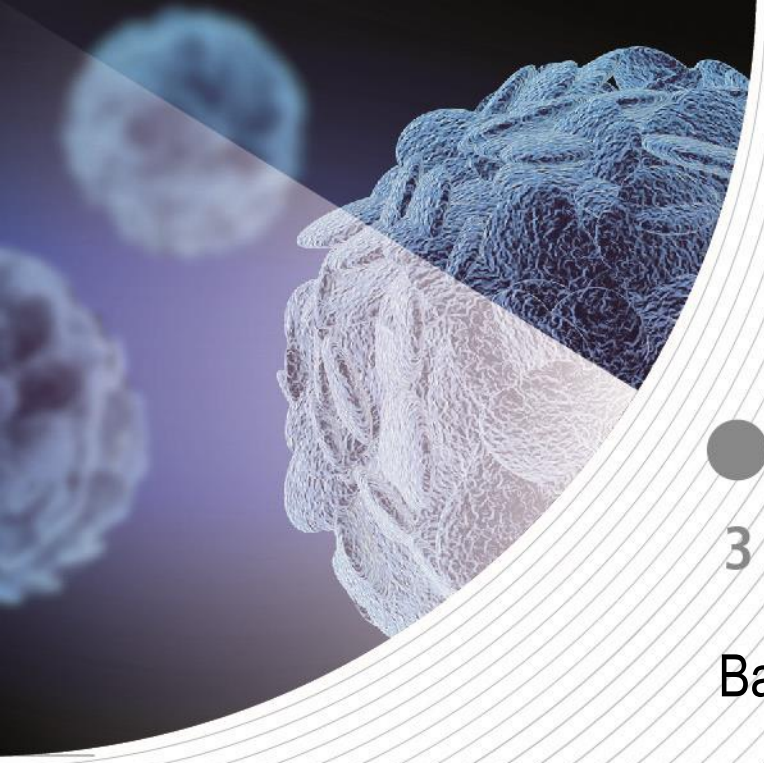

3

# Bacteria Management Strategies

Several of the OBSERVE findings relate to the way humanity deals with bacteria. One of the most prominent aspects is the rise of antibiotic resistance which poses a severe threat to many established practices of today's societies. All the more relevant, seem other ways of dealing with bacteria such as antibacterial shields but also better understanding of the role of bacteria for human life (microbiome) and ways to influence bacteria e.g. through genome editing. At the same time bacteria are increasingly being used in manufacturing processes.

**Related OBSERVE Radar Elements**
Post antibiotics N&S12
Water based nano-bacteria shields N&S6
Antibacterial bio-microfilm N&S3
Understanding the microbiome S7, SP&S1
Emerging research front: CRISPR/CAS Genome-editing technology S8
Biomanufacturing C4

**Related FET Proactive Consultation Contributions**
Infection-free medical devices would save lives!



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4

# Biomimicry New Frontiers

A rapidly growing number of technologies are inspired by biological functions and solutions. One driver of the new momentum for biomimicry is the advance in simulation and freeform manufacturing (3D printing). Current examples of cutting edge biomimicry innovations include smell-guided-navigation, jellyfish inspired locomotion, insect-inspired robot design (vision and movement) and research into animal system behaviour (e.g. ants) that could help us develop the internet – or even understand how cancer spreads. Furthermore, biological principles and characteristics could be used for better computing. There are already many attempts to emulate biological systems in order to enhance computer chip performance or binary communication processes as well as bioinspired parallel and neuromorphic computing. In the 2015 Lift China Conference there was a focus in biomimicry as the next generation sustainability concept.

**Related OBSERVE Radar Elements**
Biomimicry New Frontiers H2



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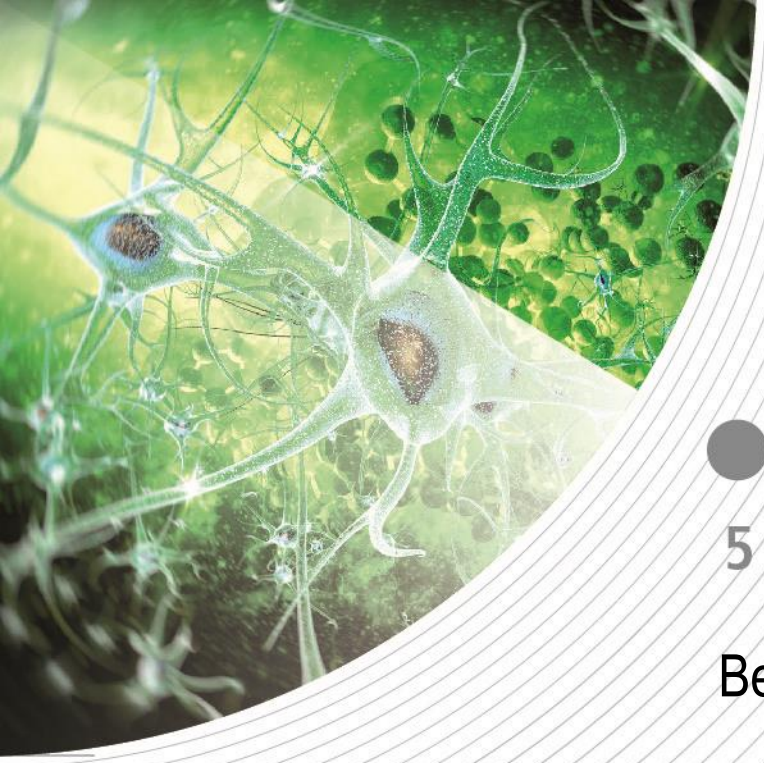

5

# Beyond, Within and Into the Brain

The findings from the OBSERVE screening include several topics related to the brain. On the one hand research on understanding the human brain and brain related innovation such as direct brain to brain communication is fast advancing. At the same time, several societal questions are emerging such as understanding the co-evolution of the human brain and the digital society and dealing with mental illness.

**Related OBSERVE Radar Elements**

Brain networking H28
Artificial brain S12
Brain cell transplantation N&S4
Mental illness controversy N12
The human brain in the digital society C6
Global Challenge: Education and learning N4
Measuring Imagination S10
Timekeeping mechanism of human brain uncovered S6
Brain understanding S19
Understanding and influencing human behaviour H23
Non-invasive brain influencing T28
Treating phantom pain with a mirror SP&S2
Particle pollution may be the main cause for brain degenerative diseases N14
Brain interfaces and implants T18



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6

# Zero Waste Technologies

Approaches towards a sustainable and circular cradle2cradle economy feature prominently in the debate among scientists, innovators, actors from civil society and policy makers. Establishing fully circular resource flows is however extremely demanding both for design and production. Circular solutions are bound to disrupt established patterns of science and engineering on the one hand and production and consumption on the other.

**Related OBSERVE Radar Elements**
Circular material flows H5
Wooden material on the rise SP&T1
Carbon nanofibres made from CO2 in the air N&T7

www.horizon-observatory.eu

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7

# Civilisational Transformation

Some of the OBSERVE screening results reflect on possibly upcoming fundamental transformations of human civilisation. Drivers of the debate include both severe threats such as antimicrobial resistance and decline of global forests and opportunities such as exploration of space and underwater territories as new human habitats.

**Related OBSERVE Radar Elements**
Future of civilization H12
Technological singularity H16
Forest health H27
Underwater operations H24
Long term preservation of knowledge and timekeeping SI4/5
Post antibiotics N&S12
Extraordinary advances in facial recognition cause huge privacy issues N&T9
Space exploration H21



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8

# Breathtaking Air Research

Air pollution is a key topic in current futures debates. Monitoring air pollution as well as better understanding its evolution and effects pose substantial challenges to current research. For combating air pollution radical solutions are required.

**Related OBSERVE Radar Elements**

Research front: Atmospheric aerosol nucleation and growth N&S16
Carbon nanofibres made from CO2 in the air N&T7
Moss walls for air cleaning SI2
Particle pollution may be the main cause for brain degenerative diseases N14
Bio-sensors: Using plants as environmental sensors and connecting them to sensor networks T8



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9

# Infrastructures for Communicating in New Dimensions

The OBSERVE screening revealed a diverse set of items related to the way we communicate ranging from highly technical aspects like molecular communication and spectrum overcrowding to cultural changes like the rise of active audiences and compressed communication through emoticons.

**Related OBSERVE Radar Elements**
Compressed conversations SP4
Terahertz communication enables a new range of wireless applications in the fu-ture T14
Spectrum overcrowding N11
Active audiences H3
Molecular communications S4

**Related FET Proactive Consultation Contributions**
Misinformation Spreading
Automatic Fact Checking Technology for Improving our Society
Molecular Communication



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10

# Revolutionary Healthcare Diagnostics

In the field of diagnostics disruptive advances may be upcoming through a combination of several developments. On the one hand diagnostic technology is able to analyse ever more parameters with ever lighter and cheaper equipment and in less time. At the same time more diseases can be detected through analysis of fluids especially blood, due to advances in life sciences.

**Related OBSERVE Radar Elements**

Microfluidics advancing Lab-on-a-Chip-technologies & other new applications T5
Enhanced bloodtest functionality N&T11
Fast HIV detection N&T10
Micromotors in nano-scale micro-electro-mechanical systems T36
Cancer-detection in real-time T31

**Related FET Proactive Consultation Contributions**

IDAlert (self diagnosis device)
Biosensors for Point-of-Care Applications
Detecting risk factors for Alzheimer's disease decades before disease onset to enable early therapeutic intervention



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11

# Global Enabling Infrastructures for New Economic Patterns

A number of items captured in the OBSERVE radar reflect on emerging new economic models, the related modes of production and consumption and associated societal and technical transformations. One aspect often stressed is the emergence of a new type of distributed infrastructures for these emerging patterns.

**Related OBSERVE Radar Elements**
Time as money SP2
Postcapitalist economy H10
Global Challenge: Transnational organized crime N3
Distributed collaboration platforms (eg. blockchain) H9

**Related FET Proactive Consultation Contributions**
How much is a bitcoin worth, and why?



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12

# Dormant Effects of Climate Change

The dynamics and effects of climate change are subject to intense research in many disciplines. Researchers from all-over the world point to the increasing likelihood of yet unknown catastrophic events as well as severe health risks and urge acting now. While some aspects are widely researched and discussed, the OBSERVE screening brought up also less explored aspects such as the rise of wildfires, possible emergence of super-storms and effects on soil bacteria.

**Related OBSERVE Radar Elements**
Effects of climate change N&S24



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13

# Emergency Preparedness

Several of the findings of the OBSERVE screening point to possible disruptive events that may lead to emergency situations for human societies. At the same time the findings include strategies to deal with and prepare for specific threats and for disruptive change in general.

**Related OBSERVE Radar Elements**
Post antibiotics N&S12
Threat of "space weather" N9
Pandemics strategy N13
Big data supported crisis management N&T17
Submarine Cables for Environmental Monitoring H8
Decline in solar activity by 2030 N10
Universal software bug N8
3D printed emergency shelter N&T5
Distributed collaboration platforms H9

**Related FET Proactive Consultation Contributions**
FORMAL VERIFICATION OF SAFETY-CRITICAL DISTRIBUTED SYSTEMS
Protection of the Sun against energy informational fields
Development of the telescope for supervision in a range of vibrations of zero energy
Detection of tunnels with hydrocarbons which will rescue a civilization from de-struction



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14

# Groundbreaking Food Supply Systems

Feeding the world without transgressing the earth's carrying capacity is one of the key challenges of the future that is also deeply related to other challenges such as water, energy, housing and health. In the near future we have to produce 70% more food than today without harming the environment. Meanwhile, the decrease in variety in plant and animal based food (eg rice/apples) is making food systems more susceptible to pests and diseases. Globally dependency on grain imports is on the rise. Production of meat and fish is rising steeply. At the same time ever more people advocate fundamental changes in human animal relationships. Technical approaches to food production such as smart floating farms, high-tech urban farming (e.g. vertical aquaponic growing system), fully automated and artificial food abound. Another angle is the reduction of food waste. Finally, there is a growing threat from foodborne diseases. Research addressing infection or intoxication caused by pathogenic factors entering into human bodies through food is one of the most dynamic fields in agricultural, plant and animal sciences.

**Related OBSERVE Radar Elements**
Food systems H11
Synthetic food H22
Automated indoor farming T11
Human animal relationship H15



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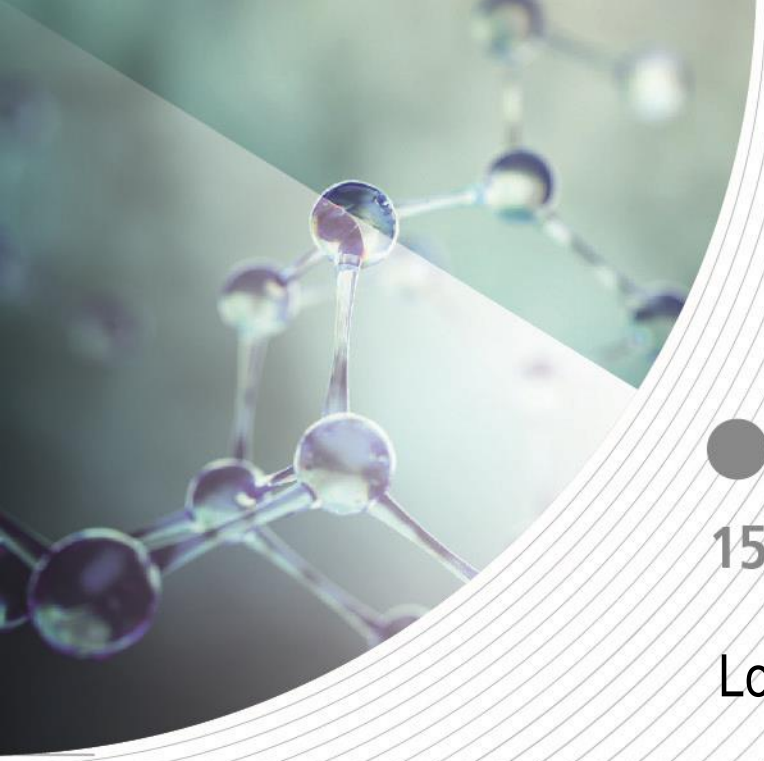

15

# Low Footprint Chemical Processes

Already in 1998 scientists developed 12 principles of “green chemistry” underpinning more environmentally benign chemical processes with e.g. less waste, higher efficiency and toxicity to human health and the environment. Several findings of the OBSERVE analysis relate to these principles indicating that this domain is still a highly active and future relevant domain for research and innovation with room for disruptive and foundational approaches with substantial sustainability benefit.

**Related OBSERVE Radar Elements**

Emerging research front: Metal organic materials with optimal adsorption thermodynamics and kinetics for CO2 separation S14
Emerging research front: Magnetically retrievable nanocatalysts S16
Research front: Functional metal organic frameworks N&S20
Emerging research front: Synthesis of copolymers by direct arylation polycondensation S15
Emerging research front: Enhanced Visible Light photocatalysts N&S23
Research front: Synthesis of pillar [5/6] arenes & their host guest chemistry S9
Emerging research front: Photoinitiated polymerization and Photoinitiators S17



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16

# Understanding Beneficial Human Machine Symbiosis

New forms of machine-human-symbiosis emerge on all levels and across types of activities. Aspects range from automation in all spheres of human activities to augmentation of intimate functions within the human body. In spite of frantic research in many of the aspects many argue that there is still little progress in understanding human machine interaction patterns that truly benefit our societies.

**Related OBSERVE Radar Elements**

Machine Society H18
Modelling the human SP&T2
Automation H4
Technological Singularity H16
Human enhancement H1
Robot reasoning H26
Virtual Personal Assistant Bots T1
Fully autonomous production organism T17
Rise of the drones T2
Cognitive overburden through perpetual evaluation SP6
The human brain in the digital society C6
Implants that store and transfer data SP&T5
Optical implants N&T14
Automated indoor farming T11
Brain interfaces and implants T18
Robots will become more human-like as their vocabulary comes closer to that of real humans T25
Insights from cognition research and biology may enable better Ambient Intelligence (AmI) systems T27

**Related FET Proactive Consultation Contributions**

Home in a networked world; or rethinking architecture
Adaptive bioelectronics



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17

# Socio-Technical Internet Futures

The internet will change in a technical and in a social way. Several debates are evolving around its long-term future. Some expect that smaller and more specific networks may emerge where processing power and intelligence is distributed to “smart-hotspots” that facilitate seamless local interaction between diverse networked people and things (IFTF). Others speculate about the way the digital and physical world may be interwoven in the future e.g. in a screenless “Internet **in** things” or a fully ambient user experience. At the same time some observers warn that even today’s expectations on the “Internet of Things” may be inflated and serious infrastructure bottlenecks are looming. Finally, efforts are under way to provide remote and mobile internet access points to the internet e.g. through drones or even satellites. On the societal side, the rise of non human traffic, trolls, viruses and abusive behaviour is raising concerns that trust in virtual communication is being undermined. Media and artists are increasingly pointing to the dark sides of the internet. Implementation of the “right to be forgotten” in the internet remains controversial. Attempts to create “offline spaces” are on the rise.

**Related OBSERVE Radar Elements**
Internet Futures H17

**Related FET Proactive Consultation Contribution**
Internet of People



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18

# New Ways of Exploiting Functions of Living Organisms

Several of the findings from the OBSERVE screening point towards novel ways of using living organisms such as bacteria or plants for fulfilling useful functions. Approaches range from using plants as environmental sensors and connecting them to sensor networks to bacteria-robot model systems.

**Related OBSERVE Radar Elements**

Biomanufacturing C4
Bacteria-robot model systems T21
Yeast that makes opiate-like molecules out of sugar N&S2
Bugs not drugs/the Microbiome S7, SP&S1
Moss walls for air cleaning SI2
Bio-sensors - Using plants as environmental sensors and connecting them to sensor networks T8



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19

# Mixed Realities for Extended Human Sensation

Several sources argue that we are entering the age of multiple realities. Technologies and practices which allow us to experience augmented or virtual reality are extremely prominent in the current discourse: 360 degree videos, advanced vr-gaming, vr-therapy, a real time painting 3D-model translator, vr development tools for animations, paint applications for oculus rift and space experiences. Virtualization and wearable computing devices are expected to combine to create a new wave of social technology. Oculus Rift already allows users to virtually explore real environments from the perspective of a child, and wearable recording devices are beginning to capture the details of everyday life. Developments like the personal headphones which can filter out unwanted noise point to a world where “reality will be in the eye (and ear) of the beholder”. VR and augmented reality topics are one of the most popular areas on Kickstarter. Science fiction novels envisage nano-cells on the skin that simulate an environment for the body that can be felt, heard and seen. Some observers argue that long term visions for “virtual reality societies” are lacking and several challenges remain.

**Related OBSERVE Radar Elements**
Mixed Realities H25



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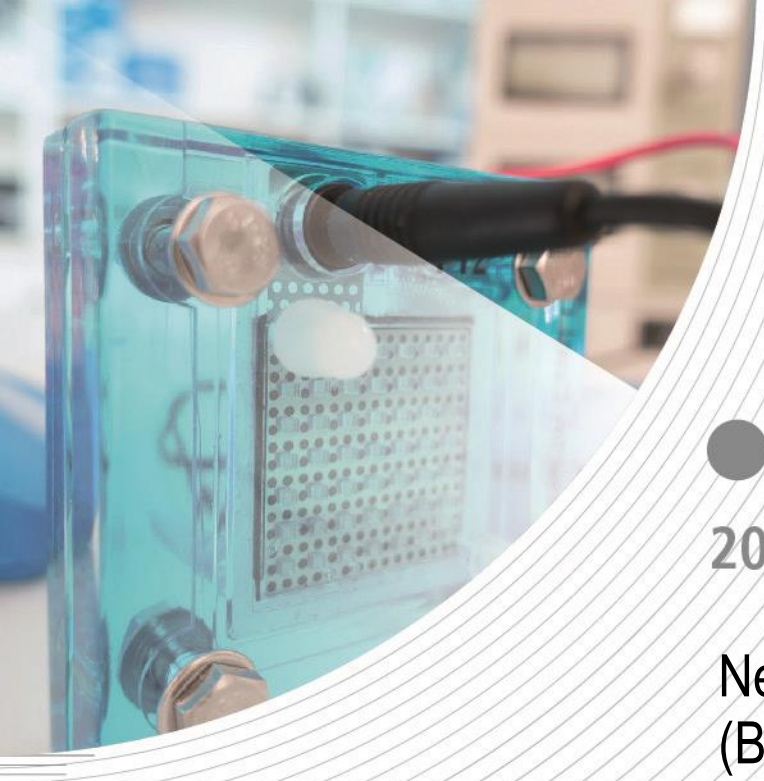

20

# Next Generation Energy Storage (Beyond Lithium)

Research and innovation in energy storage is highly dynamic driven by the rise of decentralised and renewable energy solutions. Important aspects are energy conversion efficiency, speed of storage, cost effectiveness and use of materials with low environmental and social impact. The field includes several potentially disruptive developments that go beyond today's lithium battery based solutions.

**Related OBSERVE Radar Elements**

Organic flow batteries N&S7
Emerging research front: Supercapacitors from nanoporous carbon electrode N&S22
Research front: Electrode materials for sodium-ion batteries N&S19
Global Challenge: Energy demand N2
Reversible heat pump for energy storage N&T1
Decentralisation of energy supply N&T2



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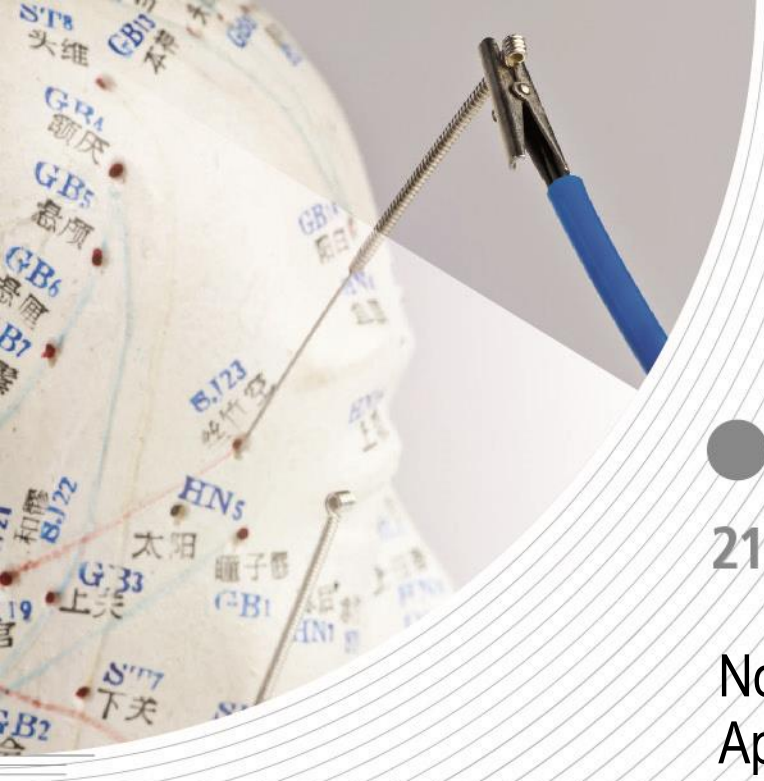

21

# Novel/unconventional Therapeutic Approaches

Several of the OBSERVE findings refer to novel unconventional therapies for different diseases ranging from functionalised nanoparticles for bio- and biomedical technologies to rising interest of scientists in traditional medicine.

**Related OBSERVE Radar Elements**

Prevent/repair heart attack N&S1
Nano needles in regenerative medicine N&S5
New methods for drug delivery inside the body N&S9
Spontaneous regression N&S11
Treating phantom pain with a mirror SP&S2
Rising interest in traditional medicine C5
Self-tracking pill N&T19
Self-Propelled particles for treating severe bleeding T12
Emerging research front: Control and treatment of schistosomiasis in Africa using the drug praziquantel N&S13
Research front: Newly emerging psychoactive substances (new designer drugs) N&S17

**Related FET Proactive Consultation Contributions**

Electromagnetic medicine (EMF-MED)
Emergent personalized nanomedicine
Functionalized Nanoparticles for Bio- and Biomedical Technologies



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22

# Privacy Providing Systems

Privacy issues are an important element in current future oriented debates especially in the context of the rising use of big data analytics, face recognition and concepts like the internet of things or industry 4.0 on the one hand and concentration of user data in the hands of very few private companies on the other. Two OBSERVE emerging topics highlight the type of disruptive pathways that may be emerging both in terms of privacy threats and privacy solutions.

**Related OBSERVE Radar Elements**
Extraordinary advances in facial recognition cause huge privacy issues N&T9
Privacy preserving technologies N&T12



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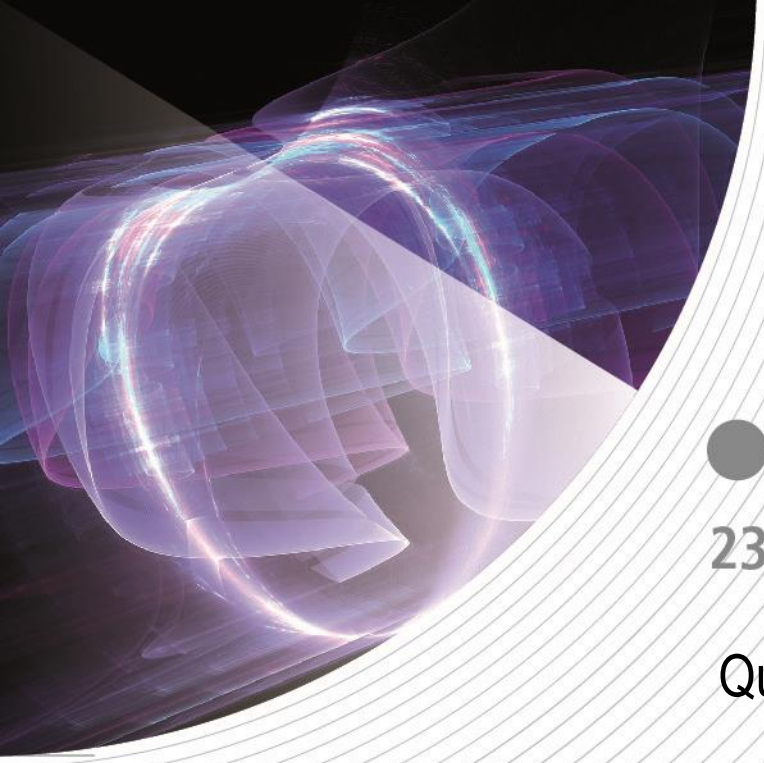

23

# Quantum Research

A number of topics that emerged in the OBSERVE screening deal with quantum research. Aspects cover basic research needs and novel applications but also possible consequences for society such as challenges to established cryptography approaches.

**Related OBSERVE Radar Elements**

Physicists set a new fiber-optic quantum teleportation record S5
Research front: Synthesis and application of graphene quantum dots S21
Quantum computing challenges cryptography N&T8
Quantum squeezing S3
Quantum technology will move from basic research to applications T30
Quantum Computing: Combining advances in quantum technology and Photonics to realize a quantum computer T33

**Related FET Proactive Consultation Contributions**

Quantum Nanophotonics
NanoPhononics for Europe: Position, Strategic Agenda and Roadmap



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24

# Unlocking Opportunities by Embracing Complexity

Complexity is increasingly recognised both as a challenge and an opportunity in a wide range of science and practice domains. In the very rich and often controversial debate three aspects could be distinguished: Recognising and observing complex processes, decision making in the face of uncertainty, and approaches to embracing and even governing complexity. A central crosscutting aspect is the exploration of human thinking, decision making and behaviour as such.

**Related OBSERVE Radar Elements**

Rise of complexity science H7
Multi-disciplinary simulation research C2
Data vs. Intuition? N7
Freakthinking SP&S3
Invisible human impact N&T18
Global ethics N1
Global foresight/decision making N5
New kinds of sensors and their smart connection will give us a new level of control over our surroundings T16
Intelligent combination of sensor-data replaces traditional technologies for authorization, monitoring and observation T10
Brain understanding S19
Understanding and influencing human behaviour H23
Faster computers and newly available massive data hold the key for problems deemed too difficult to solve in the past T35

**Related FET Proactive Consultation Contributions**

Foundations and Engineering of Collective Adaptive Systems (FoCAS)
Beyond Digital; Algorithms under Uncertainty
Predictable components, systems and systems of systems
Global Systems Science; The Big Switch
Theory of Evolving Systems; Practice and the Dynamism of Form
A “game changing” science of structures



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25

# Re-Engineering Life

Several findings of the OBSERVE screening can be grouped under this heading as these approaches are actively attempting to push current boundaries of synthetically modifying or even creating life or else reflecting on the societal implications of such activities. Examples are debates on synthetic DNA, artificial brains and the emergence of an artificial superintelligence (technological singularity).

**Related OBSERVE Radar Elements**
Emerging research front: CRISPR/CAS Genome-editing technology S8
Synthetic DNA S2
Bio patent conflicts - who owns your body? SP&T6
Artificial brain S12
Brain cell transplantation N&S4
Technological Singularity H16
Robot reasoning H26

**Related FET Proactive Consultation Contributions**
3D BIOPRINTING EUROPE



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26

# Shifts in Research Practices

The OBSERVE screening revealed debates around changes in research practices. Some are driven by societal demands such as gender equality, transparency, citizen participation and animal rights others stem from shifts in scientific approaches such as increasing use of computational methods and integration of arts into research practices.

**Related OBSERVE Radar Elements**
Distributed collaboration platforms H9
Scientists share their embarrassing #fieldworkfail stories SP5
Gendering in research innovation H13
Human animal relationship H15
Bioinformatics S18
Research front: Human disease analysis using Genome Wide Association studies N&S18
Digital humanities C1
Multi-disciplinary simulation research C2

**Related FET Proactive Consultation Contributions**
Fully integrating Arts in the S&T research and innovation agenda: the role of imagining and making in the creation of knowledge for innovation



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27

# Robotic Frontiers

Throughout the OBSERVE screening period robotics was an extremely dynamic field both in S&T sources and wider public debate. This was driven on the one hand by spectacular breakthroughs most notably in the field of deep learning and autonomous robotics. On the other hand social experiments and art projects such as the hitchhiking robot and the trust inspiring robot (Boxie) as well as popular fiction and movies featuring robots and AI fuelled the robotics discourse. Finally, in the ongoing debates around automation of ever more human activities and industry 4.0 robots form a core element. Aspects related to new forms of interactions between humans and machines are captured under human machine symbiosis.

**Related OBSERVE Radar Elements**
Robot to robot collaborations T23
Robot learning T24
Robot reasoning H26
Bacteria-robot model systems T21
New materials for robot parts T22
Interdisciplinary research to build context-aware robots T7

**Related FET Proactive Consultation Contributions**
Soft Robotics: the way for bringing science-based robotics to Society



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28

# Multi-Signal Sensing Systems

Novel developments in sensing are mainly driven by the use of new materials and new concepts. This includes social innovations such as citizen driven measuring and monitoring initiatives. At the same time urgent requirements such as measurement of ocean acidification are calling for novel solutions.

**Related OBSERVE Radar Elements**
New sensors to measure ocean acidification T13
Emerging research front: Synthesis of copolymers by direct arylation polycondensation S15
Motion microscope N&T16
Distributed collaboration platforms H9
Intelligent combination of sensor-data replaces traditional technologies for authorization, monitoring and observation T10
Bio-sensors - Using plants as environmental sensors and connecting them to sensor networks T8

**Related FET Proactive Consultation Contributions**
Drone technology for conservation



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29

# Shifting Understanding of Life and its Boundaries

Our perception of what it means to be human and what characterises other species is shifting. Boundaries between humans and animals on the one hand and humans animals and machines on the other are blurring. Also plants are increasingly viewed in a new perspective e.g. as active communicators. New research methods transform the way we analyse species evolution.

**Related OBSERVE Radar Elements**
Plant communication H14
Human animal relationship H15
Technological Singularity H16
Robot reasoning H26
Research front: Models for predicting potential distributions of species N&S15
Bacteria-robot model systems T21



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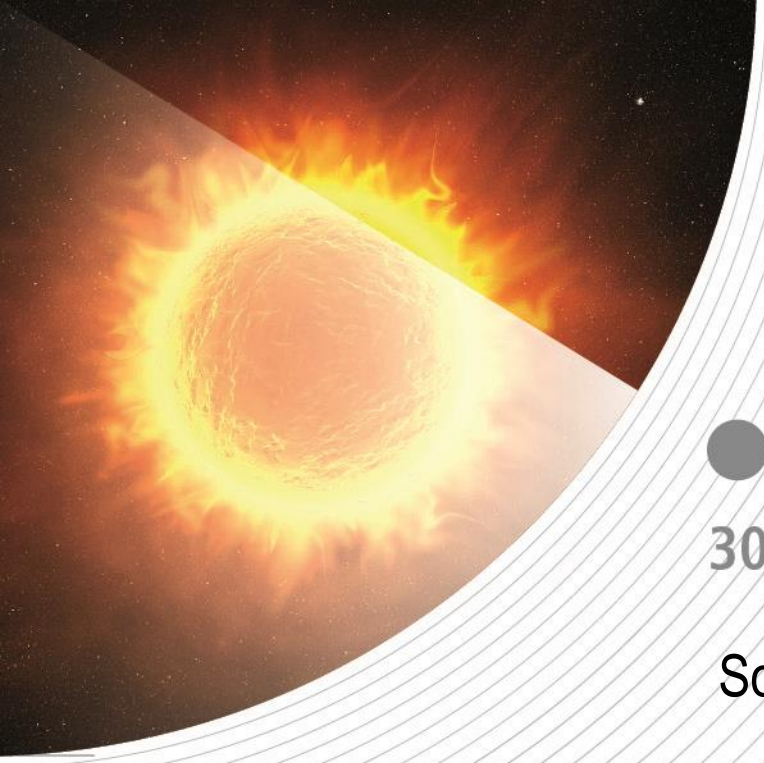

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# Solar Age

The reinforced search for renewable energy sources forwards the solar technology and solar installations in generally. New designs and materials for solar cells, solar powered devices and monitoring of favourable conditions for solar panel installation (e.g. in space) were key topics in the current debate. Several research aspects in chemistry, material science but also social sciences emerged.

**Related OBSERVE Radar Elements**
Solar Age H20
Research front: Graphene-based photocatalysts N&S21
Emerging research front: Synthesis of copolymers by direct arylation polycondensation S15
Decline in solar activity by 2030 N10



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# Future Living Spaces

Several emerging topics relate to sustainable living spaces both in urban and rural areas. A particular focus could be on the question of how to dwell in a networked world. As highlighted by one contribution to the FET Proactive consultation there is an urgent need to rethink our approaches to the “built environment” and realise the high potential of cross-disciplinary research on adaptation of spaces to human needs.

**Related OBSERVE Radar Elements**
Sustainable Housing H29
Urban catalysts C3
Urban system design H6
Cycling Futures SP1
Moss walls for air cleaning SI2
Bee highway SI6
Wooden material on the rise SP&T1
Personal Heating N&T13
Mobility futures H19
Rise of the drones T2

**Related FET Proactive Consultation Contributions**
Home in a networked world; or rethinking architecture



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# Diverse Unconventional Energy Supply Solutions

Meeting global energy demand in a sustainable manner is one of the most discussed global challenges. In parallel to the mainstream lines of research for new energy technologies and concepts more unconventional approaches are followed by several research and innovation teams. In line with the diversification of energy technologies, innovations in grids and overall system designs are key topics of the debate on energy futures. A particular focus is on the decentralisation of energy supply.

**Related OBSERVE Radar Elements**
Global Challenge: Energy demand N2
Unconventional energy sources N&T15
Local energy production will power the smart grid SI1
Decentralisation of energy supply N&T2
Wireless transfer of electricity T9
Energy Harvesting T4
Energy from oxidation in human bodies N&T4

**Related FET Proactive Consultation Contributions**
Energy sustainable ICT
Powering the Internet of Things
Demonstration Project of full scale floating prototype for Offshore Wind Market



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# Underwater Operations

Preparing for underwater operations emerges as a highly dynamic domain for research and innovation in a wide range of fields. Key issues are underwater: -gardening, -living, -(mini)robots, -cities, -streetview, -radio (graphene), -chemical plants, -charging, -flight, -volcanoes, -farms, -archaeology, -screening radar, -energy (wave/wind farms) and materials for underwater use.

**Related OBSERVE Radar Elements**
Underwater H24



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# Water Challenge

Water and especially clean water is becoming a scarce resource in ever more areas as climate change threatens water security. We need global strategies to prevent this or deal with. Implementation of existing strategies such as the European Water Framework Directive (WFD) requires suitable tools and methods. Water was one of the most addressed topics in 2015 science related tweets. Topics were water: -generation, -cleaning, -recycling, -pollution, -splitting, -based energy generation, -saving and -quality monitoring as well as measures dealing with droughts. Ways of measuring the quality of oceans, coastal and transitional waters is becoming an important research front in ecology. Another strand of debate is focussing on the future of oceans. Research on the impact of ocean acidification on marine ecosystems is growing fast. Artists such as Maarten Vanden Eynde (plastic reef) point towards the rise of plastic debris in the ocean – a topic that is also much discussed in science publications and media in general.

**Related OBSERVE Radar Elements**
Water Challenge N&S14
Decline of microscopic plant-life in oceans N&S10
Electric bio rocks save coral reefs N&T3
New sensors to measure ocean acidification T13
Noise pollution in sea threatens whales N6
Research front: Effects of ocean acidification on marine ecosystems N&S 24

**Related FET Proactive Consultation Contributions**
FET in water and for water



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