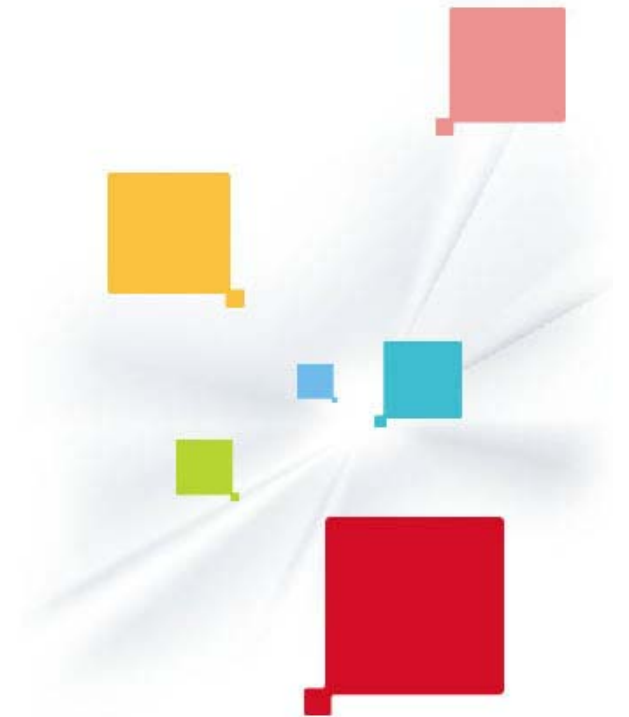
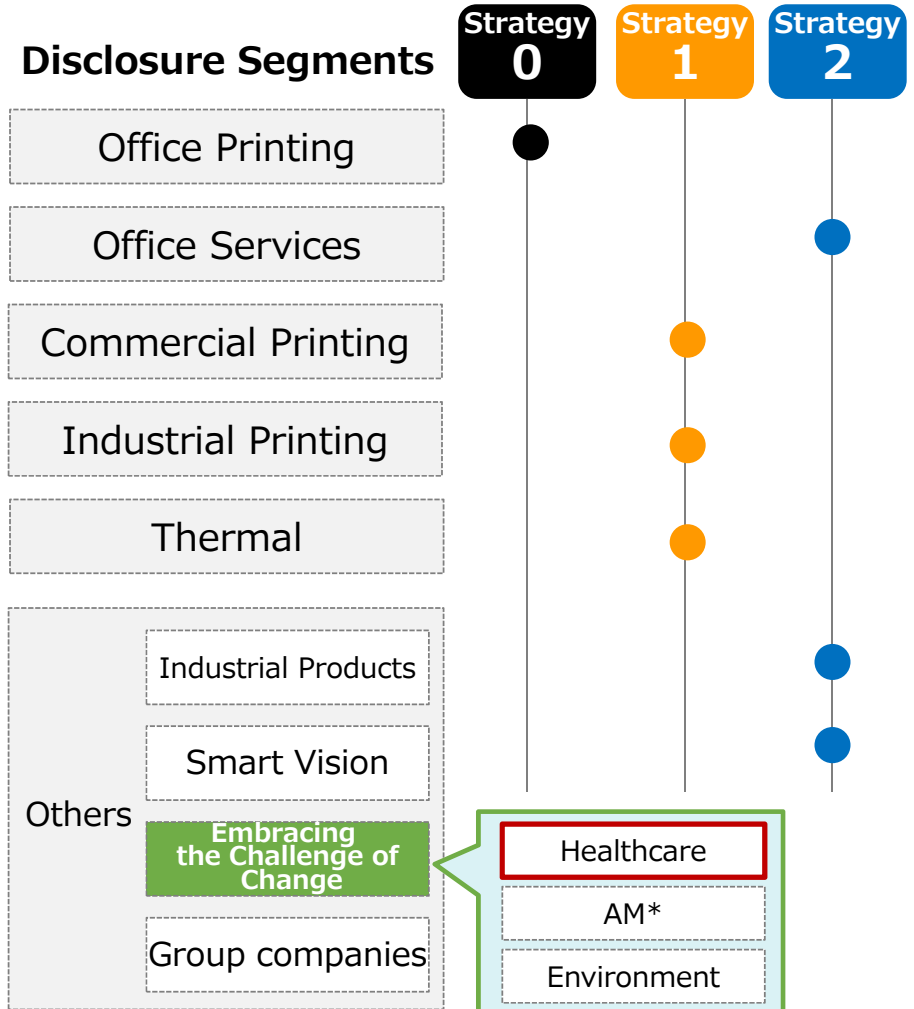
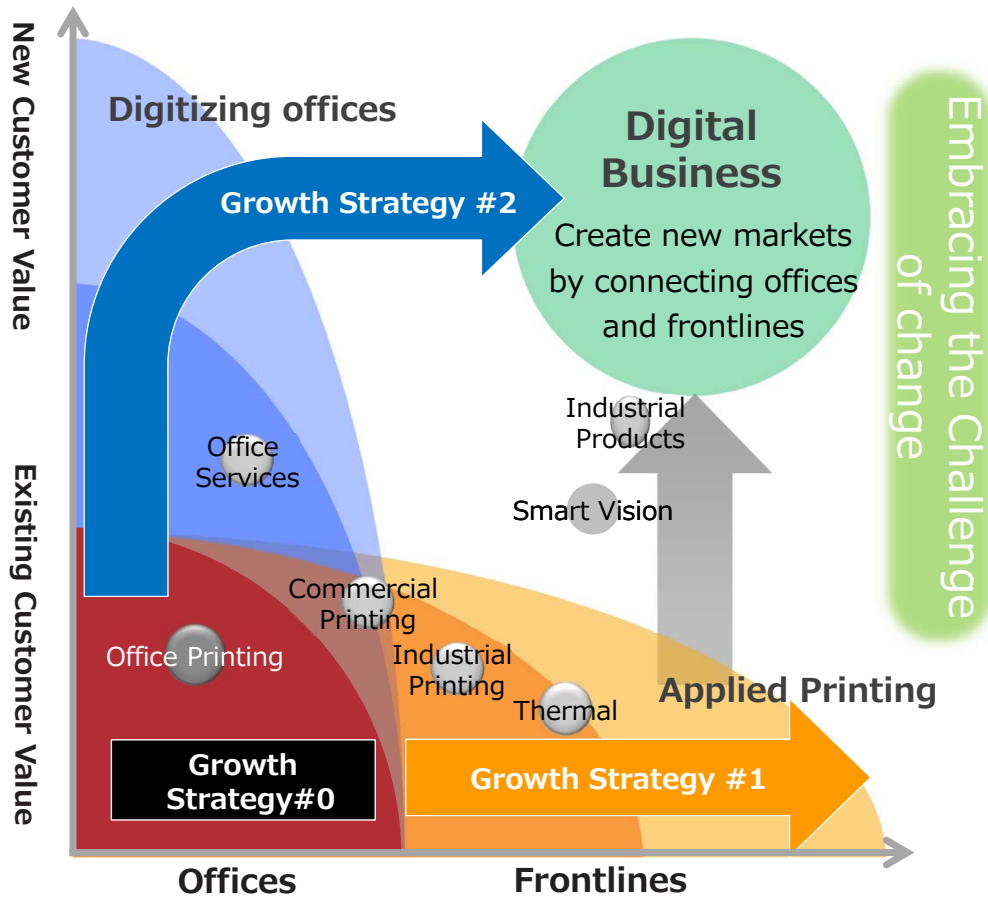


# Healthcare Business Strategy

**Nobihiro Genma**  
General Manager of  
Healthcare Business Group  
July 31, 2019



# RICOH Ignite Growth Strategy

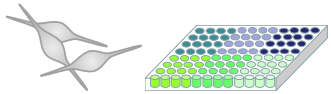


# Healthcare Business Vision

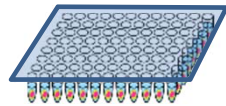
Help diagnose and swiftly detect and treat spinal cord, brain, and nervous system disorders to enhance health and longevity in aging societies

## Drug discovery (biomedical business)

Drug discovery support with iPS differentiated cells and cell chips



Highly precise genetic testing with DNA standard plates



## Regenerative medicine (R&D)

Monitoring functional recovery of spinal cords with magnetospinography



Accelerating neuroregenerative medicine R&D with magnetospinography

## Diagnostics (medical imaging business)

Using MEG to swiftly diagnose dementia and developmental disorders



Mapping body's entire nervous functions with magnetospinography



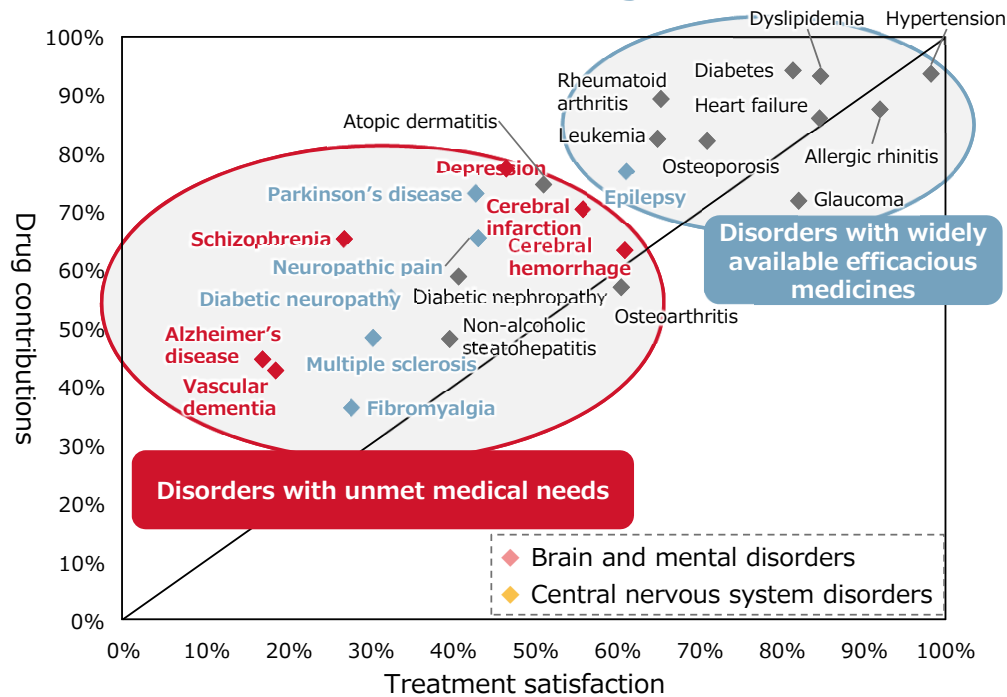
2030年に向けて  
世界が合意した  
「持続可能な開発目標」です



# Potential for Diagnosing and Treating Cranial Nerve Diseases

## Significant unmet needs remain for central nervous system disorders

### Satisfaction with treatments and drug contributions



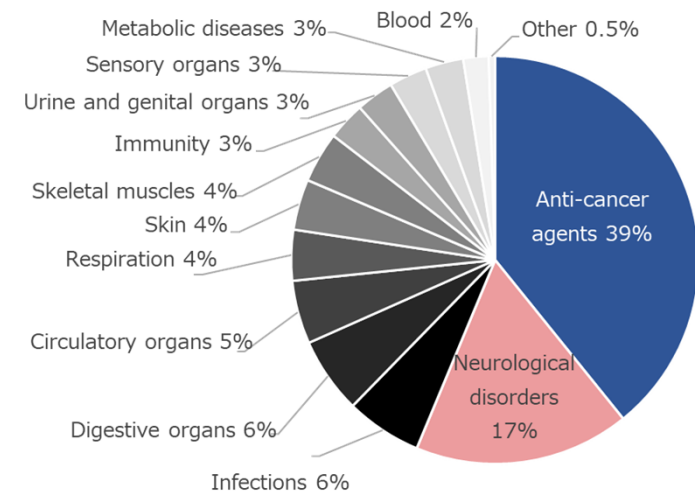
Source: 2014 Japan Basic Technology Survey Report by Japan Health Sciences Foundation

### Disorders that elude new drug targets

#### Unmet medical needs

- Cancer and neurological diseases in particular
- Where improvements with efficacious drugs have run their course

Pipeline percentages by disease worldwide



Ricoh seeks to save countless millions of people with brain and neurological disorders by leveraging medical imaging technology mapping neural activity and biomedical technology employing iPS cells

# Medical Imaging Business

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

- **Products and services**

- Brain and central and peripheral nervous system imaging equipment

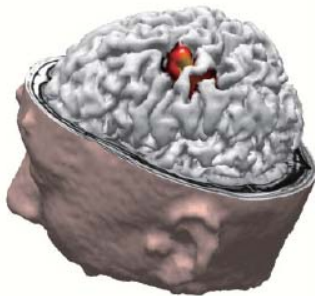
- **Features**

- Functional diagnostics:
- Unlike magnetic resonance imaging (MRI) and other systems that map shapes, measures human body's weak magnetic field (a billionth of Earth's)
- Ultraprecision magnetic sensor: Harnesses SQUID (superconducting quantum interference device)



## MEG

- For epilepsy and examinations prior to neurosurgery
- Detecting early signs of dementia and children's developmental disorders



MEG measurement system: PQA160C  
Medical device approval number: 22100BZX00914000

## Magnetospinography (not clinically approved)

- Supporting orthopedic surgical procedures for which MRI diagnostics have been difficult, notably for spinal collapses



Joint research entities: Tokyo Medical and Dental University Kanazawa Institute of Technology

# Developments to Date

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## Product development through joint research

- Have conducted joint magnetospinography R&D since fiscal 2014 with Tokyo Medical and Dental University and Kanazawa Institute of Technology



## Magnetoencephalograph business approach

- Acquired Yokogawa Electric's magnetoencephalography business on April 1, 2016



MEG measurement system: PQA160C  
Medical device approval number: 22100BZX00914000



## Fully entering healthcare arena

- December 2017: Commercialized RICOH MEG in United States
- July 2017: Commercialized RICOH MEG in Japan

# MEG

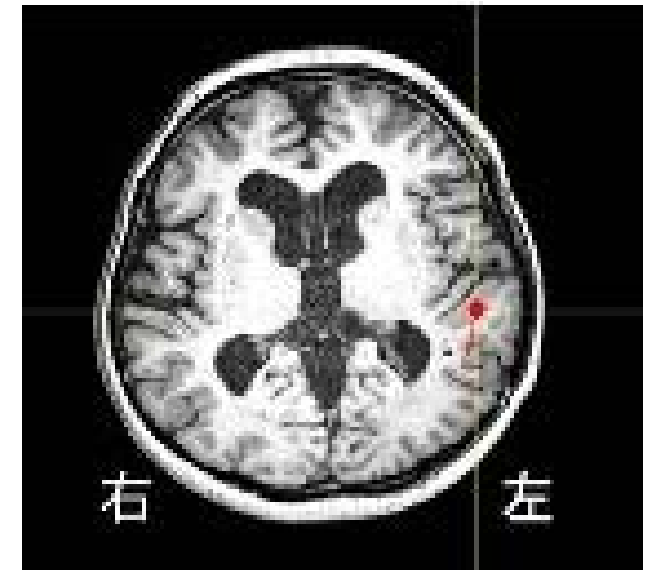
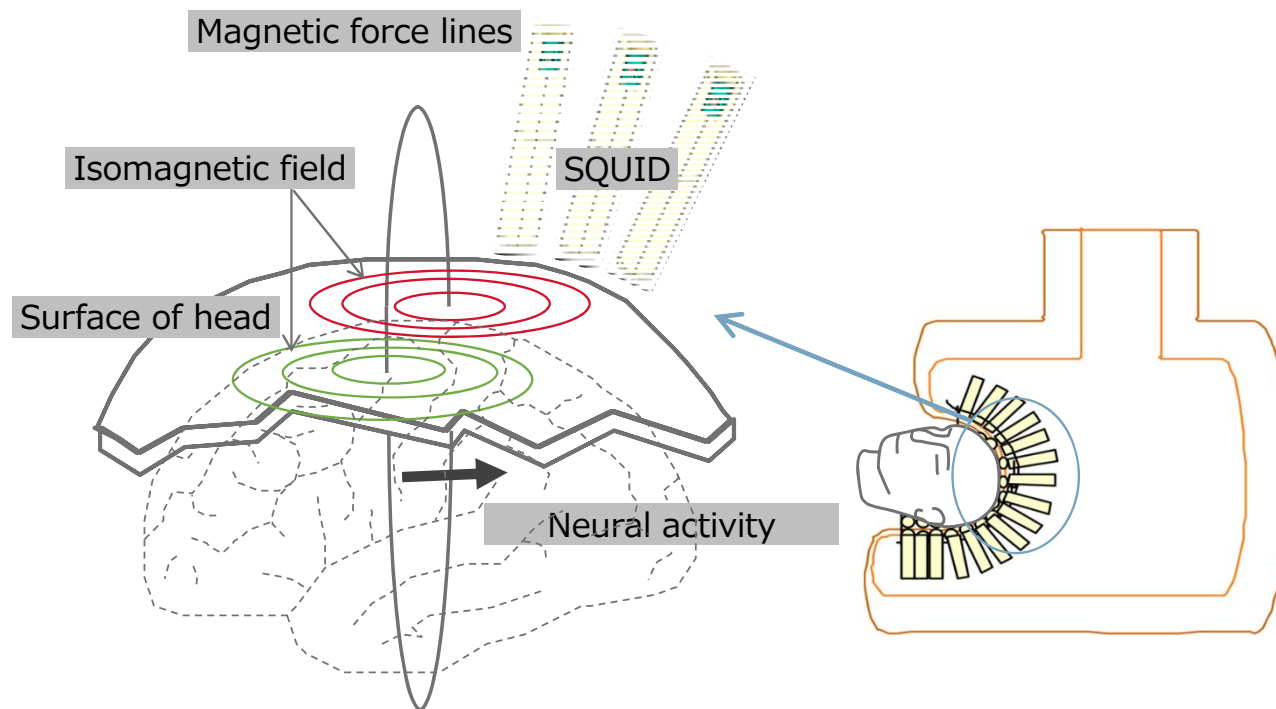
Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

- Employed in clinical trials, notably to identify epilepsy and brain tumors
- R&D to swiftly diagnose developmental disorders and dementia



Using both MEG and MRI makes it possible to accurately identify sources of abnormalities and thereby determine surgical locations, such as for people with epilepsy



# New MEG Approaches

Bioprinting Technology

R&D

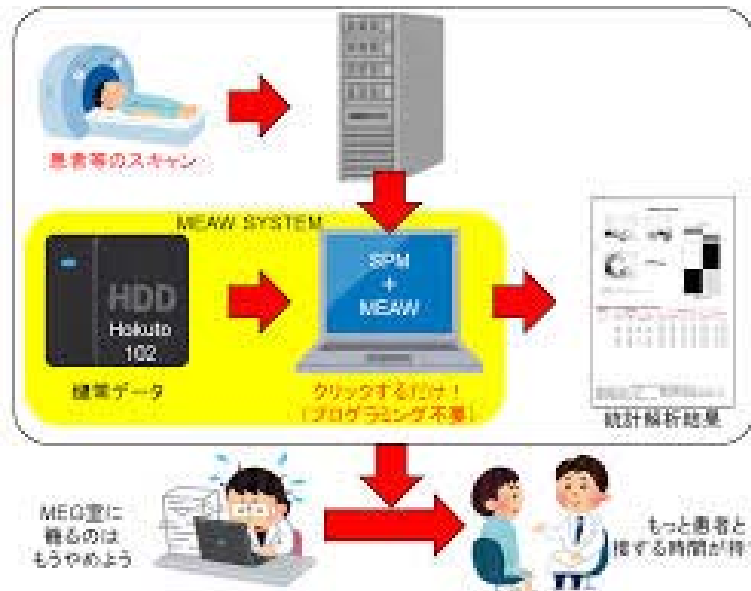
Medical Imaging Business

**RICOH**  
imagine. change.

- Launching brain function dock initiative with Hokuto Hospital
- Beginning joint research with Kanazawa University to swiftly diagnose developmental disorders

## Joint research with Hokuto Hospital

- Project to create free and open neural function Big Data and analysis support tools



## Joint research with Kanazawa University

- Using world's only three children's MEGs in joint research with Kanazawa University to swiftly diagnose developmental disorders





# Spinograph

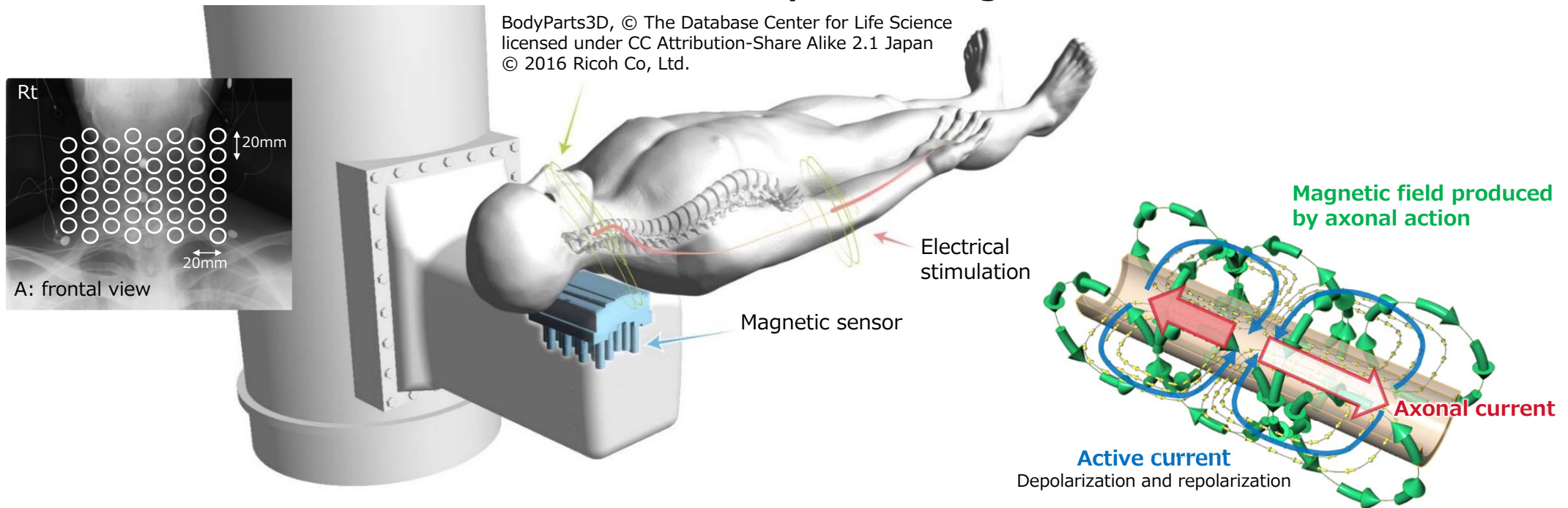
Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## Detecting neural activity (in milliseconds, for one-tenth to one hundredth of brain magnetic field after electrically stimulating limbs



The only system that can provide **minimally invasive** imaging of central and peripheral nerve activity, materializing safe and comfortable medical measurement services

# Mapping Neural Activity by Measuring Neuromagnetic Fields

## I. Magnetospinography

1. Neck
2. Waist

## II. Magnetoneurography

1. Hands
2. Brachial plexus

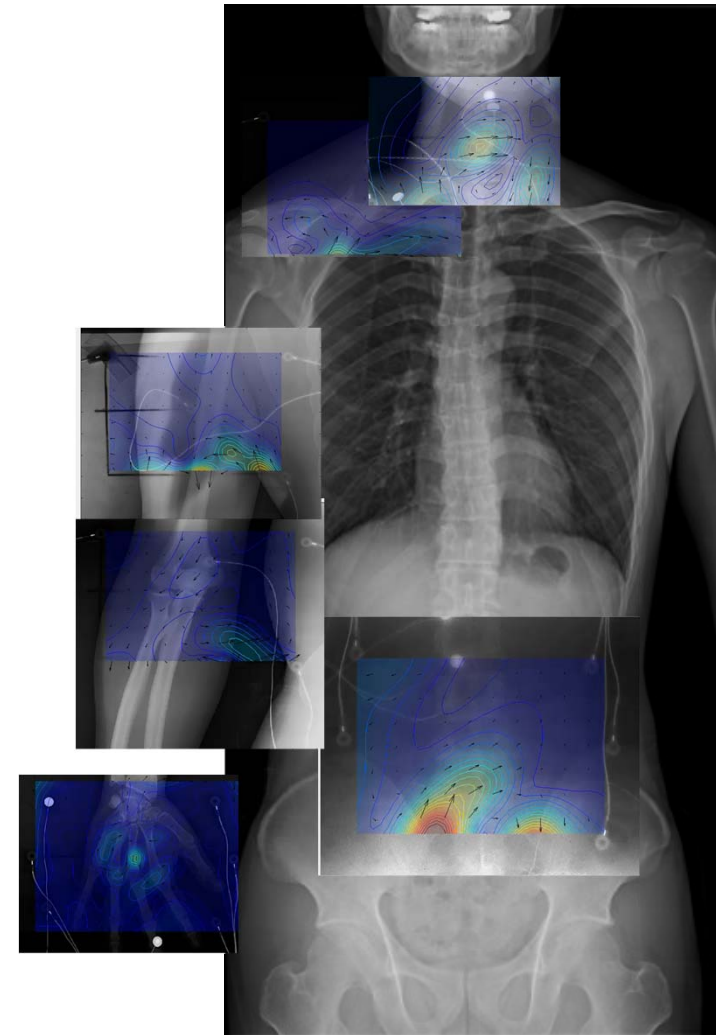


Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.



# Potential of Magnetospinography

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

- **Advanced** system developed to map neural activity of spinal cord and peripheral nerves
  - Enabling noninvasive assessments
  - Enabling functional rather than shape evaluations
- Conducting surveys in Japan and abroad through academic and other activities, **confirming spread of ailments that can be researched** and validating **great potential of practical applications** for system

## Key areas of research potential

- Spine and spinal cord diseases
- Brachial plexus disorder
- Diabetic neuropathy
- Guillain-Barre syndrome
- Multiple sclerosis
- Amyotrophic lateral sclerosis

## Patient universe

Spinal diseases

Diabetic neuropathy

Multiple sclerosis

# Biomedical Business

Bioprinting Technology

R&D

Medical Imaging Business

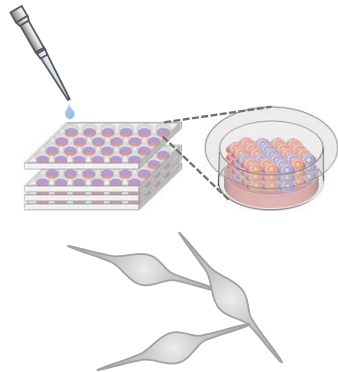
**RICOH**  
imagine. change.

## ● Vision

- Leveraging Ricoh's bioprinting technologies and Elixirgen Scientific's iPS cell technologies to tackle new challenges in drug discovery and diagnostics

## Biomedical business

### Personalized and stratified medicine Companion diagnostics



#### ● In Vitro screening services

- Pharmaceutical test assay service
- Safety test assay service

#### ● Drug discovery support tool sales

- iPS differentiated cell and tissue chip
- Disorder model chip

#### ● Cell and differentiation reagent sales

- iPS cell-derived neurons

Drug discovery  
business

Diagnostic agent  
business

#### ● Diagnostic reagent sales

- Multiplex diagnostic agents
- Micro-quantification genetic diagnostic agents

#### ● Clinical laboratory standardization reagent sales

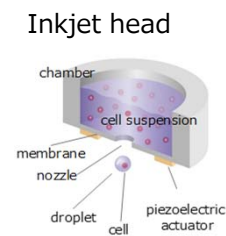
- DNA standard plates
- Positive control



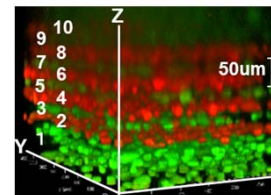
## Core technologies

1. Precision inkjet deposition of live cells (precise control of cell numbers and positions)
2. 3D accumulation of hydrogel and live cells
3. Rapid iPS cell differentiation technology

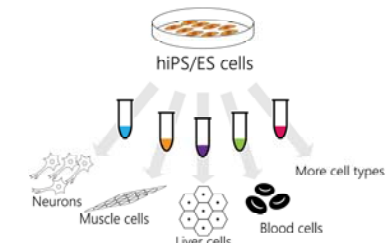
### Bioprinting technologies



#### 3D accumulation



### Rapid iPS cell differentiation technologies



# Bioprinting Technology

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

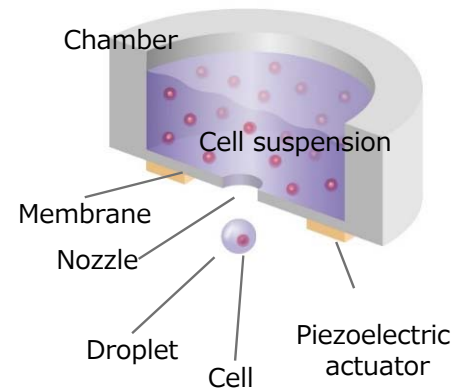
## Bioprinters

- Developing new inkjet heads with simple structures that can discharge cells

Instrument



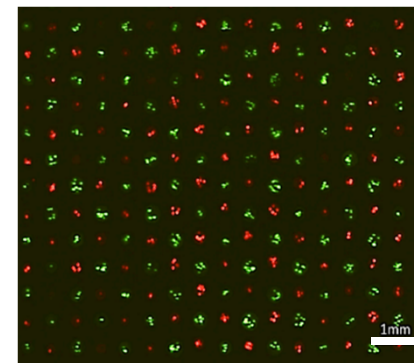
Inkjet head



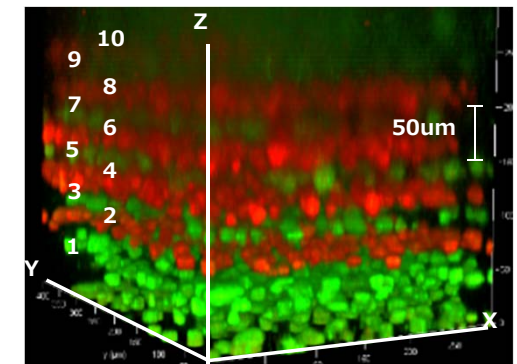
## Cell patterning

- Combining human cells and hydrogels to create various shapes and reproduce functionality of human organs

2D patterning



3D accumulation



Developing unique inkjet technology that can precisely dispense living cells  
(precisely controlling cell numbers and positions)



# Rapid iPS Cell Differentiation Technology

Bioprinting Technology

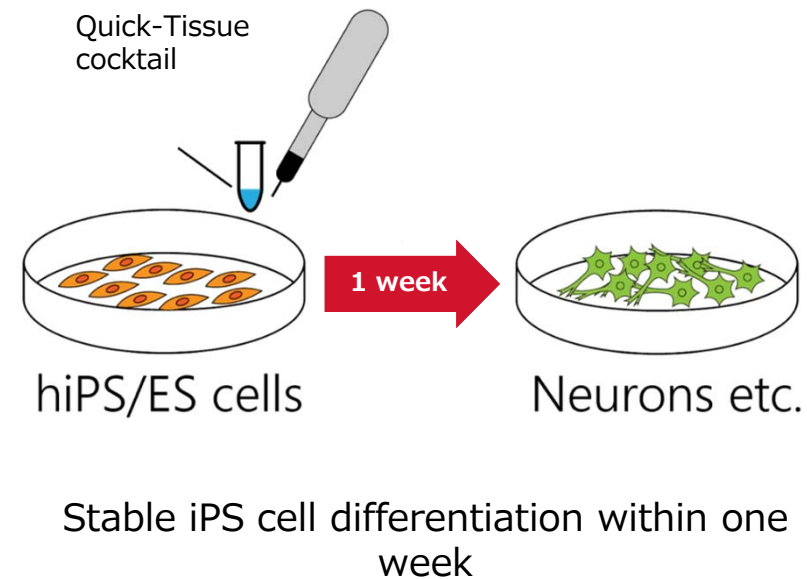
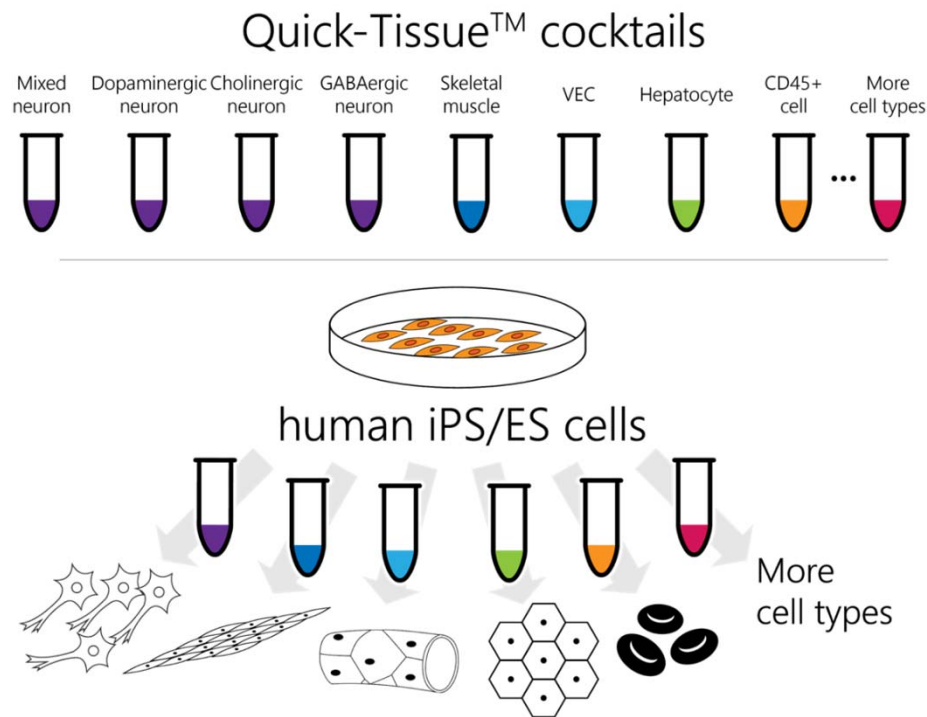
R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## Elixirgen Scientific Quick-Tissue™ technology

- Fast differentiation through simple process of applying transcription factor-derived cocktails to human iPS cells



# Drug Discovery Business Objectives

Bioprinting Technology

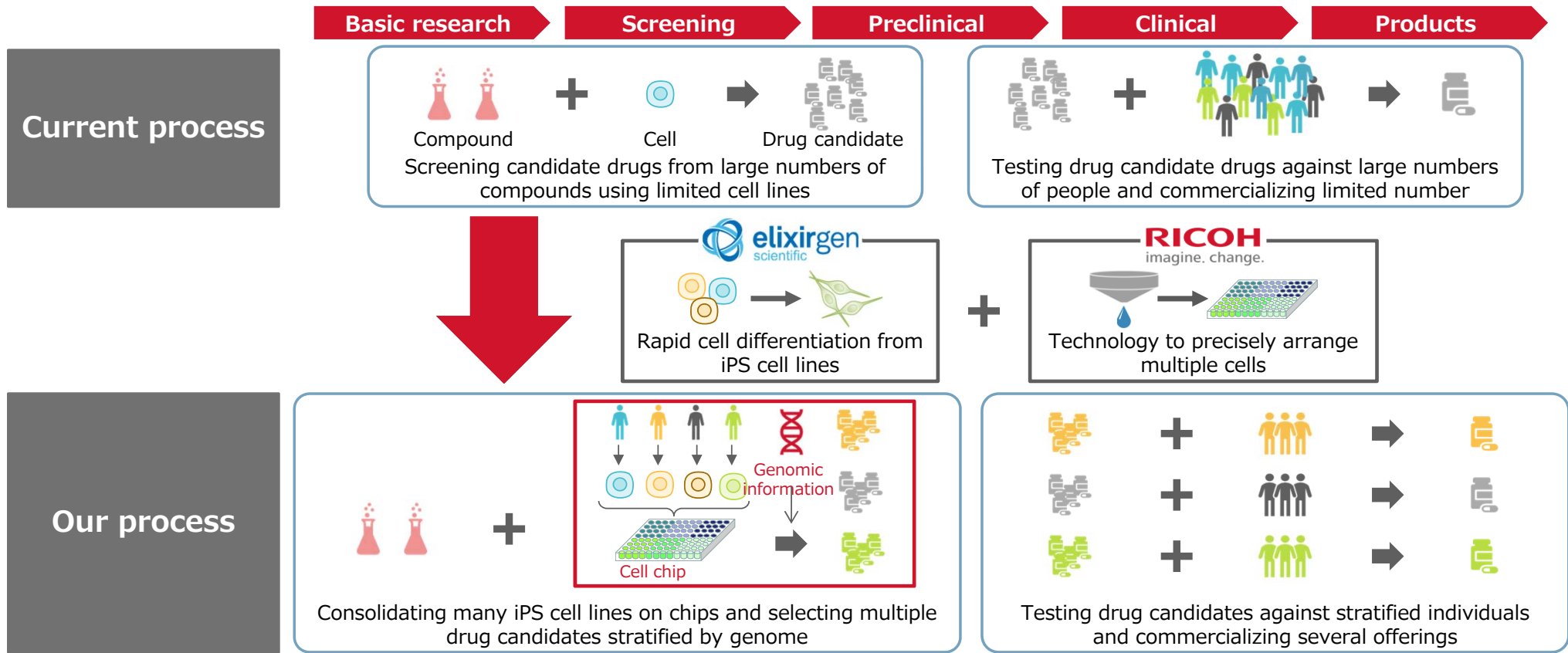
R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## Toward drug discovery process innovation and personalized medicine

- Drug discovery process (new drug development)





# Business Steps, Winning Edge, and Strengths

Bioprinting Technology

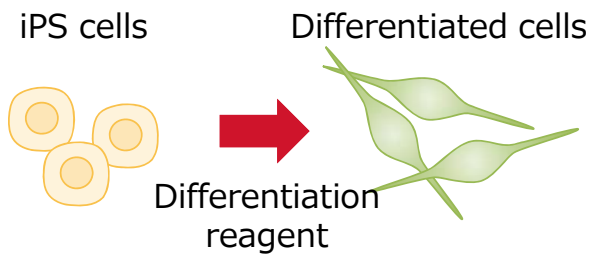
R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## Phase 1

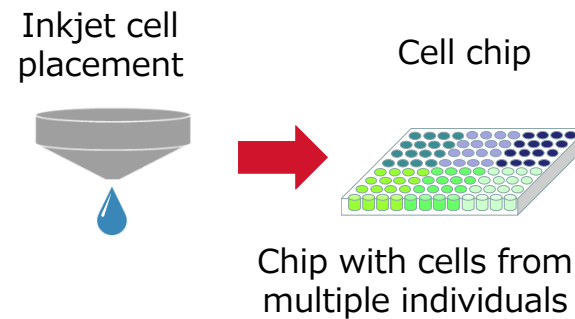
### Drug discovery (new drug development) process



- Stably supply iPS differentiated cells by drawing on differentiation technology of Elixirgen Scientific
- Provide neurons with mature functions

## Phase 2

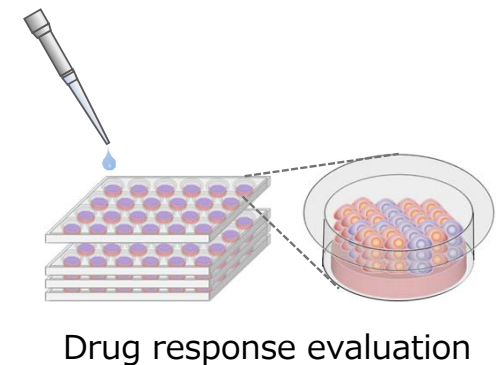
### Cell plate and chip business



- Materialize chip and plate that collectively evaluates impact of genetic diversity on drug candidates (stratified drug development)

## Phase 3

### Assay service business (Drug discovery support business)



- Develop assay that supports own tissue model and thereby offer drug discovery approach differing from existing approaches

# Targeting Cranial Nerve Disorders

Bioprinting Technology

R&D

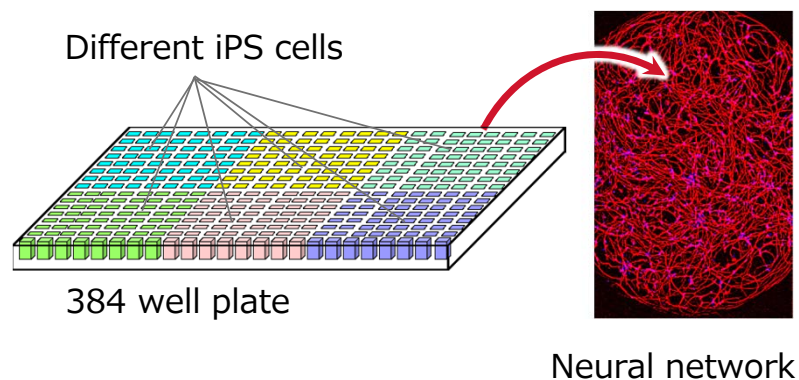
Medical Imaging Business

**RICOH**  
imagine. change.

- Nerve tissue chip to evaluate efficacy and neurotoxicity with cranial nervous system diseases
- Efficacy and toxicity evaluation services using this chip

## Nerve cell chip

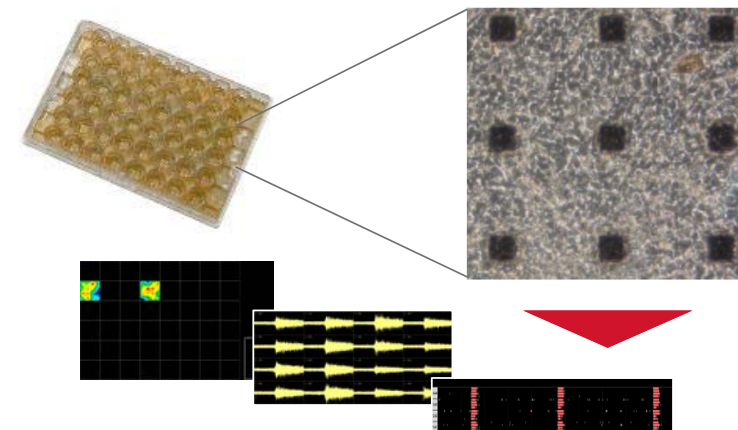
- Evaluating diversity by using iPS cells derived from multiple people



## Electrode chip for evaluating neural functions

- Measuring nerve cell firing electrophysiologically
- Evaluating spasms and other neurotoxicity
- Epilepsy and other efficacy evaluations

Multi-point electrode plate      Neural cells on electrode



# Overview of Diagnostic Agent Business

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

## ● Vision

- Supply diagnostic agents for personalized medicine, centered on companion diagnostic drugs

## ● Products and services

- DNA standard plates to calibrate genetic testing equipment and control test precision
- Looking to offer companion diagnostic agents to determine efficacy of stratified drugs for cranial nerve disorders

# DNA Standard Plates

Bioprinting Technology

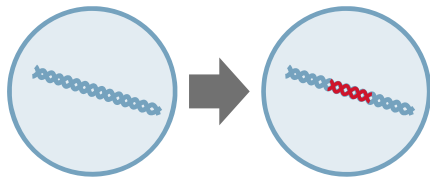
R&D

Medical Imaging Business

**RICOH**  
imagine. change.

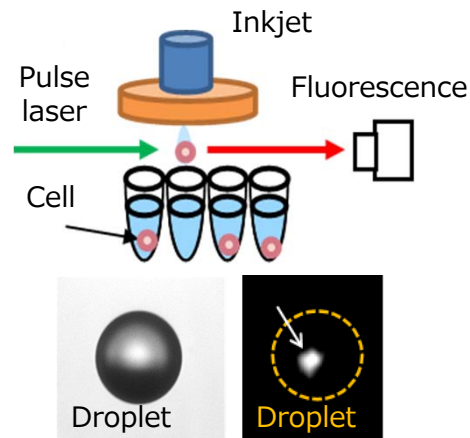
## Toward drug discovery process innovation and advanced personalized medicine

### Genetic recombination



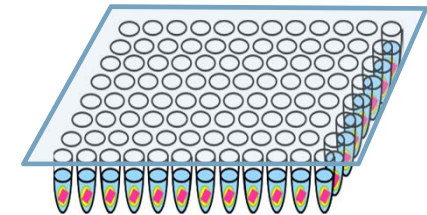
- Introduce desired DNA sequence into cells through genetic recombination

### Precise cell dispensing



- Dispensing through inkjet while counting number of discharged cells

### DNA standard plate



- Plate specifying number of arbitrarily sequenced DNA copies
- Specifying 1 to 1,000 copies

Joint studies with National Agricultural and Food Research Organization and FASMAC, which is part of Nippon Flour Mills Group

# DNA Standard Plate Evaluation Results

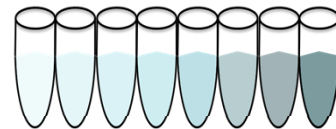
Bioprinting Technology

R&D

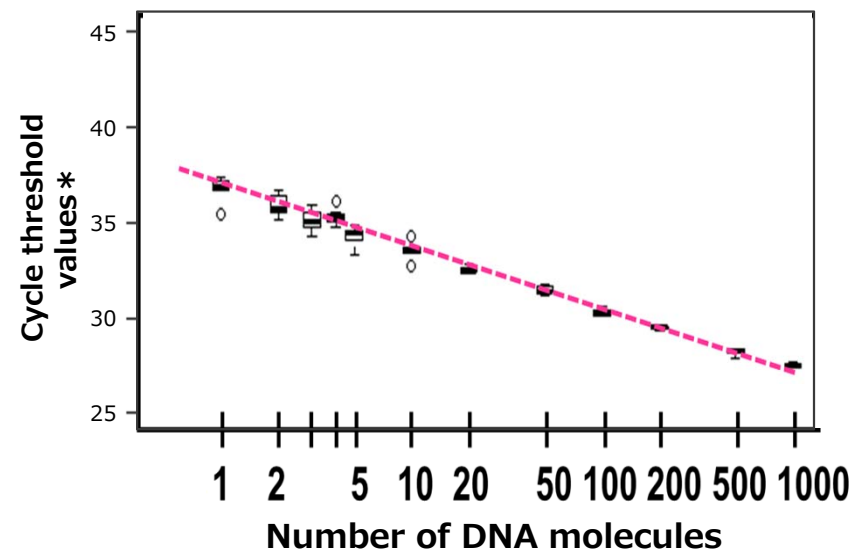
Medical Imaging Business

**RICOH**  
imagine. change.

- Inspection equipment and reagent quality control
- Guaranteed detection accuracy for low number of molecules



1 to 1,000 molecules



**Linearity ensured for 1 to 1,000 molecules**

\*Cycle threshold value = number of amplification cycles required for detection

# DNA Standard Plate Commercialization

Bioprinting Technology

R&D

Medical Imaging Business

**RICOH**  
imagine. change.

- We plan to launch DNA standard plates



96 well plate

## Plans

- ✓ Expand lineup of accuracy control and positive control plates
- ✓ Internationally standardize genetic testing

**RICOH**

imagine. change.



# Forward-Looking Statements

The plans, prospects, strategies and other statements, except for the historical events, mentioned in this material are forward-looking statements with respect to future events and business results. Those statements were made based on the judgment of Ricoh's Directors from the information that is now obtainable. Actual results may differ materially from those projected or implied in such forward-looking statements and from any historical trends. Please refrain from judging only from these forward-looking statements with respect to future events and business results. The following important factors, without limiting the generality of the foregoing, could affect future results and could cause those results to differ materially from those expressed in the forward-looking statements:

- a. General economic conditions and business trend
- b. Exchange rates and their fluctuations
- c. Rapid technological innovation
- d. Uncertainty as to Ricoh's ability to continue to design, develop, produce and market products and services that achieve market acceptance in hot competitive market

No company's name and/or organization's name used, quoted and/or referenced in this material shall be interpreted as a recommendation and/or endorsement by Ricoh.

This material is not an offer or a solicitation to make investments. Please do not rely on this material as your sole source of information for your actual investments, and be aware that decisions regarding investments are the responsibility of themselves.