

# Innovation Design in RIKEN (the Institute of Physical and Chemical Research)

April 22, 2019

Shigeo Koyasu, RIKEN



# What is RIKEN?

Pure science and applied research for industrial development in Japan



Synthetic science research institute with interdisciplinary research environment



Contribution to prosperous lives of citizens and the international community, by value creation



Science and technology to support human civilization

# Future Vision and World-Class Level Research

## RIKEN's Near-Future Vision (1985)

### 1. Post-silicon era

- Material development (e.g. quantized devices, molecular devices, biotips, and frontier devices which are the combination of those materials)

### 2. New-type technology for food production

- Research on homeostasis mechanism of plants

### 3. Aging society in the 21st century

- Research on aging mechanism of the higher animals

### 4. Highly information-oriented society

- Elucidation of brain functions, and research on information processing methods including AI which simulates brain functions

### 5. New substances and materials which will become the basis of advanced industrial technology

- Research on chemical reactions which are high selectivity and high activity, by development of new reaction field



Tatsuoki  
Miyajima

## International Frontier Research System (from 1986 to 1999)

**Research on homeostasis** A13g control to cope with the aging society in the 21st century, generation of plants which adapt to various environments (e.g. dry climate, etc.), and elucidation of the function to maintain homeostasis of animals and plants)

**Research on frontier materials** (Generation of new functional devices which will become the basis of information science in the new era. The purpose is to elucidate biomolecules (e.g. cells and protein, etc.), high molecules, the extremely minute status of substances (e.g. metals, etc.), and various phenomena which occur by the combination of those materials.)

**Research on brain mechanism of mind and behavior** (Elucidate brain mechanism and principle which will become the basis of science and technology in the new era (e.g. information science, and behavioral science, etc.), by anatomical, physiological, and theoretical methods.)



Ryogo Kubo

The world's leading expert on theoretical physics, who invited many overseas researchers from all over the world (30% of researchers were from abroad)



## スライド 3

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A13

原文 : 「ホメオタシス」

ホメオスタシスの誤りとして訳出しております。

作成者, 2019/05/09

# Discovery of Future Possibility

## Paradigm Shift

### Heliocentric Theory

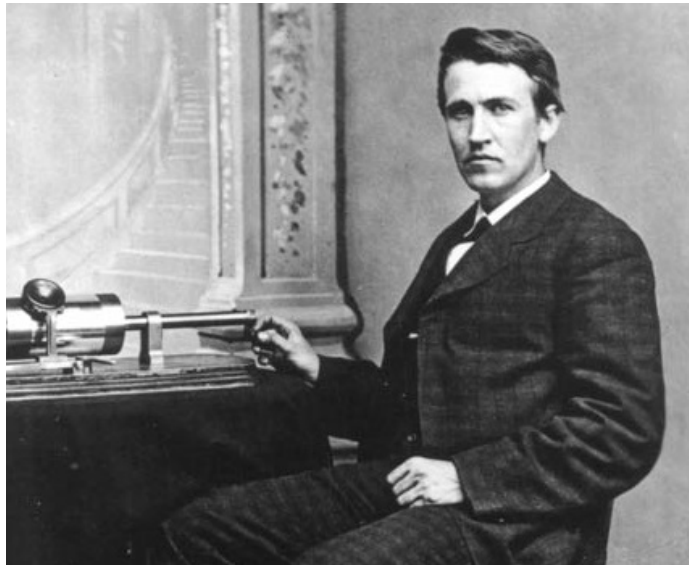


## Innovation

### Vaccine



# Expansion of Potential in the Future Society



Thomas Alva Edison

Invention of gramophone in 1877

Original Purpose: A14  
Transmission of speech using  
the telephone between  
individuals



Alexander Graham Bell

Got a patent for a telephone  
in 1876

Original Purpose:  
Life with music at home

A14

左の原文：「当初の目的：声による個人同士のやりとり」

右の原文：「当初の目的：家で音楽が聴ける生活」

人物と内容が逆になっている可能性がございます。訳文は、日本語原文通りの並びで訳出しております。

作成者, 2019/05/09

# Realization of Future Possibility

1. Basic science becomes the key to discover the future possibility
2. Expansion of potential in the future society  
(hope, history, ethics, etc.) x science and technology
3. Co-creation to realize the future vision



# Agenda for Future Society

While the old generation holds high expectations for the future, the young without occupation and the refugees with advanced academic backgrounds hold extremely low expectation for the future. The gap between them shows a sharp contrast to us.

A15

- Jørgen Randers

Energy, climate, population, food, biodiversity, security, etc.  
- the survival of civilization is at risk

## Relationship between the global climate and human beings

Establish the recycle system of CO2

## Economic growth and wealth of each individual

Potential of automation of intellectual labor, and expansion of humanosphere

## Forecast of future nature and society

Behavioral changes on the basis of forecast

## Health and happiness of people all around the world

Understand the diversity and provide opportunities

## スライド 8

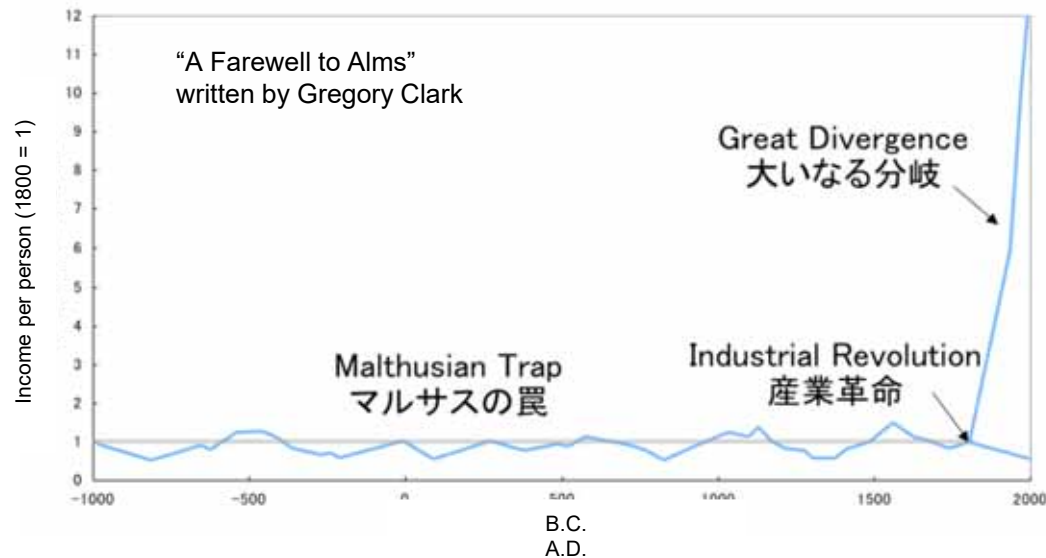
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A15

原文：「旧世代の未来への期待の高さと、職の無い若者や高学歴難民の希望のなさは強烈なコントラストを描いている」  
発言であるため、暫定訳となっております。ご確認ください。

作成者, 2019/05/09

# Automation of intellectual labor

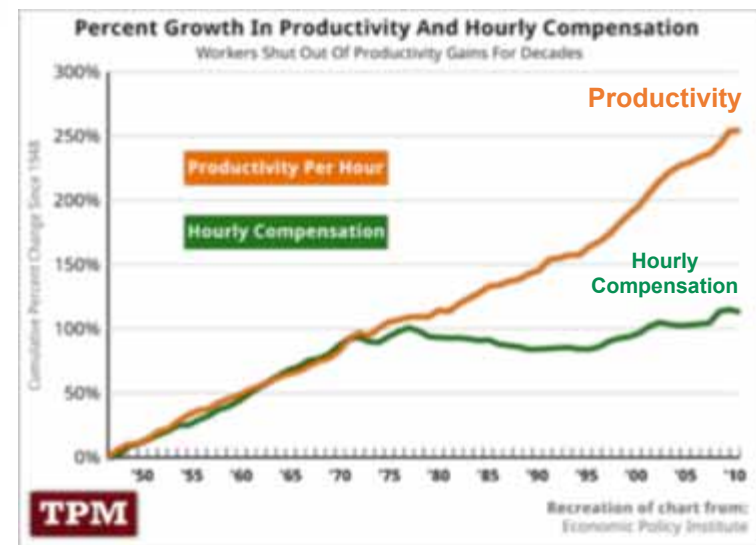


“Great Divergence” became the decisive factor to bring the society with economic disparity

Imbalance development of the world

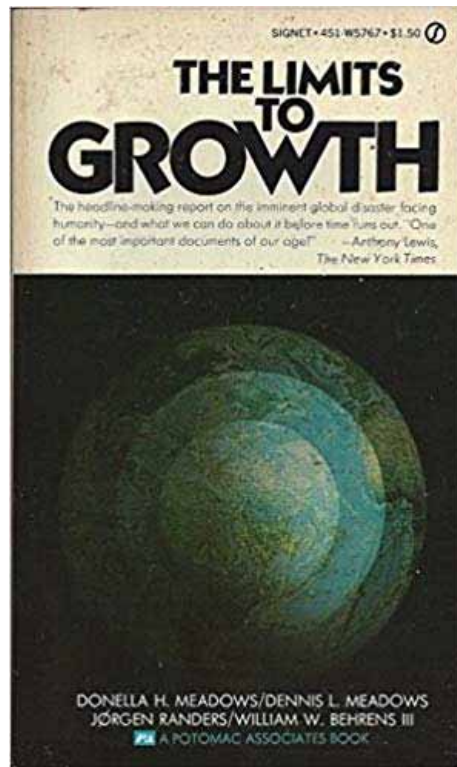
In America, the gap between the productivity and hourly compensation started emerging in 1970s.

Expiration of the second industrial revolution where mass production and mass consumption were promoted by mechanization of production technology?



Will the automation of intellectual labor bring the potential second great divergence?

# “The Limits to Growth” and “Green Revolution”



“The Limits to Growth” written by the Club of Rome

Our growth will reach the limits in 100 years, if no technical innovation is made.



“Green Revolution”

Malnutrition rates have drastically decreased in these 40 years in Asia.

We need to create new culture and lifestyle,  
on the basis of new science and vision.

# Forum of Innovation Design Office

## 5<sup>th</sup> Some Scenarios to Realize “Establishment of the Recycle System of CO2” held on Saturday, April 13

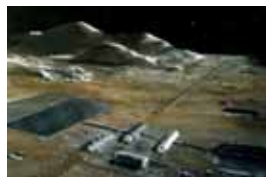
Since human activities have globally expanded, and the global warming has been rapidly accelerated, realization of carbon recycling society, and the development of basic technology to not only reduce CO2 emissions but also utilize it as resource have been currently discussed. Therefore, in this program, we firstly refer to domestic and international approaches to recycle of CO2, and clarify problems to be solved. Then, we create multistep scenarios to solve this global challenges in several decades or even 100 years, by suggesting the unique approach based on the biological system which has lasted since the born of the earth. (Environmental science, plants, microorganism, catalyst chemistry, metabolic engineering, scientific policy, etc.)



Keiichi Mochida Ryuhei Nakamura Seita Emori Masahiro Sugiyama Masakazu Sugiyama and more

## 7<sup>th</sup> “Expansion of Humansphere” from Space Colony to the Second Earth held on Thursday, June 6

We create plans on how to realize space colonies and the second earth, on the basis of the vision for expansion of humansphere outside the earth. (Plants, resources, radiation, electric power transmission, telecommunications, comfort and health, space biology, space philosophy, human history, etc.)

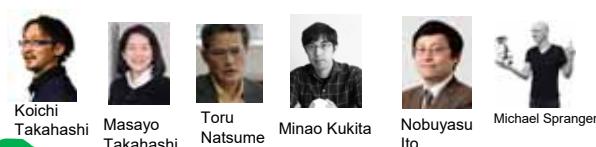


## 9<sup>th</sup> “Avatar! – Body, Mind, and Heart”

## 6<sup>th</sup> “Beyond Human” Machines Will Surpass Human Beings held on Friday, May 24



The progress of machines has drastically changed science and technology. If we can develop the intelligence system which enables autonomous finding and application of knowledge and natural law which human beings have overlooked, it may enable us to automate various intellectual operations, expand humansphere, and make our civilization sustainable. We discuss how we can realize such future, including the future vision of human civilization. (AI-driven science, robotics, AI, biology, ethics, etc.)



Koichi Takahashi Masayo Takahashi Toru Natsume Minao Kukita Nobuyasu Ito Michael Spranger

## 8<sup>th</sup> “Life and Time in Future Society” held on Tuesday, June 11

The aging society will accelerate the drop in the birthrate, and the society will shrink. If someday we can develop reproductive technology which enable human beings to have a baby inside or outside the womb at all ages, the world population will increase. Also, if such technology enables us to select a body and internal organs at the stage of fertilized egg, or even have the freedom of exchange of such parts after the birth, it actually means eternal youth and immortality. Meanwhile, though the death is still regarded as abhorrent in modern times, the new approach to positively accept the death in our lives has recently emerged. What kind of science technology will be realized in the future society, and how will the future society progress? We create some scenarios in 100 years for the life which has been supposed to be finite, and future society. (Reproduction and family, internal organs, an individual, and metabolism, aging and time, social metabolism, ethics and the view of life and death in the future society, etc.)



The mission of RIKEN Innovation Design Office is to create the vision of future society in 100 years, and plan scenarios to realize the vision, for the purpose of expansion of potential in the future society. We can know only a part of the world, and we tend to forget the great potential of future. So, now is the time to unleash our imagination and co-create the future in cooperation with people all around the world.

There is no assured or infallible method to make an approach to the future. Firstly, we would like to plan specific scenarios by starting from what can be done. We hope that gathering at our forum beyond organizations and categories will help us to gain a foothold toward our goal step by step.

## Expansion of Potential in the Future

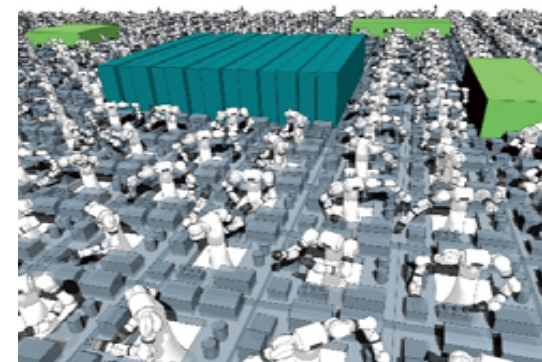


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