

# THINGS TO COME

## A TIMELINE OF FUTURE TECHNOLOGY

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"The times," someone once said, "they are a-changin'"—and nowhere is this truer than with technology. But any technological forecast of the future is a shaky sort of structure, at best—built on a quicksand foundation and liable to collapse at any time. With that caveat firmly in mind, we've assembled this speculative peek around the corner, to glimpse just a few of the many marvelous things to come.

**2019**

### EYE-CONTROLLED TECHNOLOGY

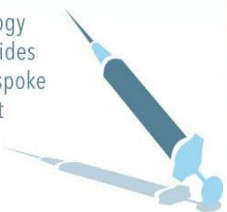
Advances in face and movement recognition software usher in an age of machines that are controlled by gestures or eye movements.



**2023**

### DESIGNER ANTIBIOTICS

Bottom-up technology for building macrolides allow for cheap, bespoke antibiotics to defeat "superbugs."



**2026**

### SMART CLOTHING

Nanoporous fabrics, miniaturized electronics, and haptic feedback make for "smart clothing" that change color or shape, and keep you cool or warm as the need arises.



**2028**

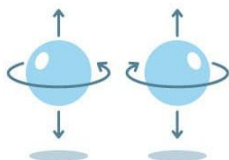
### VOLCANIC MINING

Precious metal and minerals extraction from active submarine volcanoes becomes feasible and economical.



### SPINTRONICS REVOLUTION

The rapid commercialization of "spintronics" (electron spin-orbit technology) revolutionizes smartphones, "smart" technology, and the IOT.



**2020**

### PAPER DIAGNOSTICS

Cheap diagnostic tools made of specially designed paper enable rapid screening for Ebola, tuberculosis, Zika, swine flu and many other diseases.



**2024**

### INGESTIBLE ROBOTS

Consumable, biocompatible microbots that repair our injuries from within.



**2027**

### PHOTONICS IN SPACE

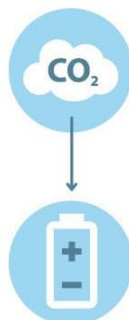
Photonics technology means increased bandwidth, a data rate 100s of times greater than RF, and lower power requirements for spacecraft communication.



**2029**

### CARBON-BREATHING BATTERIES

Electrochemical cells that suck in CO<sub>2</sub> to generate electricity and valuable byproducts, solving at once our power and pollution woes.



## 2030 SUPER ANTIVIRALS

Broad-spectrum antiviral drugs, based on the ISG15 mutation and other genetic therapies, arrive on the market.



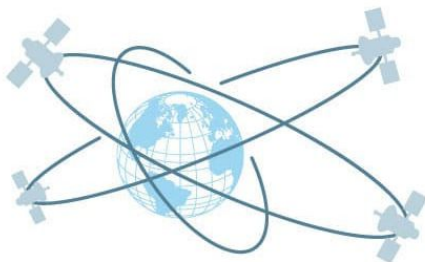
## 2032 OPTOGENETICS

After a decade of optogenetic engineering and research, neurological disorders such as Parkinson's, Alzheimer's, Tourette's, schizophrenia, autism, and many others become treatable.



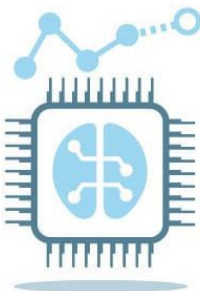
## 2034 UNHACKABLE QUANTUM INTERNET

A satellite network using entangled photons for quantum-key distribution (QKD) will create a fully secure, unhackable internet.



## 2036 THE NEXT EVOLUTION OF AI

Big data analytics and predictive AI come of age—from weather, to elections, to geopolitics, evolution, and much else, the future has become almost disappointingly predictable.



## DESIGNER MOLECULES

Artificial molecules made from "superatoms," with novel magnetic and chemical properties, enable the creation of revolutionary new materials.



## 2031 DIAMOND BATTERIES

"Nuclear batteries" are formed by encasing radioactive waste in artificial diamonds that convert radiation into electricity.



## 2033 NANO FEASIBILITY

Light-driven photomotors and DNA-inspired technology finally make for widespread, inexpensive nanotech.



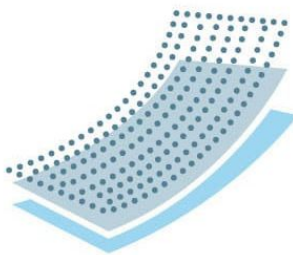
## CHEAP SOLAR POWER

Perovskite and organic solar cells near 100% efficiency; innovations in manufacturing techniques make solar power widely available.



## 2035 BIOMIMETIC MATERIALS

New materials, inspired by the behavior of living things, have led to self-cleaning clothing, self-repairing buildings, and the elimination of plastic packaging.



## 2037 3D PRINTING IN EVERY HOME

The ultimate in home shopping: cheap 3D printers in every home can print out almost anything—electronics, furniture, food, and medicine—from files purchased and downloaded from the internet.





## 2038 FULLY IMMERSIVE COMPUTER INTERFACE

Intuitive interaction with entertainment, infotainment, web-surfing and what have you through advances in VR/AR, projection mapping, haptics, and brain-computer interface.



## 2040 GENETIC COMPUTING

"Genetronics" comes of age—self-assembling microelectronics made of genetic material and DNA-based supercomputers smaller than a laptop.



## 2043 RAPID GENETIC SCREENING

Easy home genetic diagnostics lead to customized medicine, genomics-based drugs, and a revolution in the study of the genetic history of life.



## 2045 SPACE-BASED SOLAR ENERGY

The technology for space-based solar power broadcasting stations, and Earth-based receiving rectennas, finally becomes economically feasible.



## 2039 SELF-SUFFICIENT ENERGY ECOSYSTEM

Microbial fuel cells, anaerobic digestion tanks, lithium-ion batteries and solar cell technology mean that virtually every home is now a closed-loop, self-sustaining energy ecosystem.



## GERM-LINE GENETIC MODIFICATION

The first tentative legislation approving "designer babies" begins to appear in world legislative organs.



## 2041 HOLOGRAPHIC PETS

Holographic pets become the next "thing"—interactive AI holograms that express and respond to emotions. Holographic dating sites also take off.



## MICROWAVE ROCKETS

The use of gyrotron microwave arrays to beam lightweight rockets into orbit dramatically reduces the cost of space access.



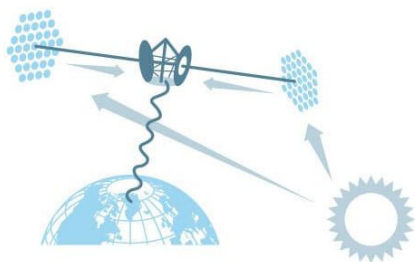
## 2044 FUSION POWER

Fusion power is commercially available; infrastructure plans are underway for converting the grid to at least 75% fusion-derived power in two decades.



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## ALGORITHMIC ADVANCES

Sophisticated algorithms—the product of advanced quantum computing—achieve wonders in medicine, astronomy, the search for extraterrestrial life, economics, architecture, and reconstructing the history of evolution on Earth.



## 2049 GEOENGINEERING

A program of calcite aerosol geoengineering begins to cool the planet and repair the ozone layer.



## 2053 GEONEUTRINO SATELLITES

Space-based geoneutrino telescopes enable high resolution imaging of the Earth's interior; similar telescopes probe the interiors of Jupiter and the Sun.



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## 2047 EVOLUTIONARY ENHANCEMENT

Genetic manipulation of the bone gene osteocrin creates individuals with a larger neocortex and enhanced cognition.



## 2050 CARBON SEQUESTRATION

Programs for injecting large amounts of atmospheric CO<sub>2</sub> into basaltic rock, for permanent storage, become practical, and are widely implemented.



## 2055 WAVETOP AND UNDERSEA CITIES

Undersea and floating cities, developed to mine deuterium fusion fuel from seawater, emerge as wealthy and powerful city-states in the second half of the 21st Century.



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## SOURCES:

Proceedings of the National Academy of Sciences, SmartThings Future Living Report, Scientific American, University of Bristol, and many more

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