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THE FORTHCOMING EPOCH OF SELF-REGULATING SYSTEMS AND MBNRIC-TECHNOLOGIES

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Disruptive Innovations, Pivotal Moments and Crossroads
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http://www.socionauki.ru/authors/grinin_l_e/other/

MBNRIC-TECHNOLOGIES

Medicine

Biotechnologies

Nanotechnologies

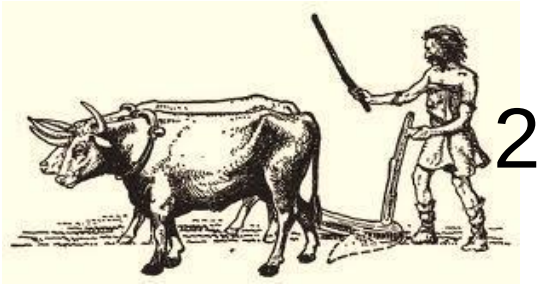
Robotics

Informational technologies

Cognitive sciences

FOUR PRODUCTION PRINCIPLES

1. Hunter-Gatherer



2. Craft-Agrarian

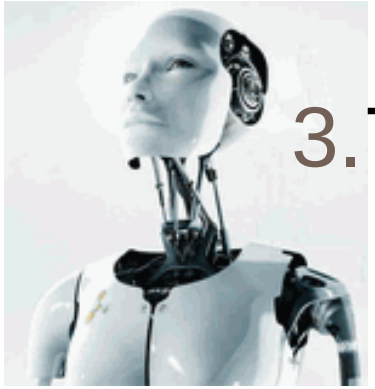
3. Trade-Industrial

4. Scientific-Cybernetic

THREE PRODUCTION REVOLUTIONS

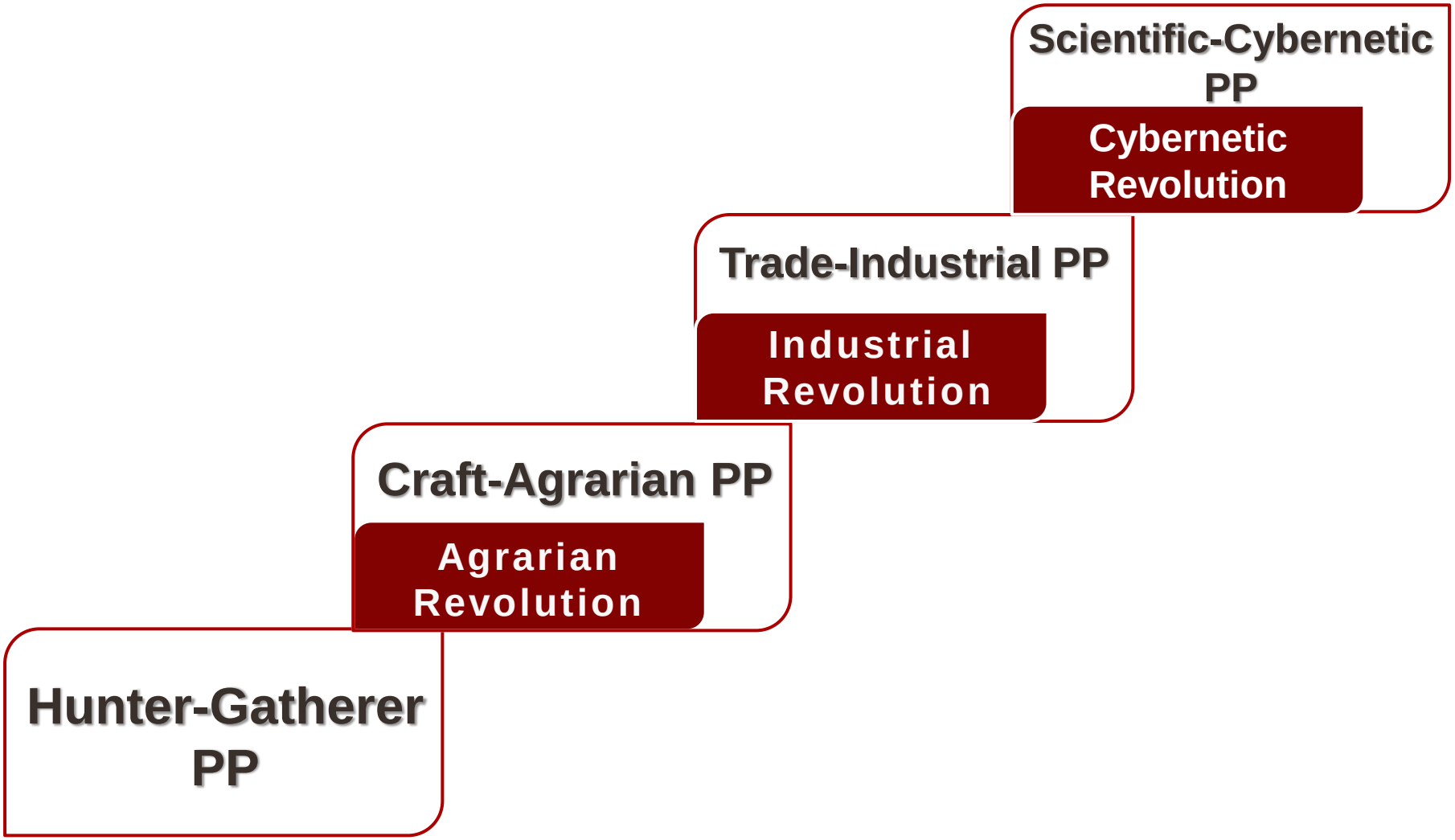
1. The Agrarian Revolution (or the Neolithic)

2. The Industrial Revolution

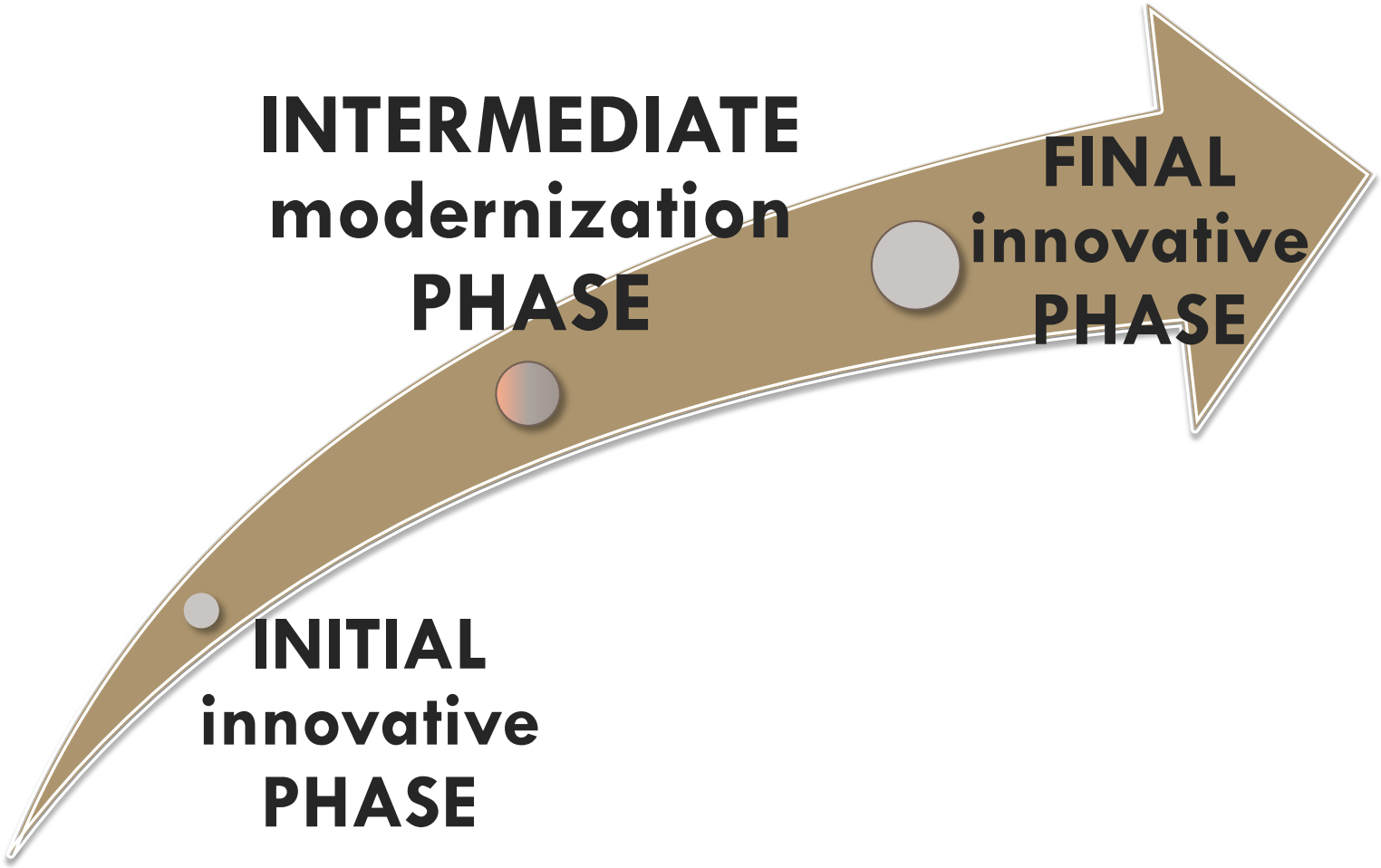


3. The Cybernetic Revolution

PRODUCTION REVOLUTIONS AS THE BORDERS BETWEEN PRODUCTION PRINCIPLES



PHASES OF PRODUCTION REVOLUTIONS



THE AGRARIAN REVOLUTION

INITIAL PHASE

- a transition from hunter-gatherers to primitive hoe agriculture and animal husbandry (12,000–9,000 years ago)

FINAL PHASE

- a transition to intensive agriculture (to large-scale irrigation and plowing) which started around 5,500 years ago

THE INDUSTRIAL REVOLUTION

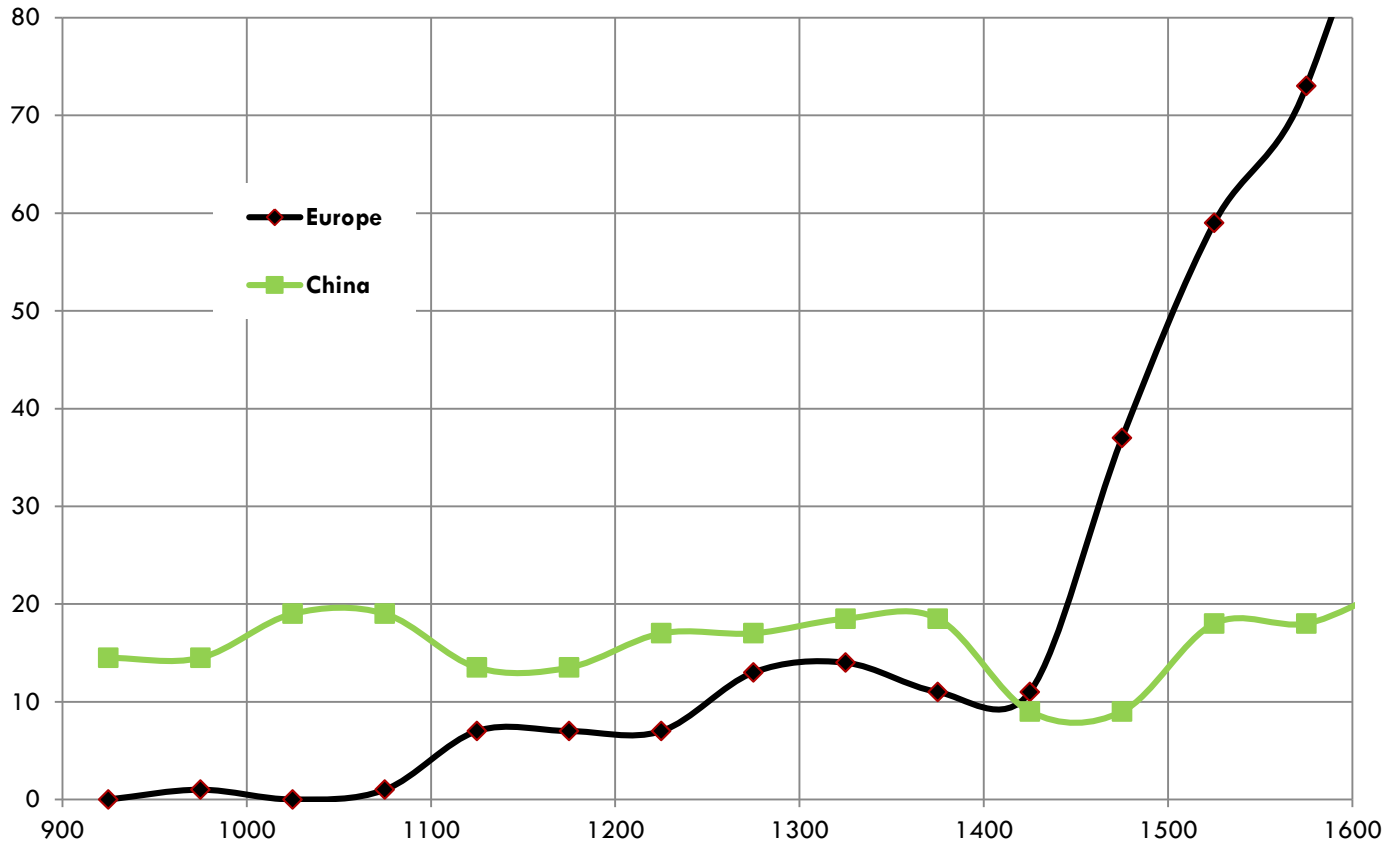
INITIAL PHASE

- started in the 15th and 16th centuries with the development of shipping, technology and mechanization based on watermill and division of labor.

FINAL PHASE

- was the breakthrough of the eighteenth and nineteenth centuries with the introduction of various machines and steam energy.

NUMBER OF INNOVATIONS IN SCIENCE AND TECHNOLOGY IN EUROPE AND CHINA PER HALF A CENTURY, 900–1600 CE



Data sources: Hellemans, Bunch 1988; Goldstone 2009: 122; Grinin, Korotayev 2015, forthcoming.

THE CYBERNETIC REVOLUTION

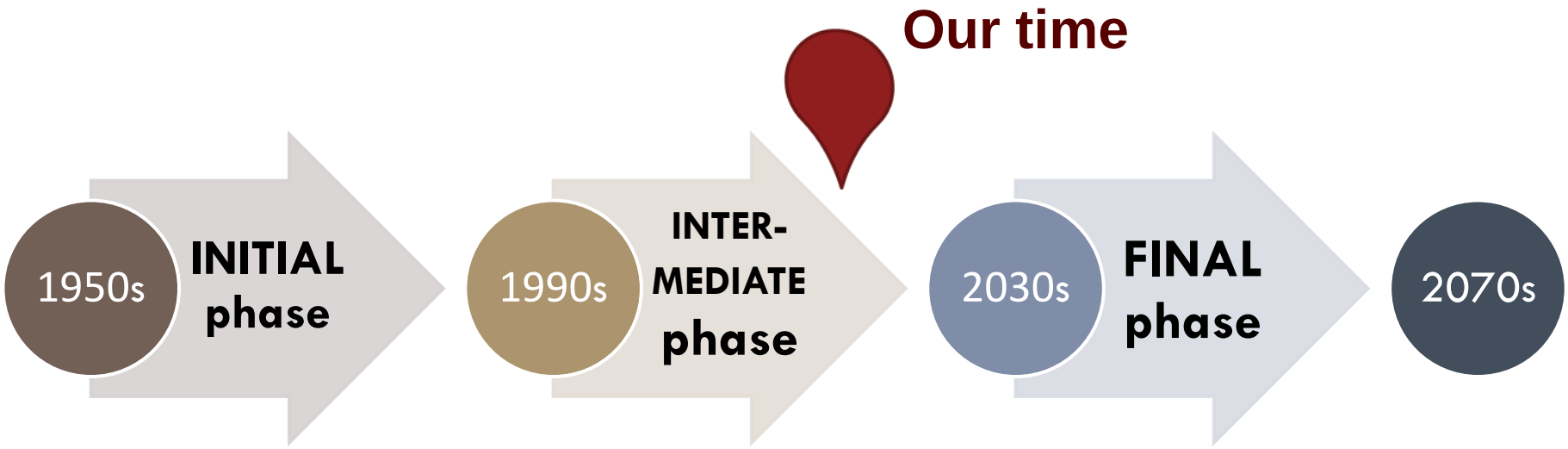
INITIAL PHASE

- from the 1950s to the 1990s. The breakthroughs occurred in automation, power engineering, synthetic materials, and especially in the development of electronic means of control, communication and information.

FINAL PHASE

- will begin in the 2030s and will last until the 2070s. It will be a transition to the production and services based on the operation of self-regulating systems.

CYBERNETIC REVOLUTION



- We call the initial phase of the Cybernetic Revolution a **scientific-information** one, and the final – a **phase of self-regulating systems.**

WHAT ARE SELF-REGULATING SYSTEMS AND WHY ARE THEY SO IMPORTANT?

Self-regulating systems are systems that can regulate themselves, responding in a pre-programmed and intelligent way to the feedback from the environment. They are the systems that operate with little or no human intervention.

SELF-REGULATING SYSTEMS IN MODERN LIFE

Space satellite

Navigator

WHY DO WE DESIGNATE THE NEW REVOLUTION AS "CYBERNETIC"?

The reason is that the principles of Cybernetics, which is a scientific study of regulatory systems, are rather suitable for self-regulating systems.

CHARACTERICTICS OF THE CYBERNETIC REVOLUTION

Group of controllability properties

- The transition to self-regulation of systems of different types and nature.
- Transition to the control of deeper and more fundamental processes and using of tiny particles as building blocks.
- Control over humans to eliminate the negative influence of the so-called human factor.

CHARACTERICTICS OF THE CYBERNETIC REVOLUTION

The group of attributes of task-aware adaptation of materials and systems

- Radical increase in systems' abilities to choose optimal regimes for different objectives and tasks.
- Individualization.
- Radical development of the resource and energy saving in many spheres.
- The synthesis of materials with previously lacking properties.
- Miniaturization and micro-miniaturization.

THE DRIVERS OF THE FINAL STAGE OF THE CYBERNETIC REVOLUTION

- Medicine;
- Biotechnologies;
- Nanotechnologies;
- Robotics;
- IT;
- Cognitive science.

Medicine will become the first sphere where the stage of self-regulating systems will start and combine others technologies.

MBNRIC-TECHNOLOGIES

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WHY MEDICINE WILL BE THE FIRST IN THE FINAL PHASE OF THE CYBERNETIC REVOLUTION?

- Population aging and labour force reduction;
- Growth of the world's middle classes, as well as education and income levels;
- People's willingness to spend money on health and beauty;
- The medical sphere integrates many new technologies.

BIOTECHNOLOGIES

- The trends to the formation of self-regulating systems can be seen, in particular, at the genome level.
- For example, alongside with a useful gene, in gene construction there are inserted special controlling genes-promoters that launch a necessary gene only under certain conditions.
- Biotechnologies can help the developing countries to increase nutritional supplements and make affordable production of pharmaceuticals.

NANOTECHNOLOGY

- Nanotechnology itself is based on the aspiration to harness the self-regulatory processes in matter, making molecules and atoms become ordered in a certain spatial and structural pattern.
- Many nanotechnologies aim at reducing energy and resources consumption. For example, a wide usage of electronic paper can save forests on the Earth.

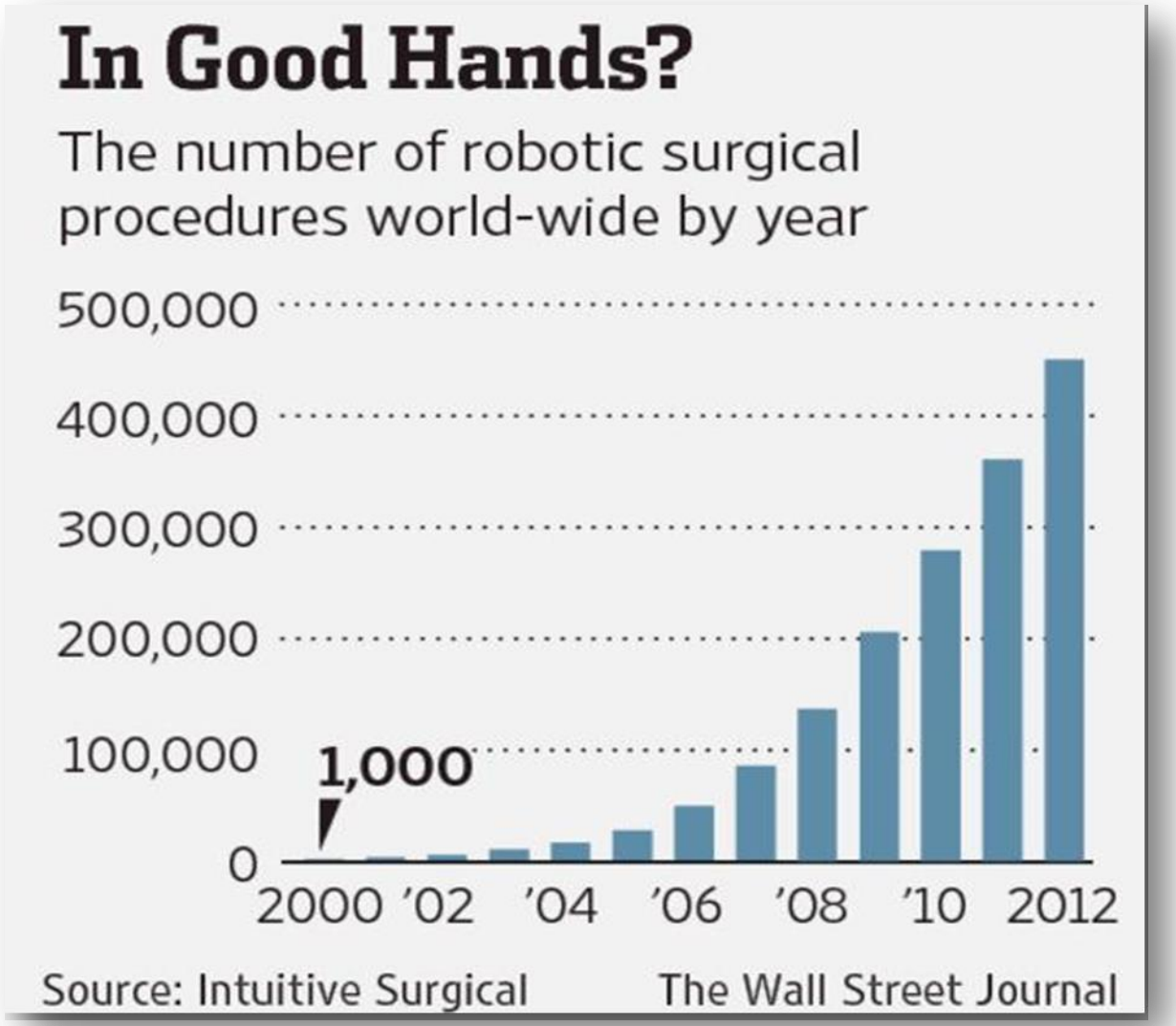
BRANCHES OF MEDICINE WHERE SELF-REGULATION WILL BE MANIFESTED FIRST (FROM THE 2030s TO THE 2070s)

Surgery

The advantages of using robots are:

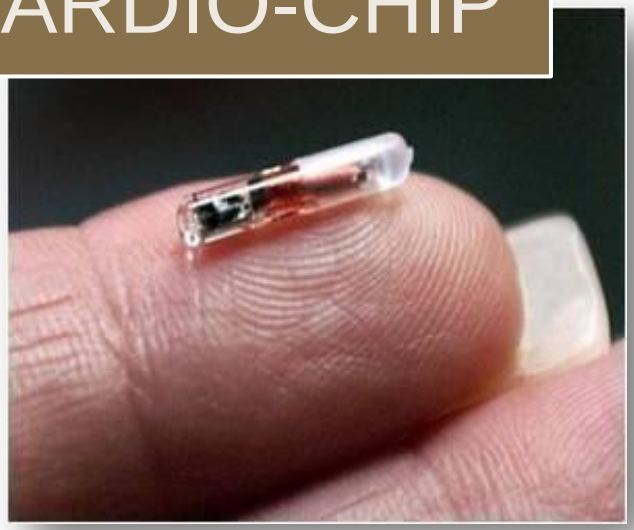
- easy access to the zone of surgery;
- small scars;
- exact accuracy;
- no hand tremor;
- possibility to control a robot at a distance via Internet.

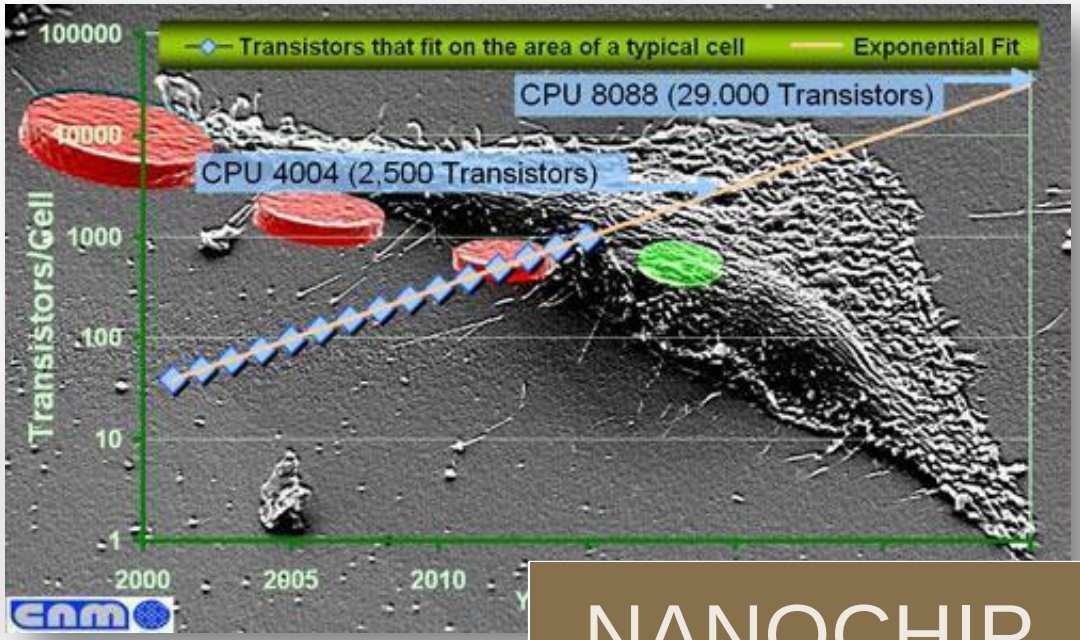
ROBOTS IN SURGERIES



BIOCHIPS

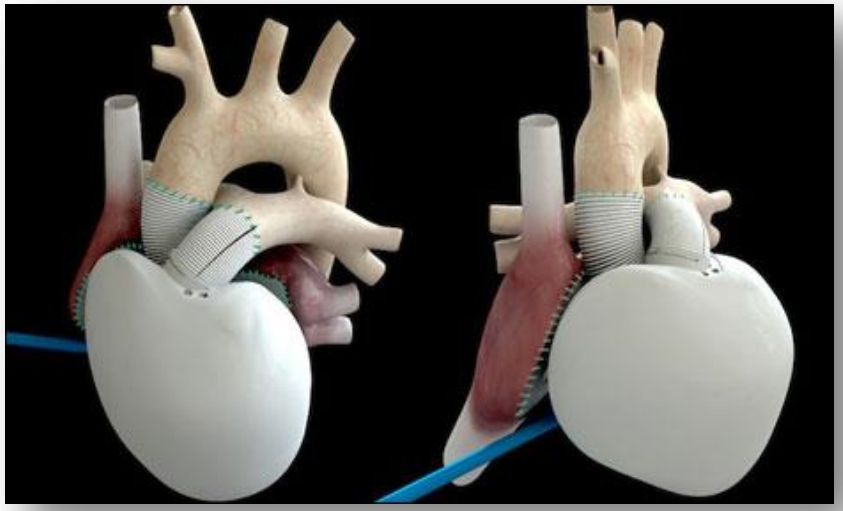
CARDIO-CHIP

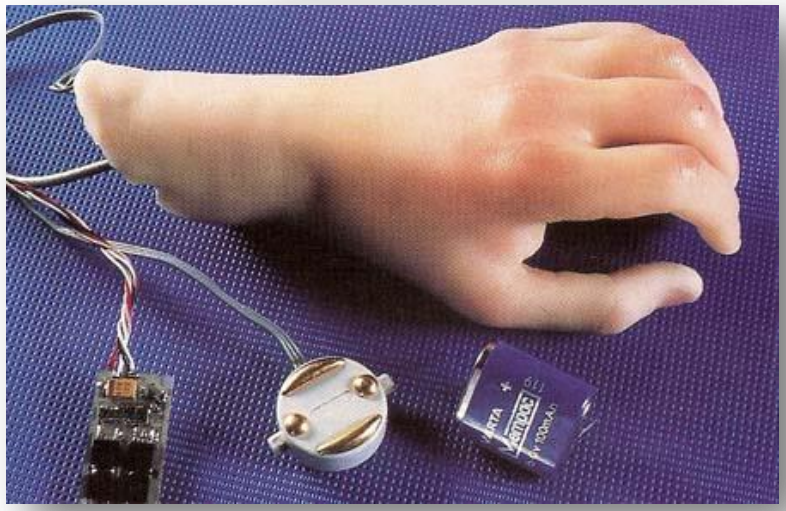




NANOCHIP

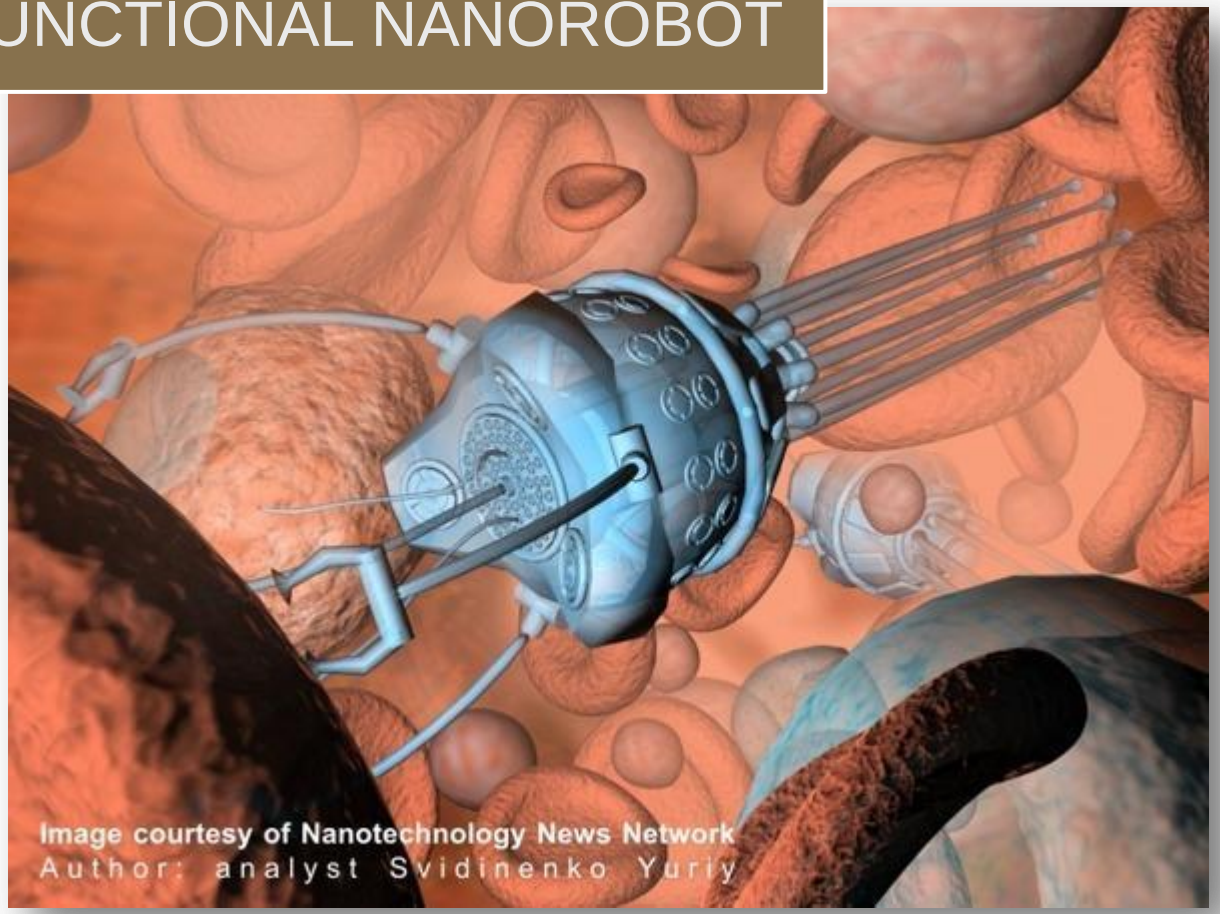
ARTIFICIAL ORGANS



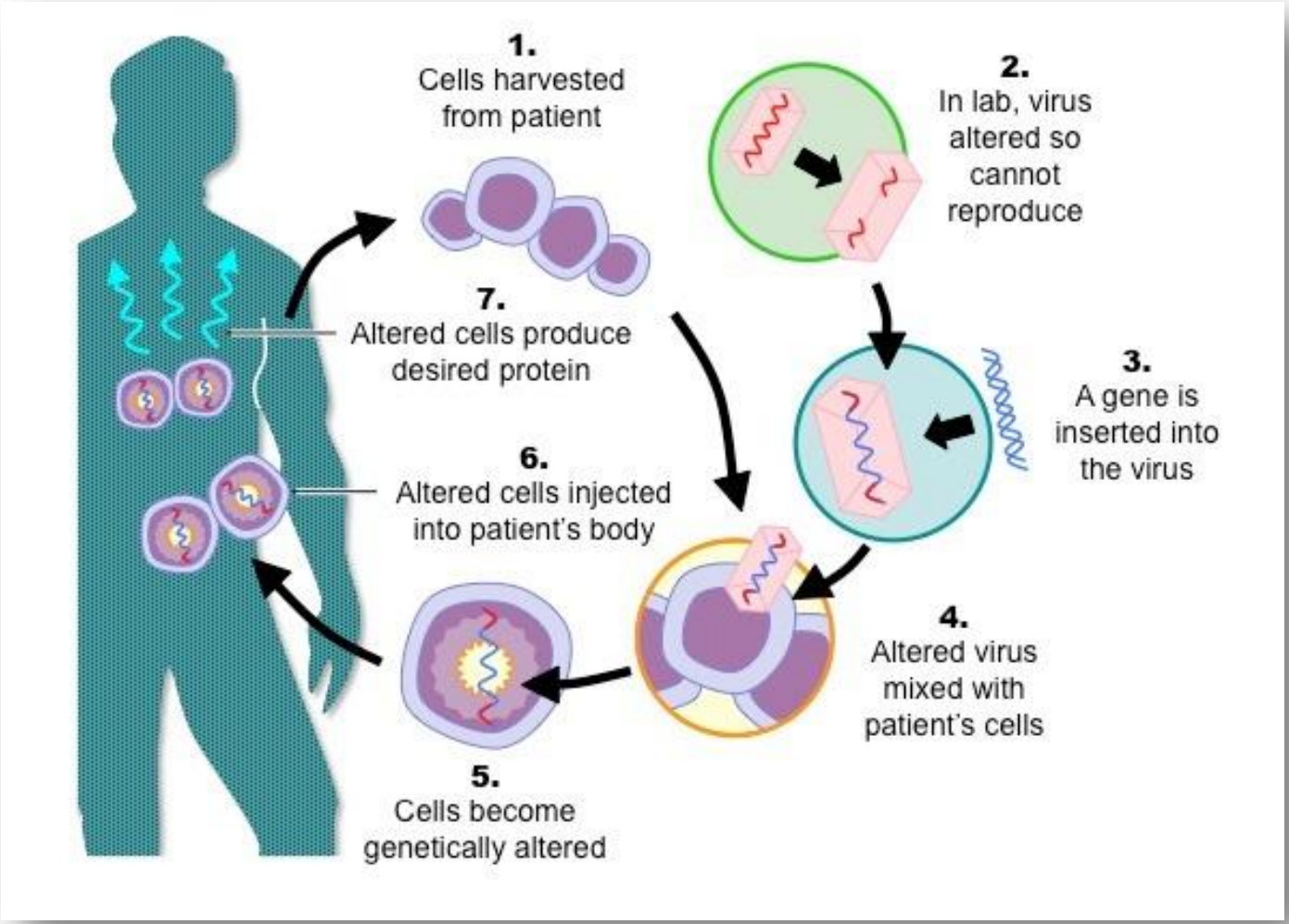


ARTIFICIAL IMMUNE SYSTEM

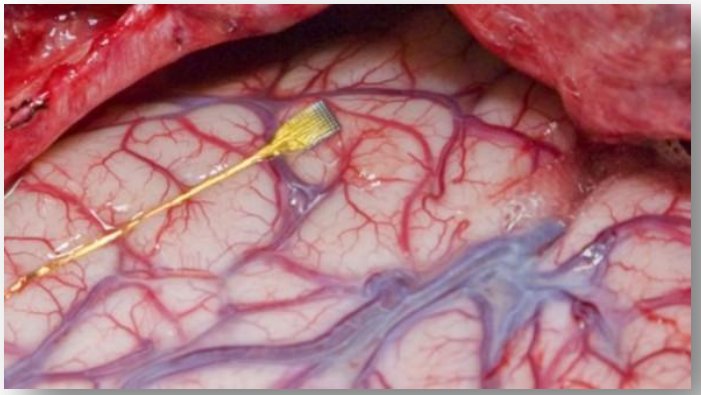
MULTIFUNCTIONAL NANOROBOT



GENE THERAPY



NEURAL INTERFACES



CONCLUSIONS

The final phase of the Cybernetic Revolution:

- Will create many various self-regulating systems.
- Will start in medicine, which in the conjuncture with different innovations will form the revolutionizing system of MBNRIC [med-bio-nano-robo-info-cogni]-technologies.
- Will lead to the emergence of opportunities to correct and modify human biology itself.
- Will increase average life expectancy (up to 100 years).

CONCLUSIONS

The final phase of the Cybernetic Revolution:

- Will improve the quality of life, in particular of old people and disabled persons;
- Will provide vigorous increase in production volume;
- Will save energy and recourses in many spheres.

THE FORTHCOMING PROBLEMS

The final phase of the Cybernetic Revolution also:

- Will substantially change social relations;
- Will reduce the number of specialists in different spheres;
- The radical changes in human organism can bring about new ethical issues and seriously damage such vital aspects as family, gender, and outlook.
- So it is very important to search for optimal means beforehand so that those changes will be not completely unexpected and their negative consequences could be minimized.

Thank you
for your attention!