

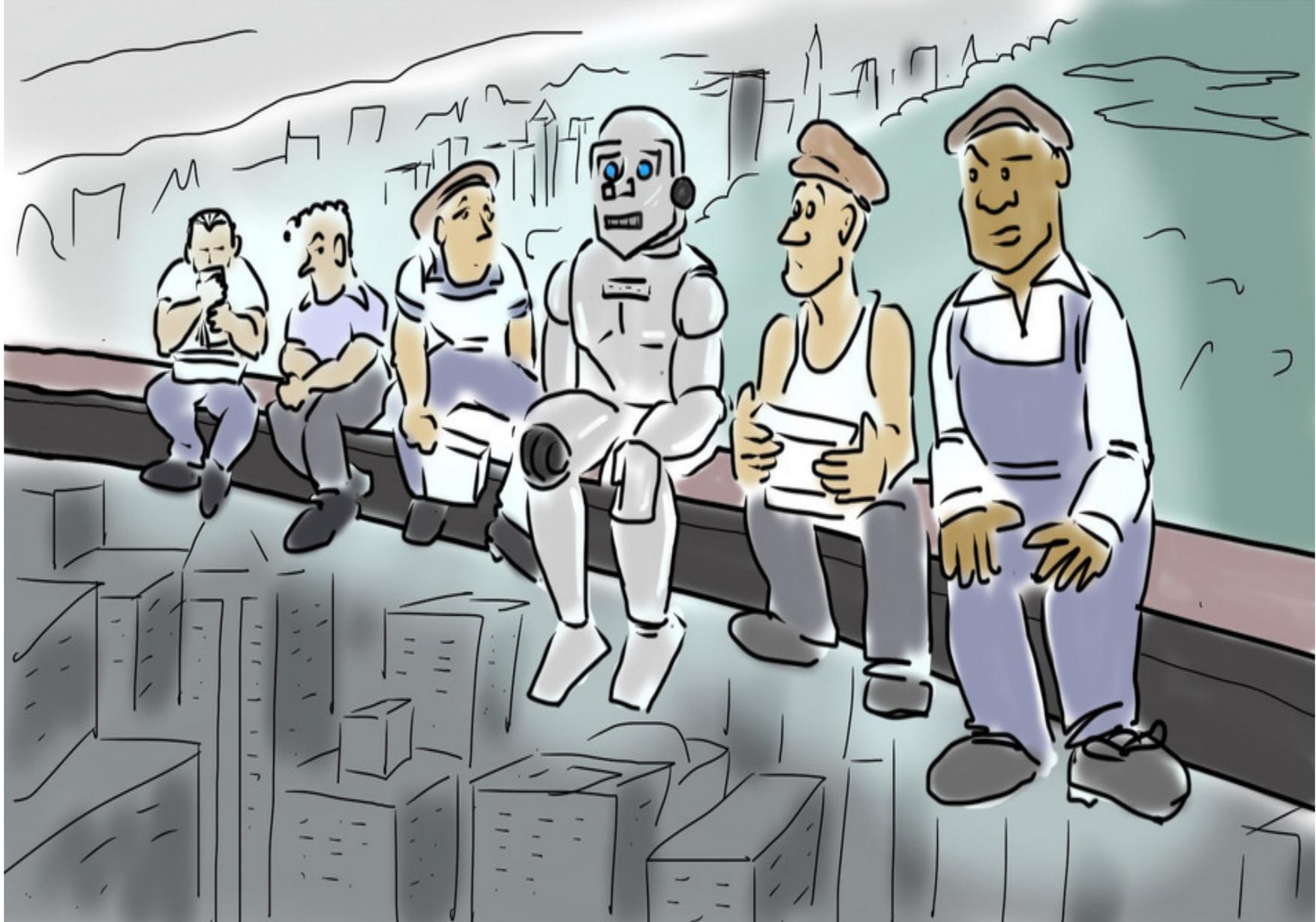
Humans & Humanoids

- an emerging partnership

Bob Bishop

ICES Foundation

Geneva, Switzerland



Isaac Asimov (1920-1992)

- Born Russia, family immigrated to Brooklyn, NYC
- Educated Columbia University
- Professor biochemistry at Boston University
- Wrote 500 books, including *I, Robot* and *Foundation*
- Coined the term *robotics*
- Coined the *3 Laws of Robotics*

Asimov's 3 Laws of Robotics

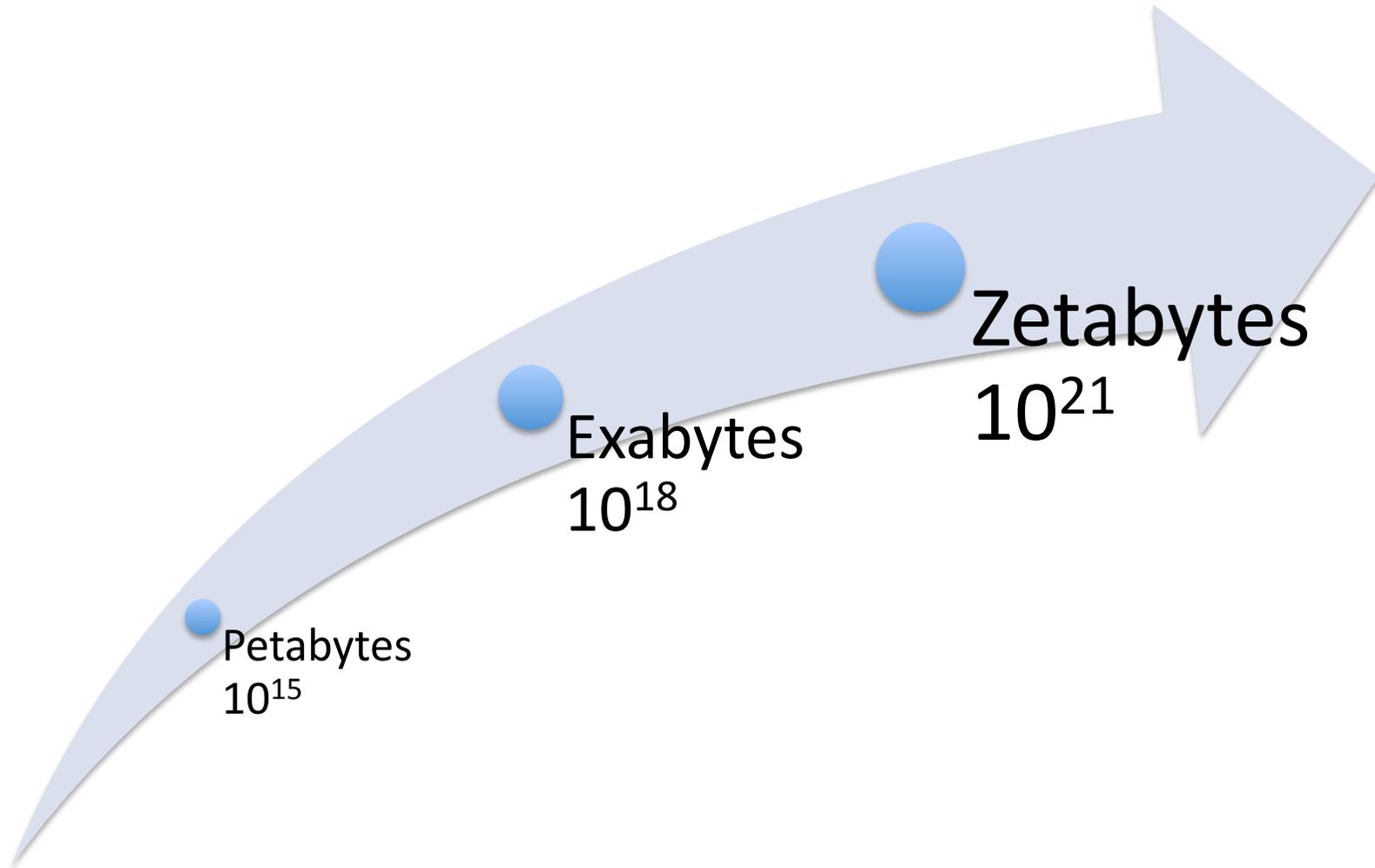
1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.



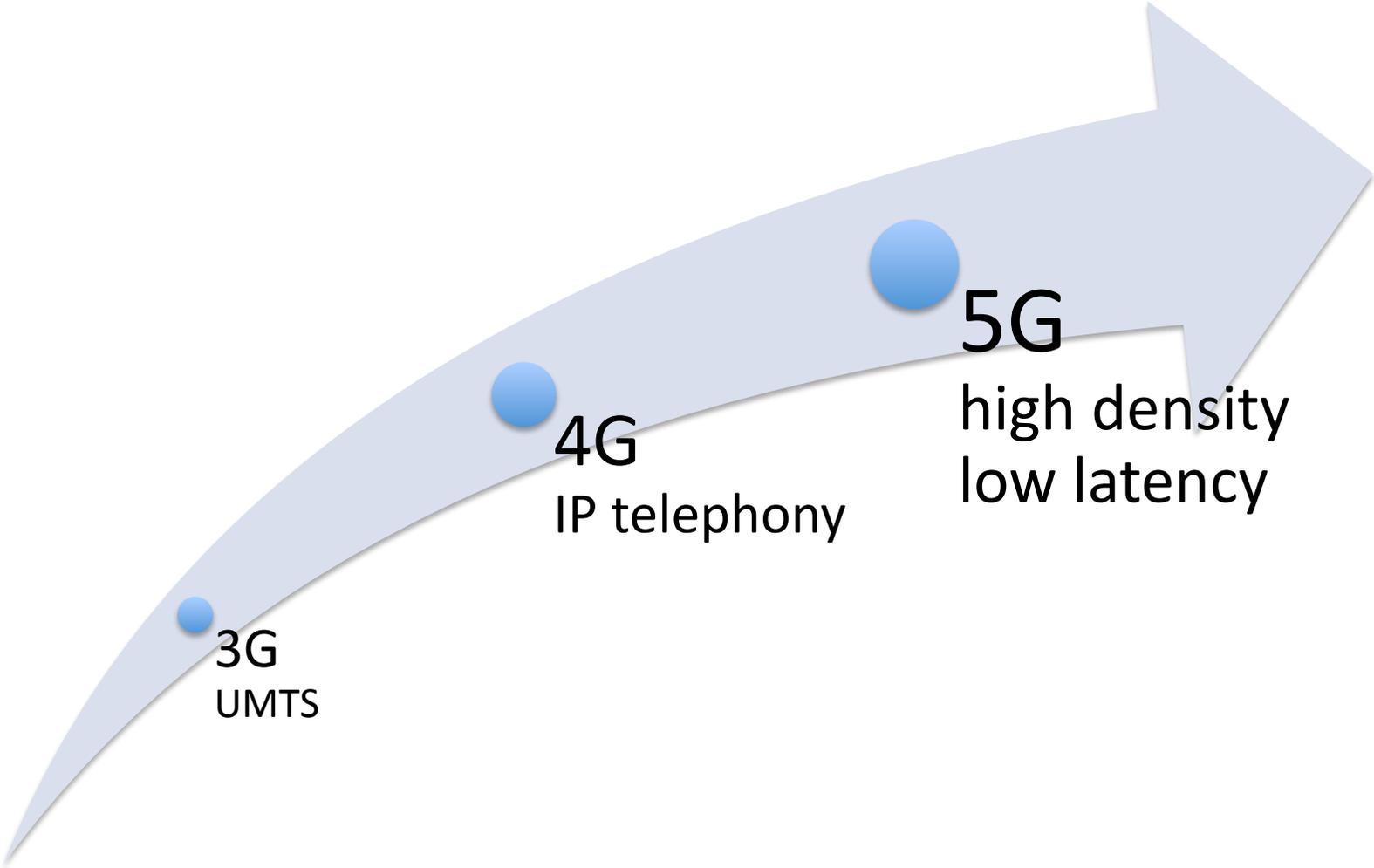
HONDA
The Power of Dreams

asimo.honda.com

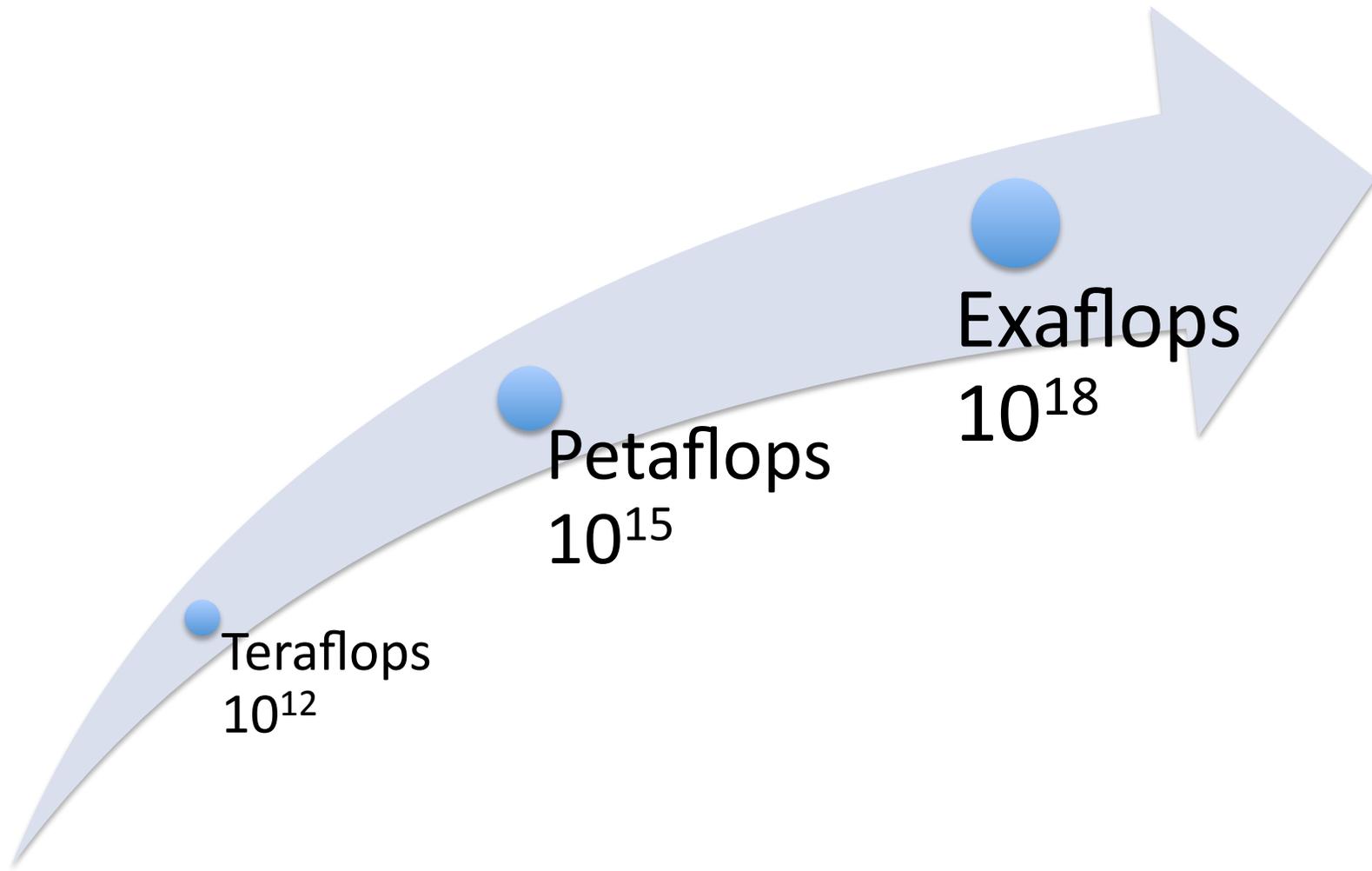
Deluge of Data



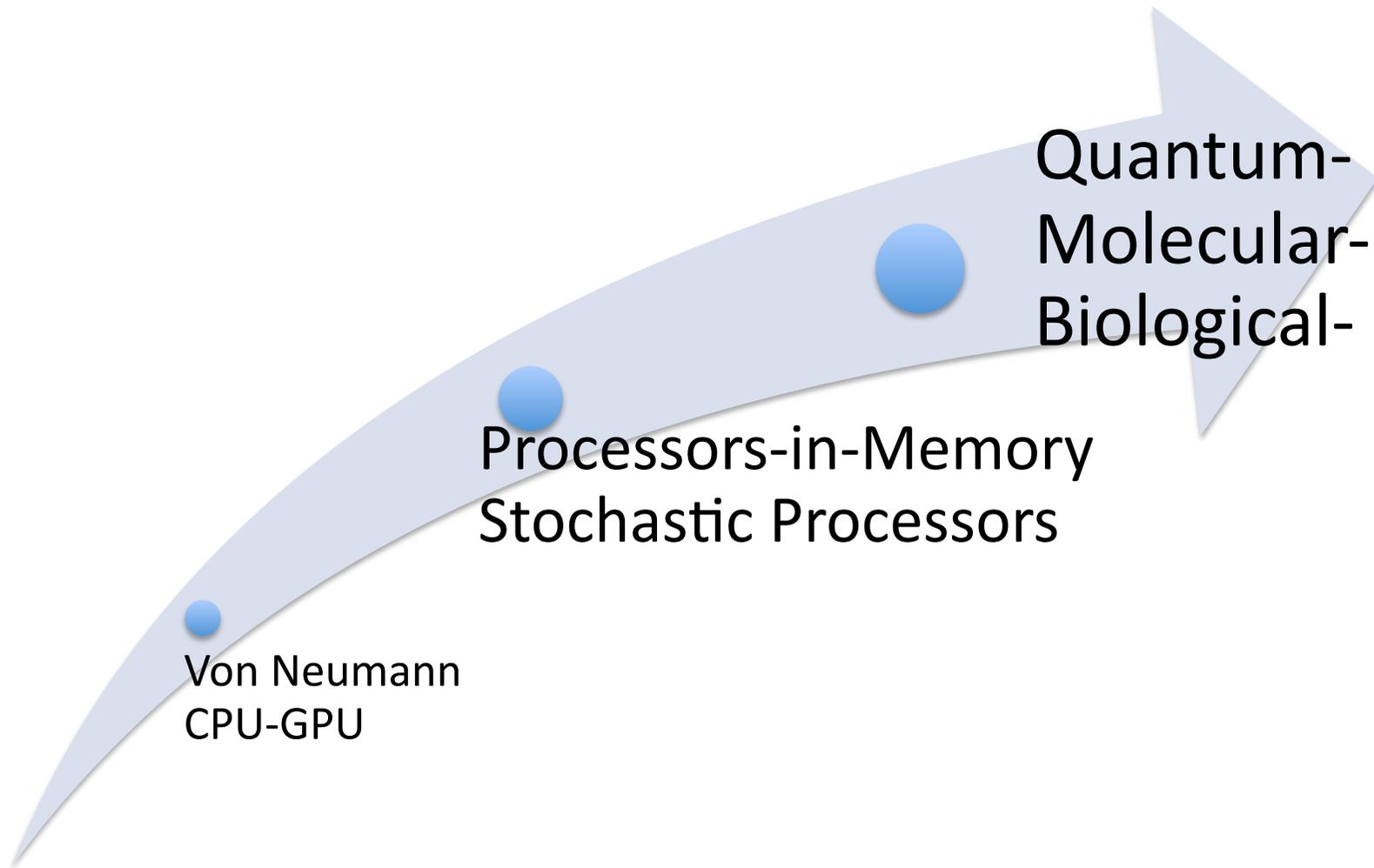
Plethora of Pipes



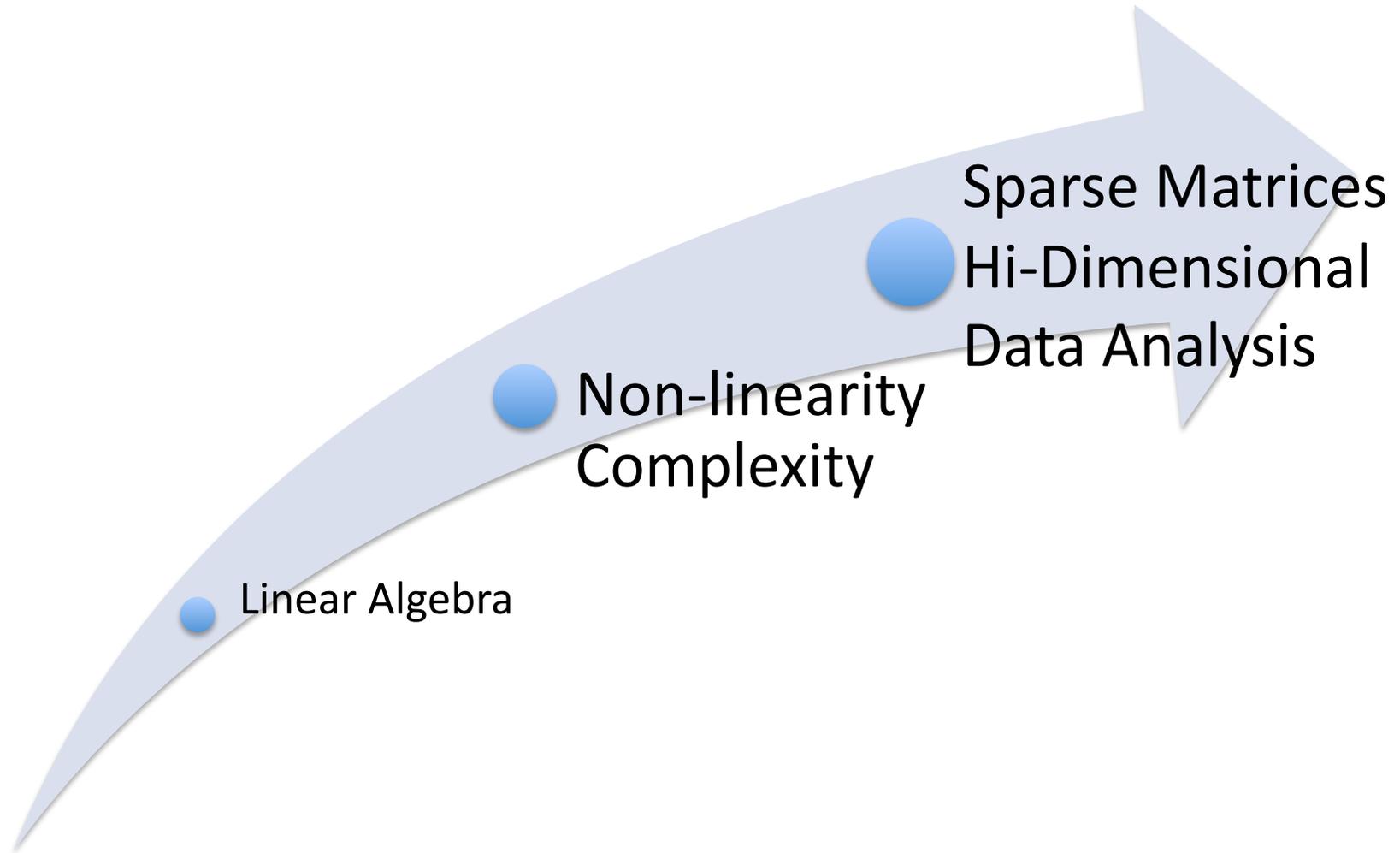
Fanfare of Flops



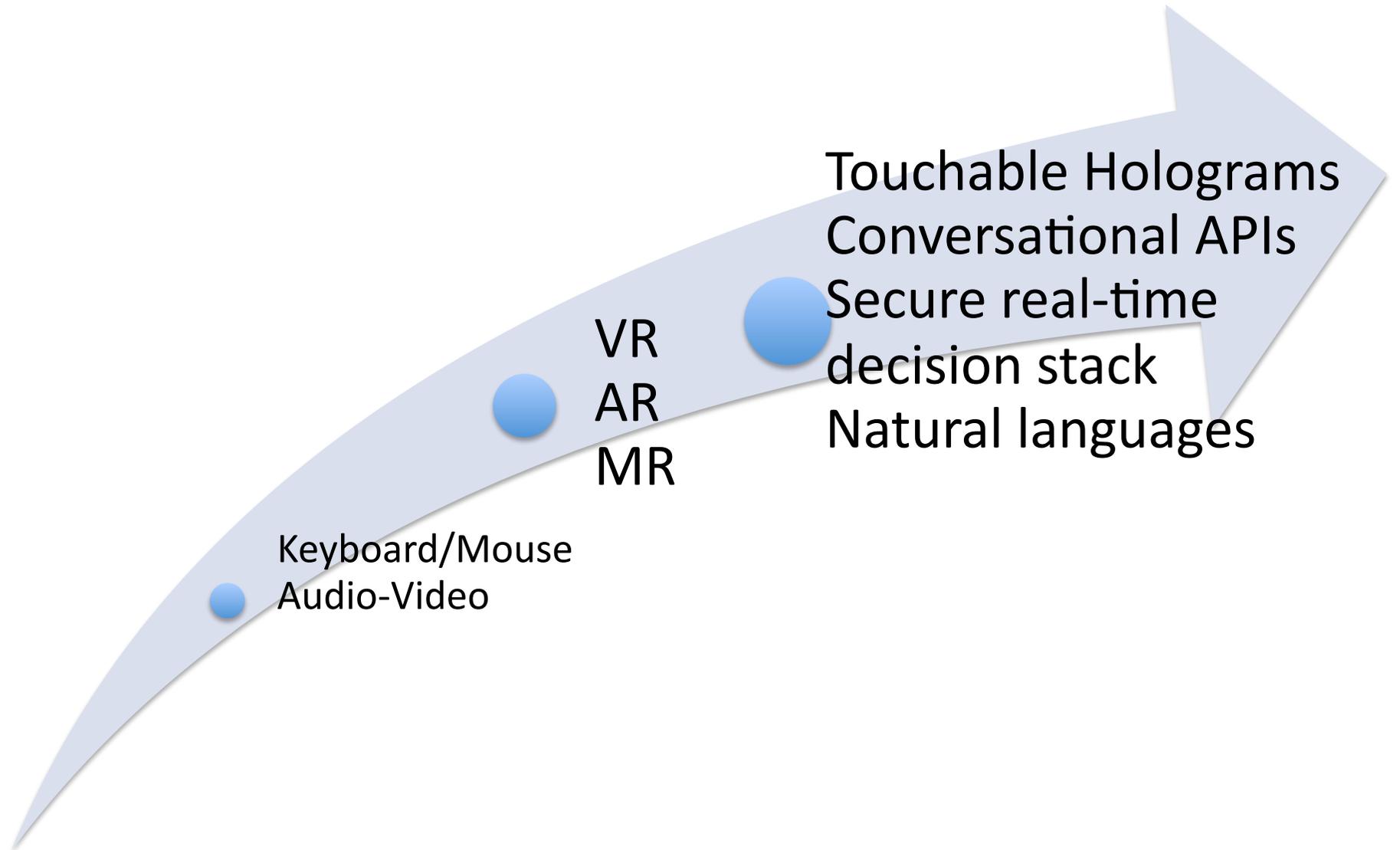
Arsenal of Architecture



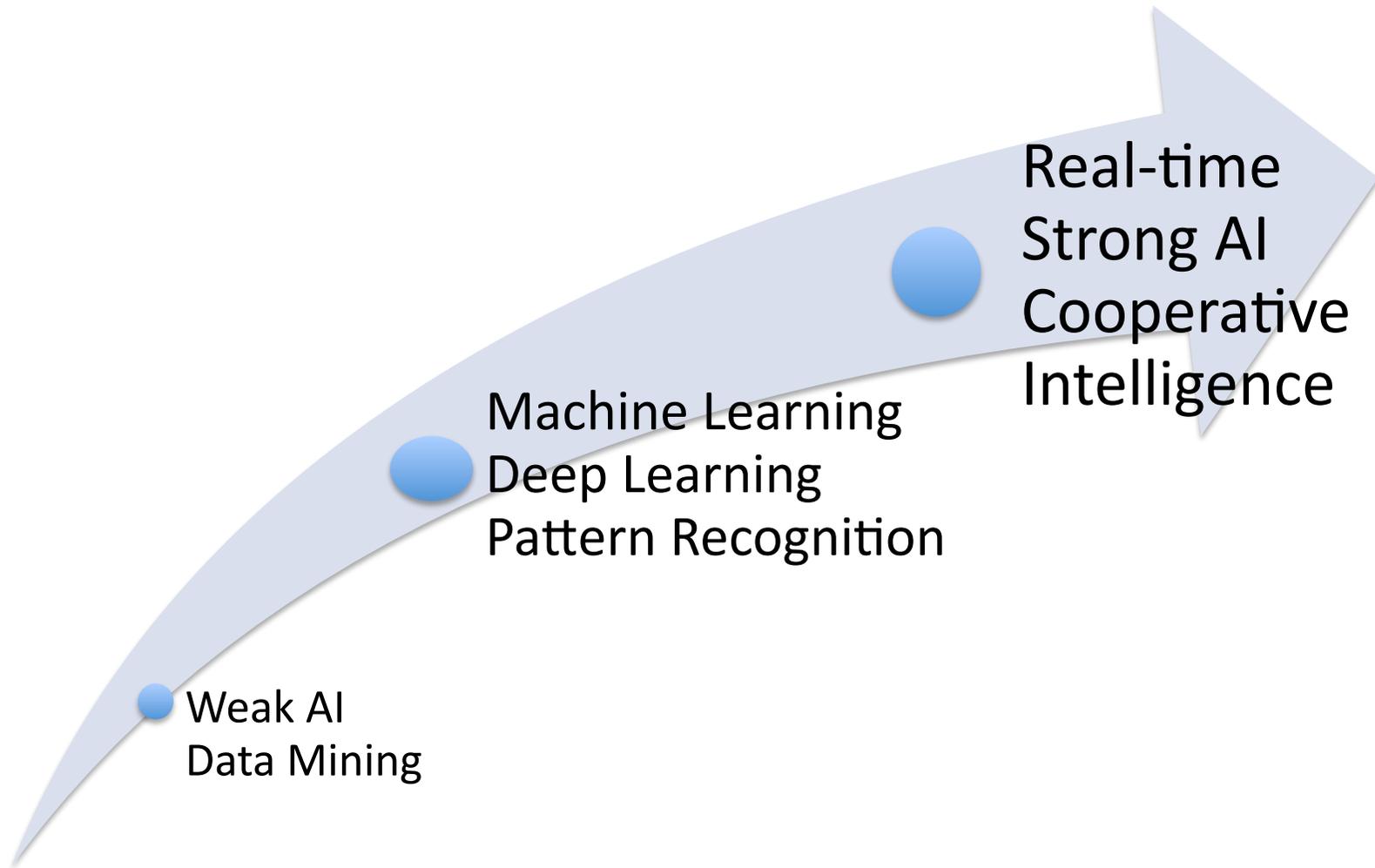
Swarm of Software



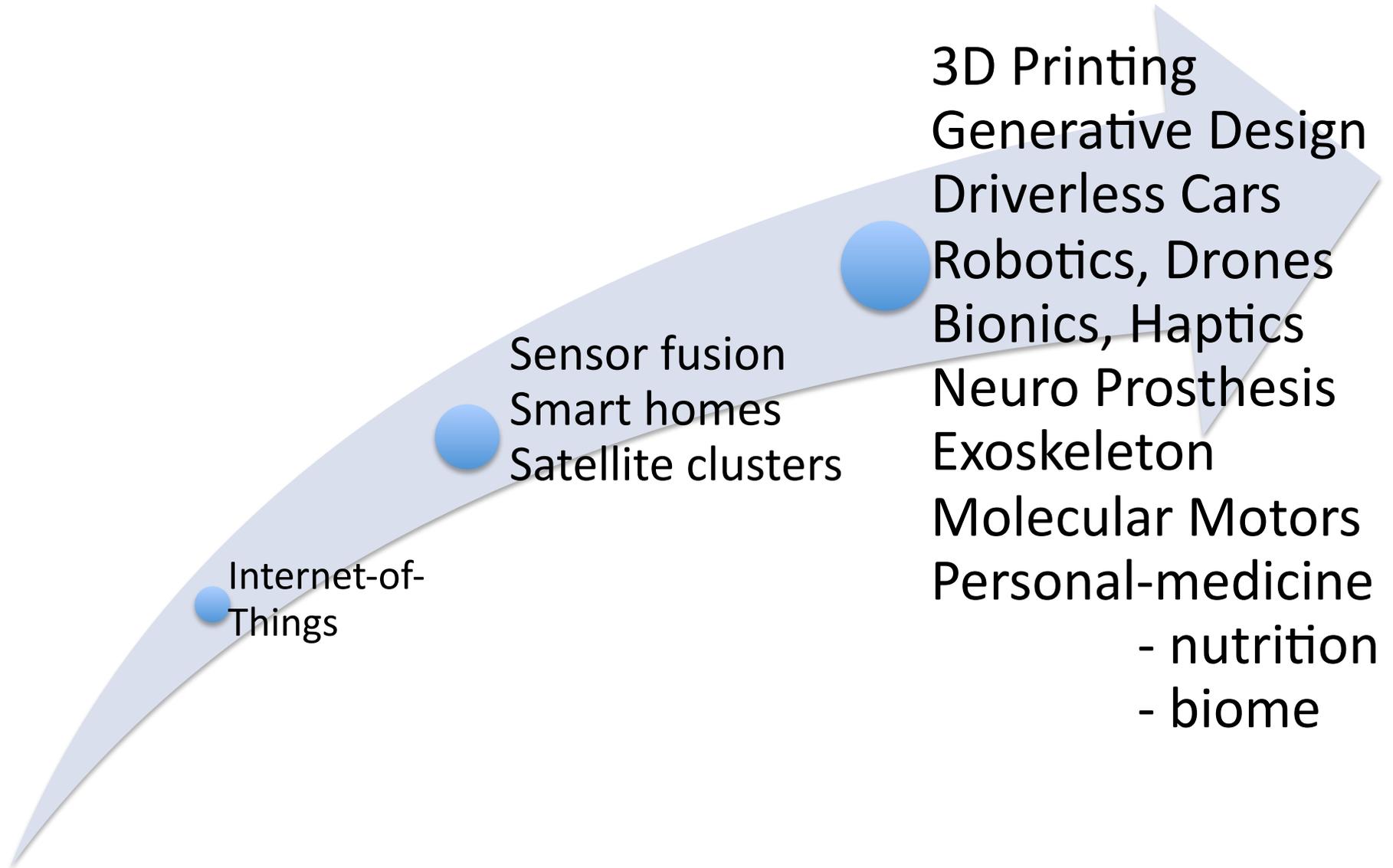
Marvels of Machine-Human Interface



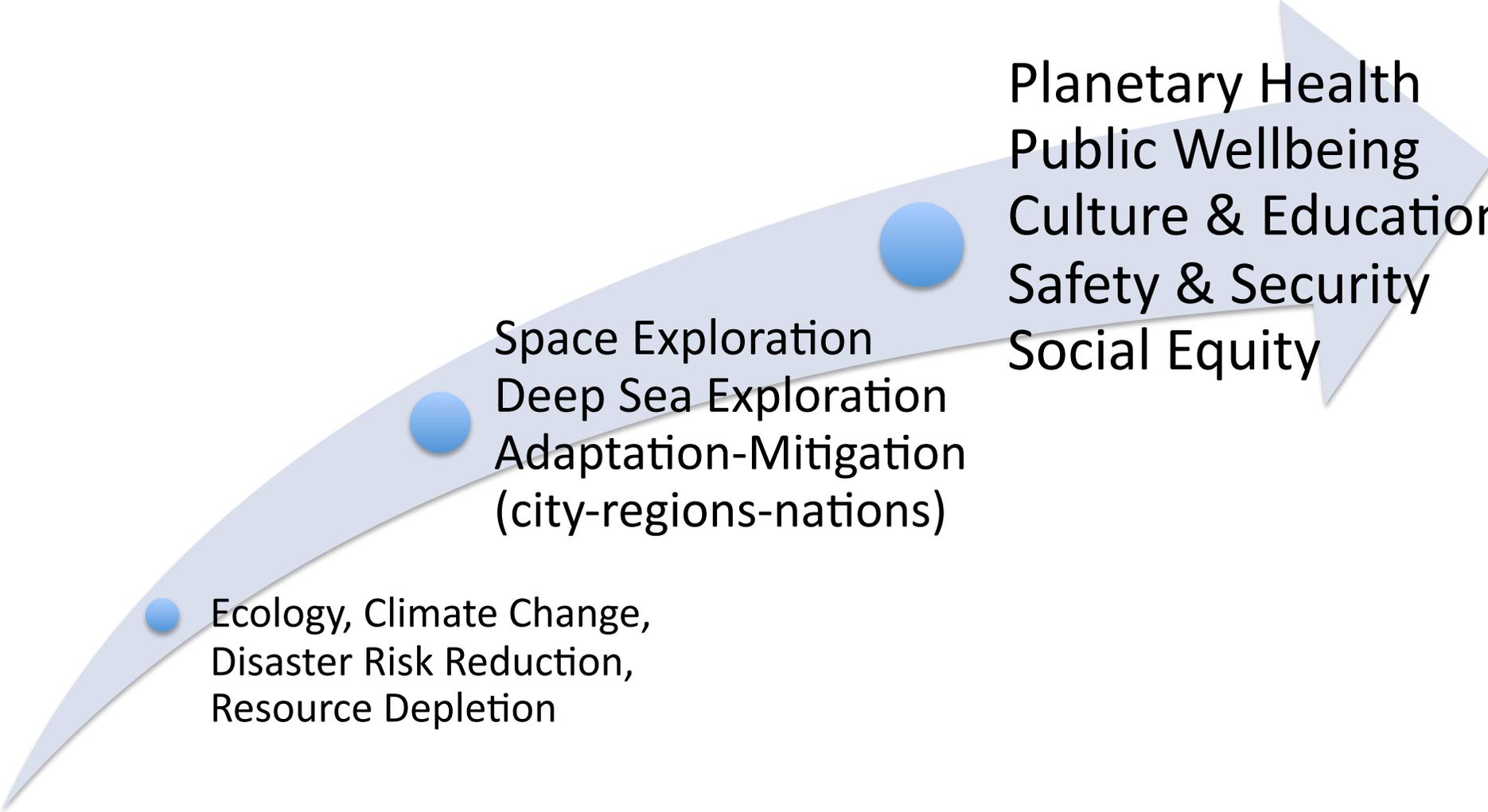
Lots of Learning



Plenty of Platforms



Wicked Problems lie ahead!



Ecology, Climate Change,
Disaster Risk Reduction,
Resource Depletion

Space Exploration
Deep Sea Exploration
Adaptation-Mitigation
(city-regions-nations)

Planetary Health
Public Wellbeing
Culture & Education
Safety & Security
Social Equity

RoboCup

LEIPZIG
GERMANY

2016

30 JUNE to 4 JULY

5-aside soccer



ETH Zurich



Assistive Exoskeletons



Strength Assistance



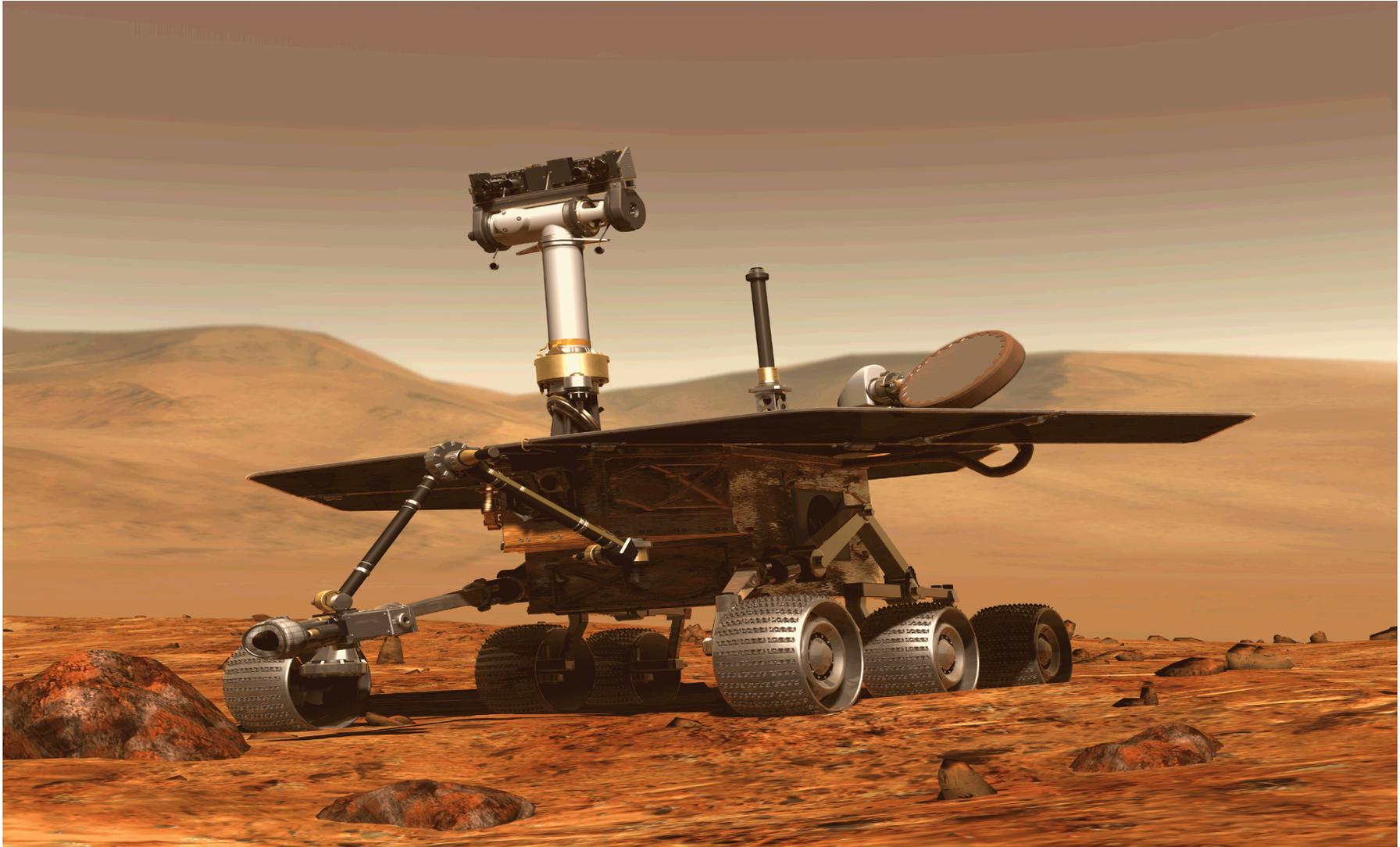
Robots in Agriculture



Drones on the Farm



Mars Robotics



Deep-sea Robotics



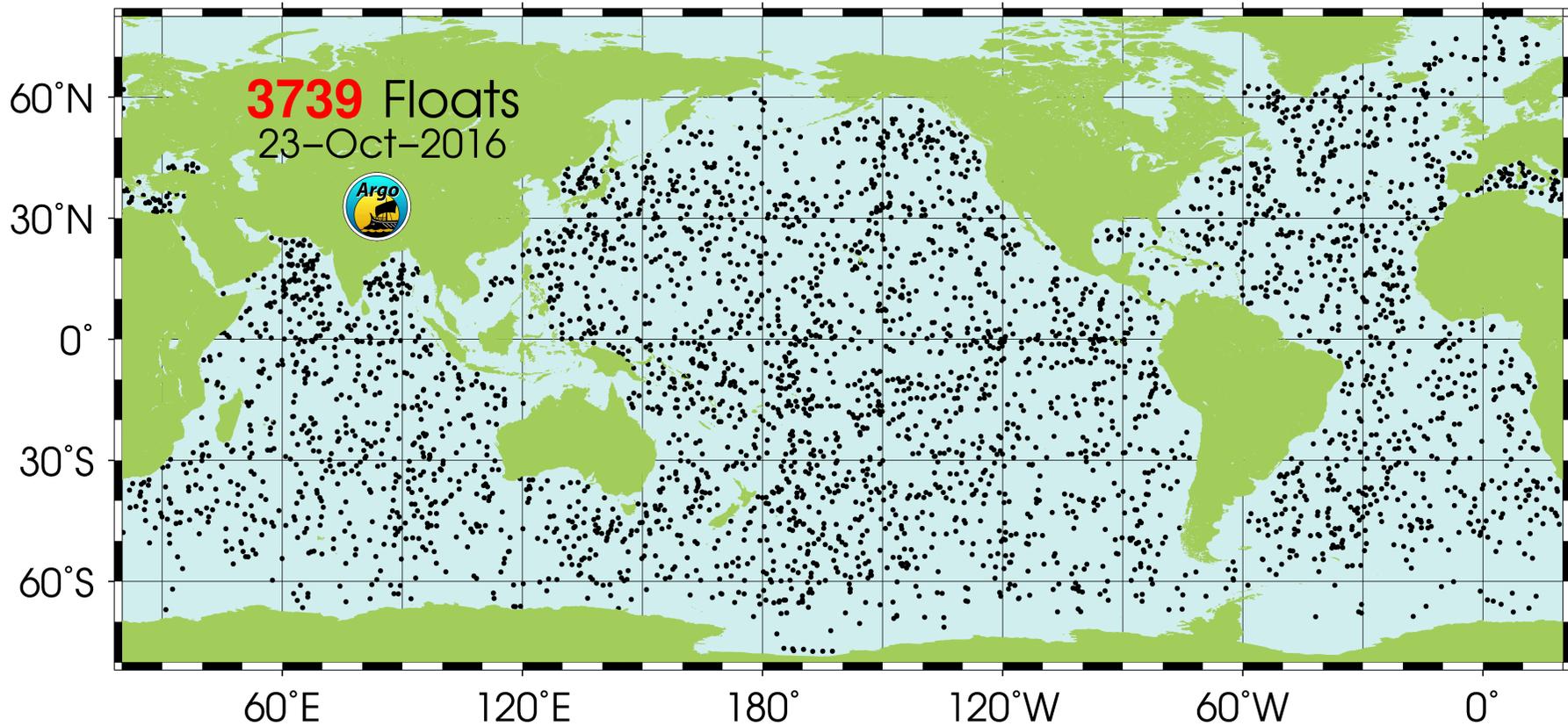
Remote Ocean – wave gliders



ARGO global float array



3,739 real time ARGO floats



Molecular Machines

"For the greatest benefit to mankind"
Alfred Nobel



The Royal Swedish Academy of Sciences has decided to award the

2016 NOBEL PRIZE IN CHEMISTRY

to:



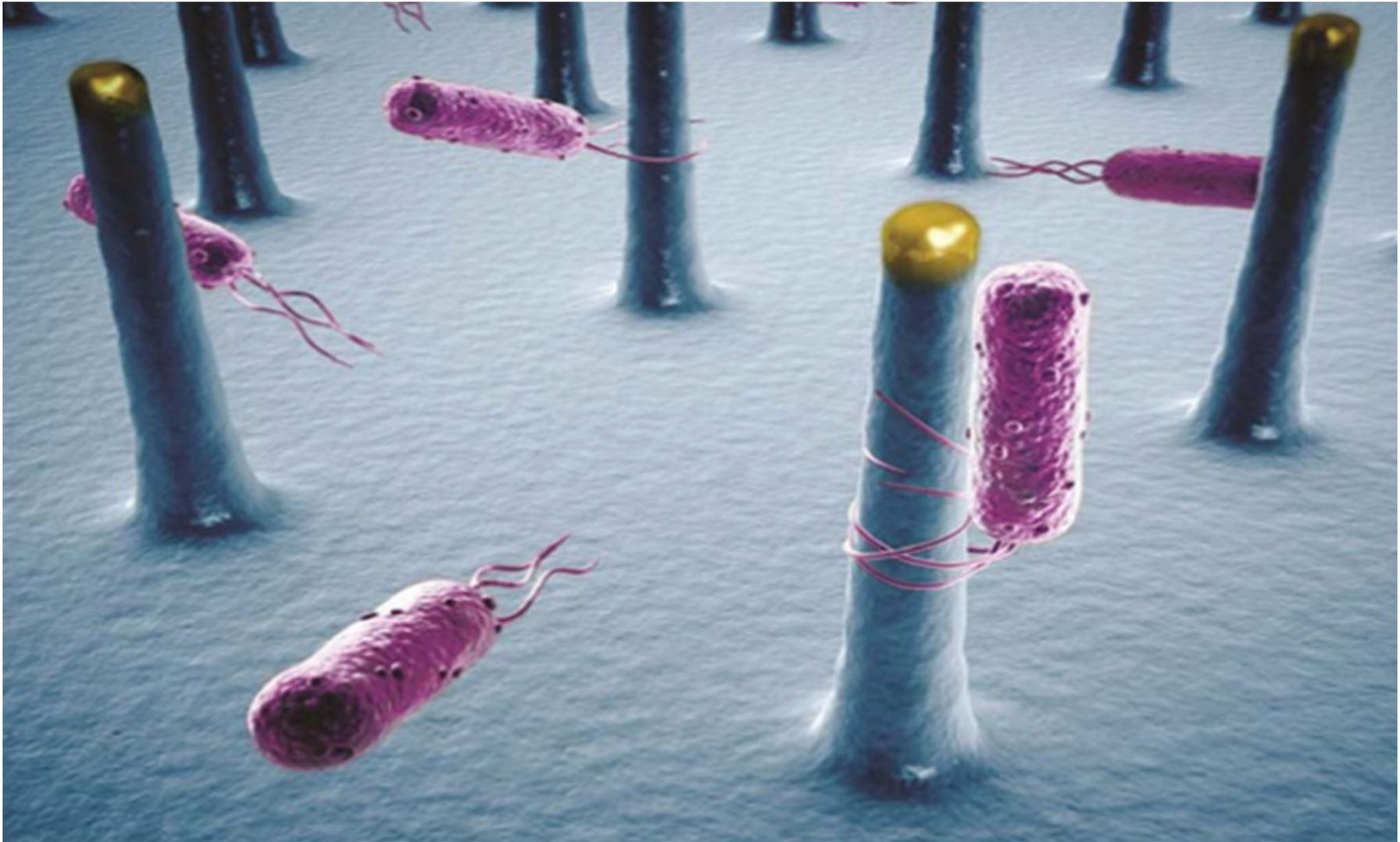
Illustrations: Niklas Elmehed, Nobel Prize Medal;
Nobel Foundation, Photo: Lovisa Engblom.

Jean-Pierre Sauvage Sir J. Fraser Stoddart Bernard L. Feringa

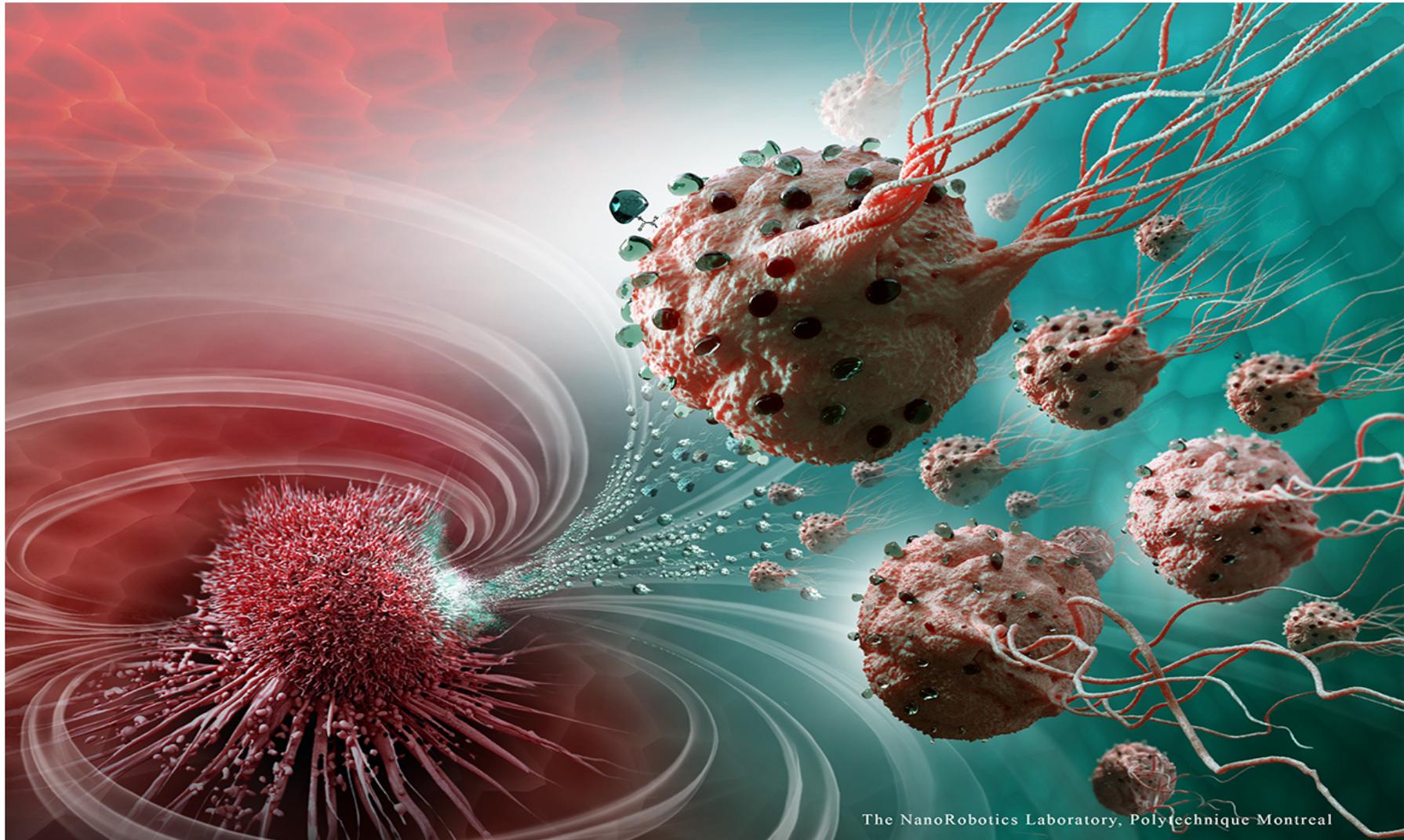
"for the design and synthesis of molecular machines"

 Nobelprize.org

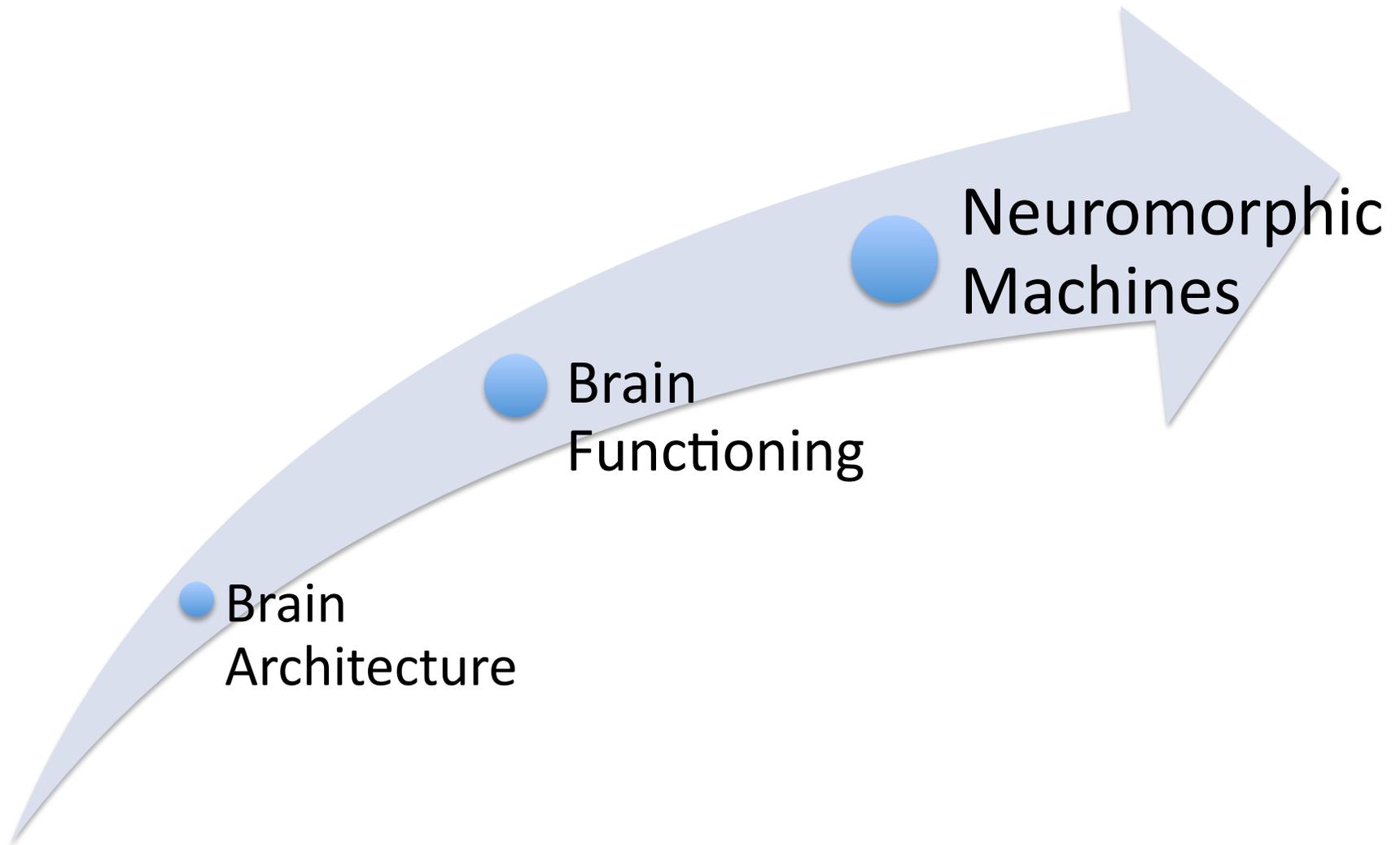
Artificial Photosynthesis



Nano-robots attack tumor cells



Toward **Cognitive** Computing



Bionic Eye



Thought-controlled robotic arm



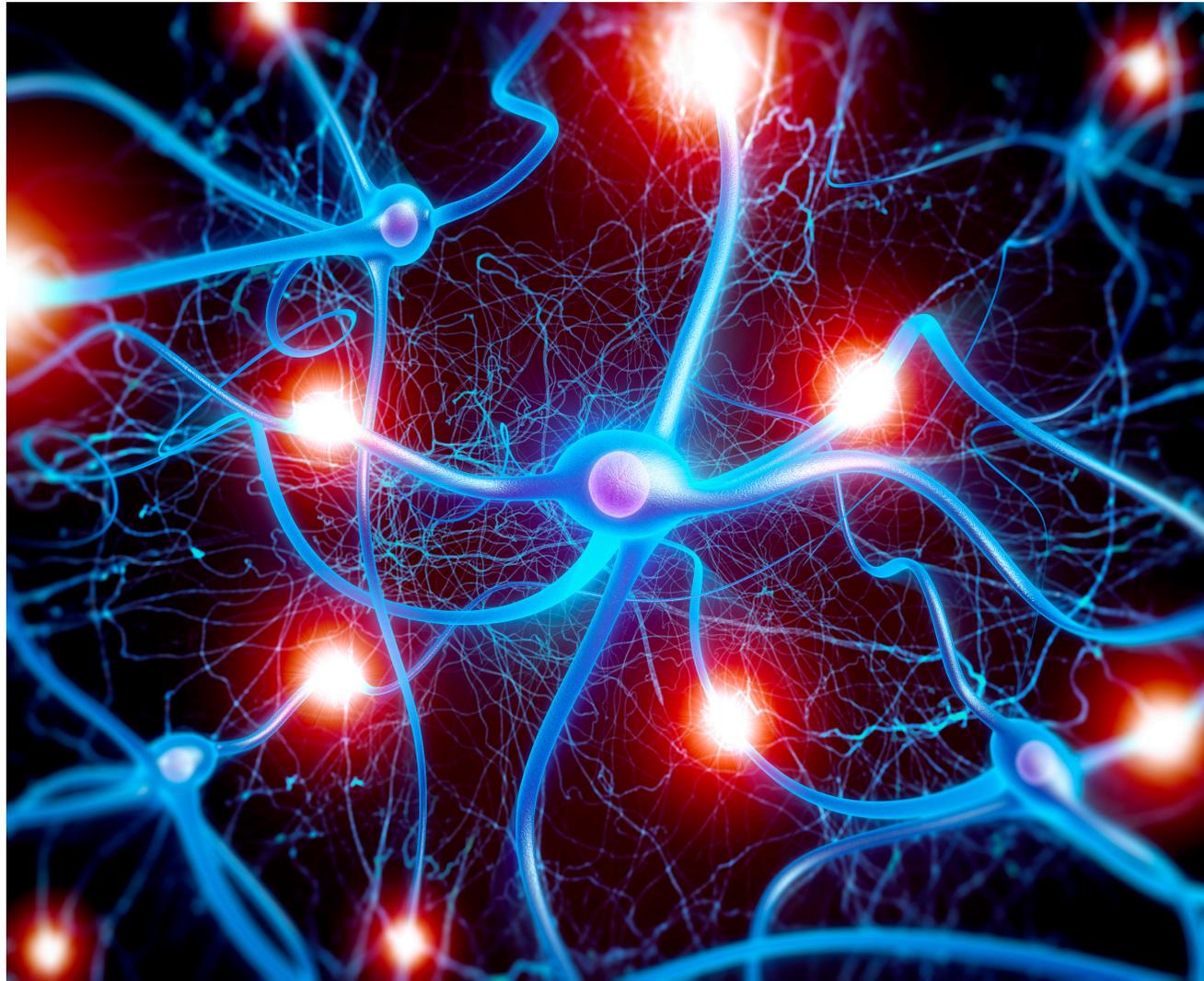
Contrasting the **Brain** to Digital Computing

- **Analog** – Digital
- **Wet** - Dry
- **Plastic** – Rigid
- **Resilient** - Fragile
- **Intuitive** – Logical
- **Creative** – Deterministic
- **Self organised** - Designed
- **Self assembled** - Manufactured
- **Asynchronous** – Mostly synchronous
- **Embedded memory** – Segregated memory
- **Variable neural network** – Fixed instruction set

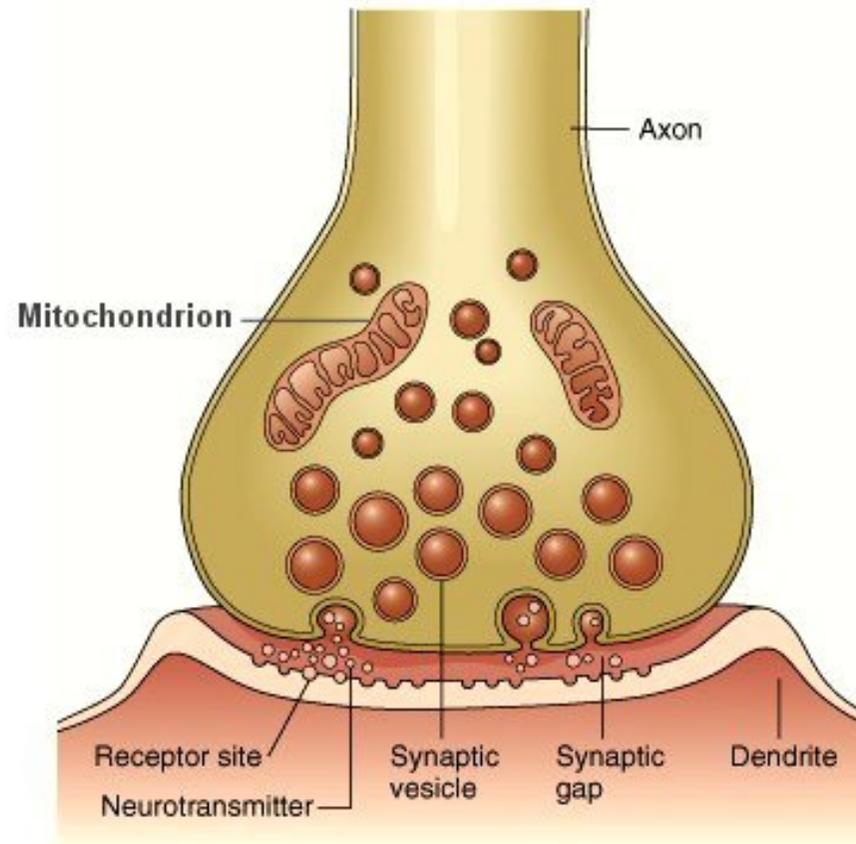
Overall structure of the human brain

- 80 billion neurons
- 500 trillion synaptic junctions
- 100 km of fibre
- 30 watts of power
- 3 meals/day

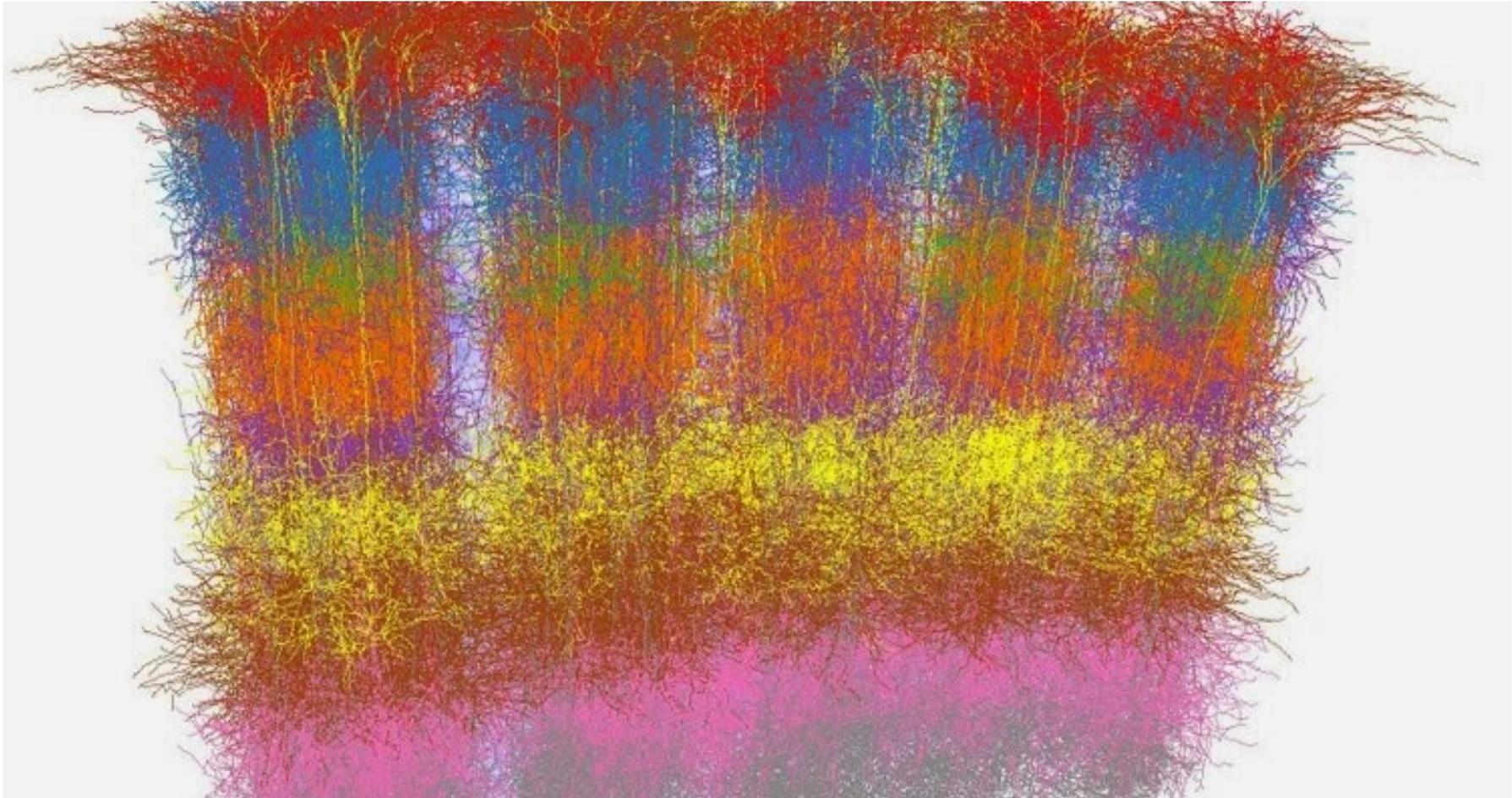
The neuron is the basic **brain unit**



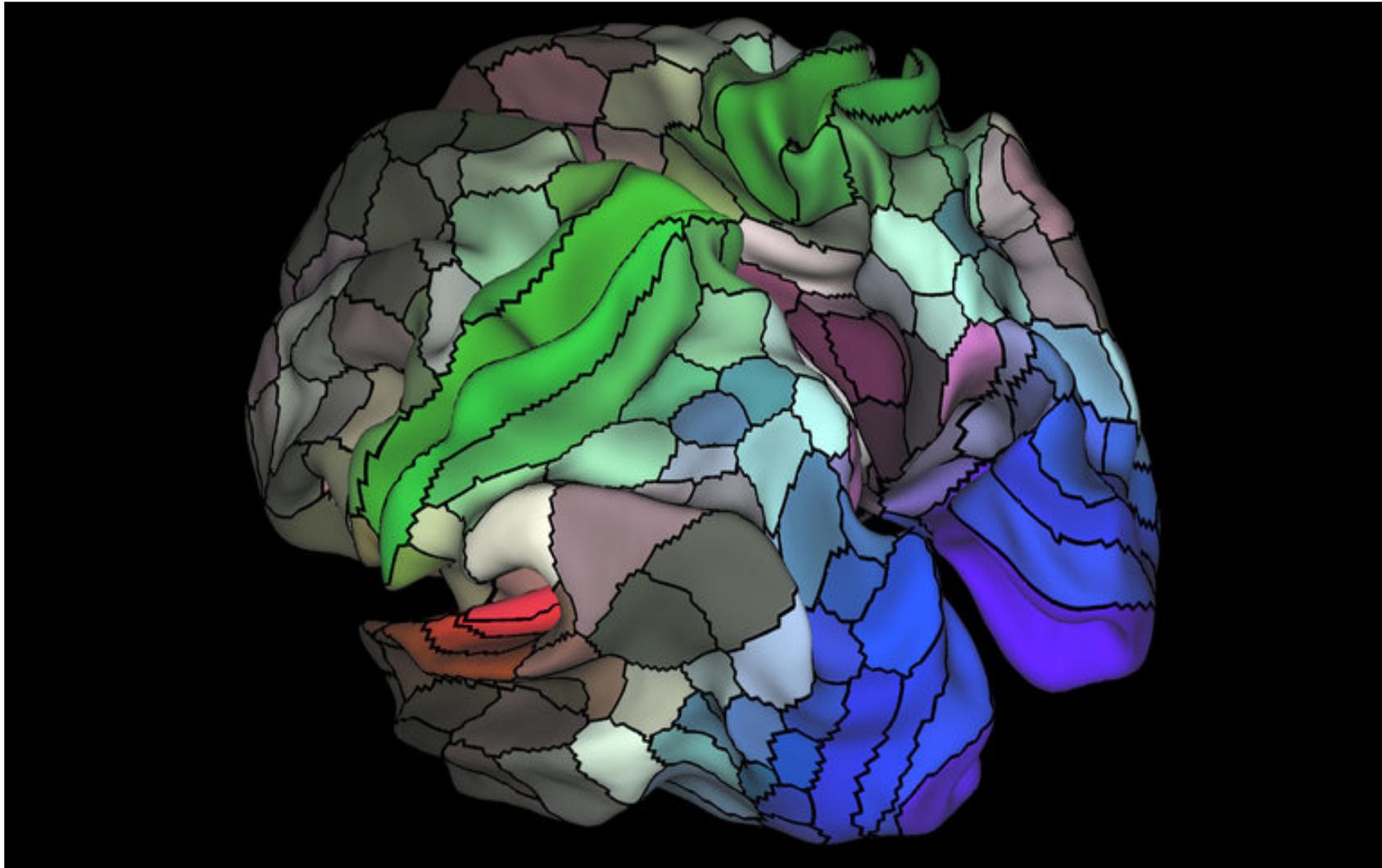
The **synaptic junction** is key



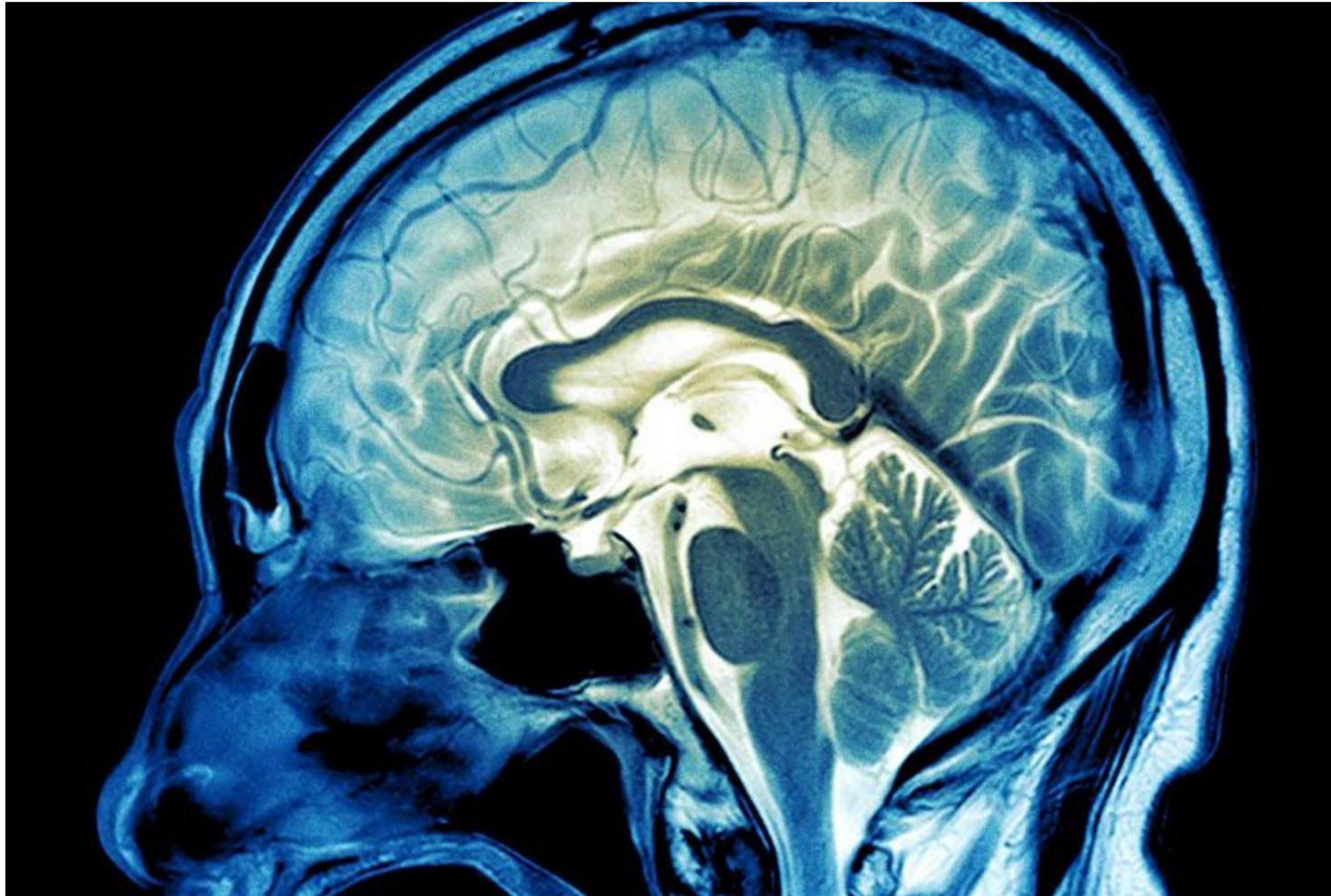
Cortical column organisation level



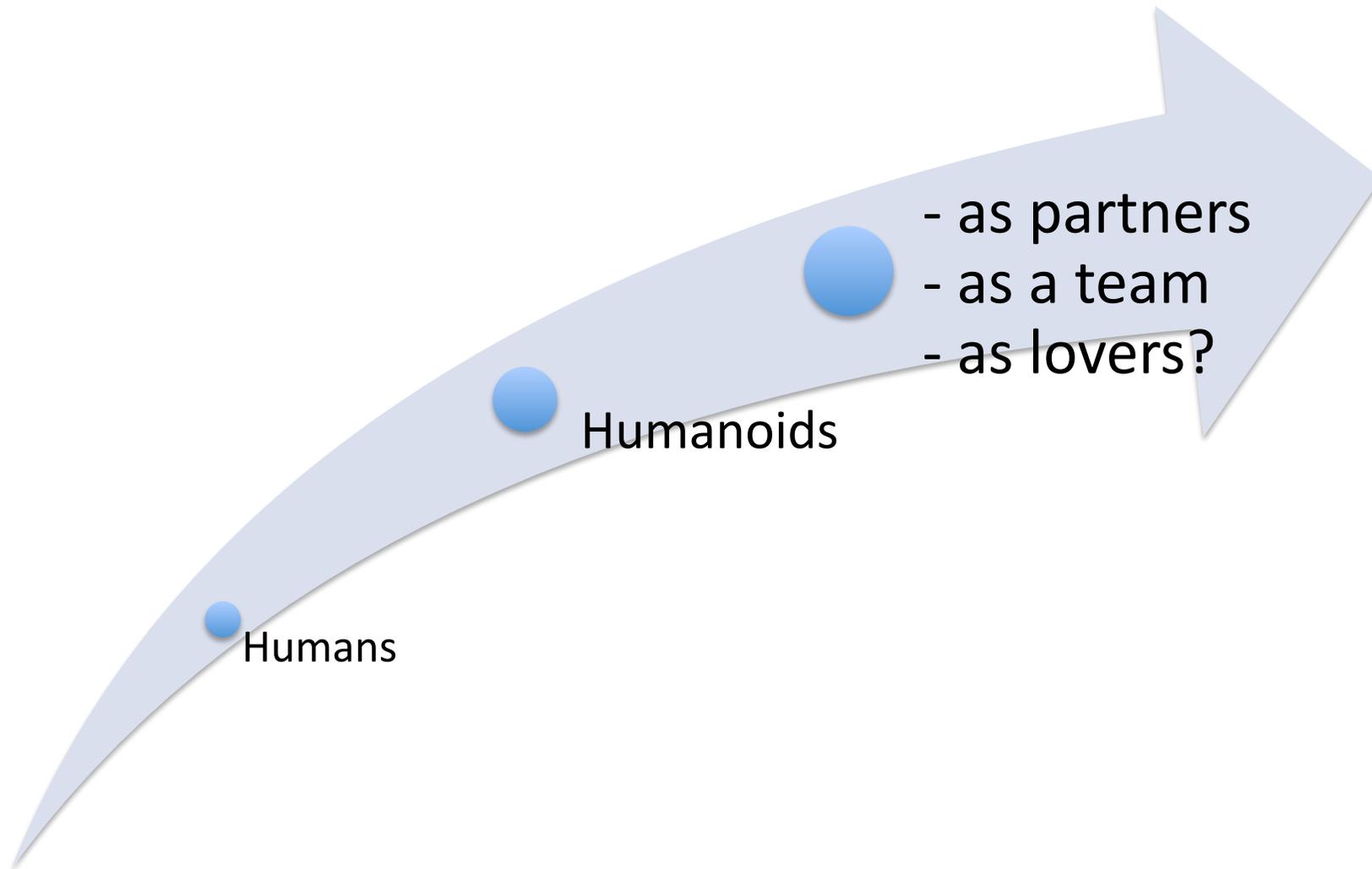
Brain regional organisation level



Mimicking the **human brain**



The Future = **Affective** Computing

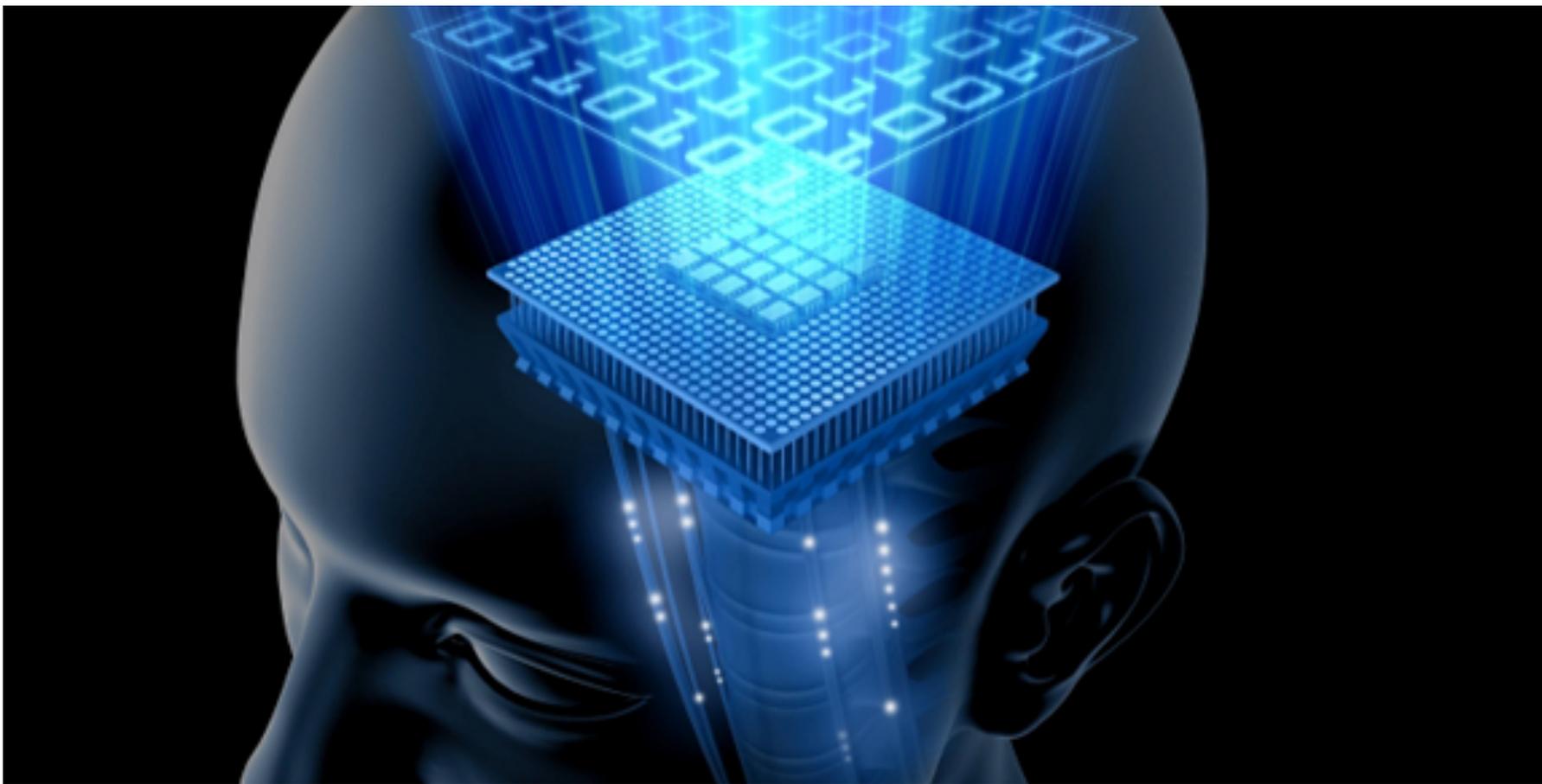


Humans

Humanoids

- as partners
- as a team
- as lovers?

Consciousness & Computers



Consciousness is the **very essence**
of what it is to be human

A quest for Artificial Consciousness will drive human beings
to **more closely examine and understand themselves**

At some time in the future we will have to decide
how human we wish to remain!