

● Starting Stage

(Fiscal Year 2002-2004)

Chiba/Tokatsu Area

Discovery and Industrial Application of Bio-Seeds in Relation to Health Science



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Core Research Organizations

Chiba University, The University of Tokyo, Tokyo University of Science

● Major Participating Research Organizations

Industry···BIO MATRIX RESEARCH, INC., SAKAGUCHI GIKEN Co., Ltd., SEIKO Precision Inc.
 Academia···Chiba University, The University of Tokyo, Tokyo University of Science
 Government···National Institute of Radiological Sciences, Chiba Cancer Center, Research Center for Innovative Oncology - National Cancer Center Hospital East

Main Results of City Area Program

1. Development of a versatile microscope offering high-speed image acquisition

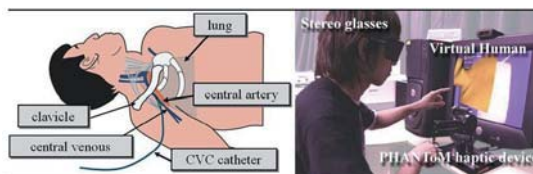
Although digital images are fully utilized in pathology research in both the United States and Europe, such images are rarely useful in the field because it requires a long time to obtain such images in Japan. In this R&D project, we developed a system via which it is possible to efficiently incorporate image data of a wide area into a computer; we then applied this method to an optical microscope. We also developed a program (multifocus display software with a virtual microscope) that enables digitized data to be viewed as a real microscope image. This technology has the potential to replace microscopic analysis with digital images.



Multifocus display software

2. Development of a high-sensitivity gene chip

Trials undertaken to improve current DNA chip technologies produced several successful results, including improvement in sensitivity by an order of magnitude and minimizing the starting materials by an order of magnitude. This development will contribute not only to transcriptome analysis but also to a wide range of medical research, including drug-discovery research. As prototype manufacturing projects, we developed a “Subclavian central vein puncture training system” and a “Neural multifunction-screening machine” in collaboration with the Research Center for Frontier Medical Engineering of Chiba University, representing the first research facility of its type in Japan. These two products have received high acclaim.

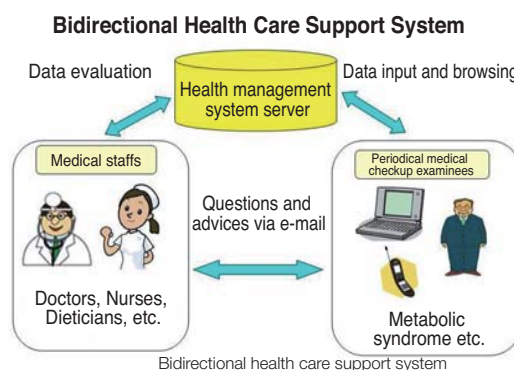


Subclavian central-vein-puncture training system

Approaches after Completion of Project

● Promotion of a joint research as part of the “Basic Stage”

The development of new instruments for the early diagnosis and prevention of lifestyle diseases and the construction of a predictive diagnostic system and a health support network system are important contemporary issues, as lifestyle diseases now represent a large proportion of the diseases encountered in Japan. By utilizing the combined technologies developed in this area (including medicine, pharmacology, genome science, engineering, and IT), in addition to previously obtained technical results, we established a new business theme titled “Dual Approach to the Prevention of Lifestyle Diseases Based on Genome Health Science,” consisting of the following two projects that were adopted as the Basic Stage industry–academia–government joint-research business (Fiscal Year 2005-2007).



1. Development of a personalized health-care support system and devices that use combined technologies to overcome metabolic syndrome and lifestyle diseases
2. Development of innovative and non-invasive expectation diagnosis system and new drug-discovery target against lifestyle diseases by novel antibody microarray and protein synthesis system

●Starting Stage

(Fiscal Year 2002-2004)

Matsuyama Area

Innovation of Production Technology Using Application Technology for In-liquid Plasma

- Major Participating Industry: About 100 organizations in this area
- Research Organizations Academia: Ehime University
- Government: Industrial Research Center of Ehime Prefecture, Ceramics Institute of Ehime Prefecture (now Ehime Institute of Industrial Technology)

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Core Research Organization
Ehime University



Others

Main Results of City Area Program

1. Development of an in-liquid plasma device for the decomposition of substances

We designed an RF circuit for generating stable plasma, and determined the equivalent circuit of the plasma generator. The plasma impedance was modeled to design a plasma reactor, leading to the production of a stable plasma reactor using microwaves and high-frequency waves with high energy efficiency.

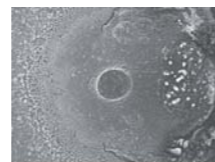
Using this device, harmful substances considered to be environmental contaminants (e.g., emissions of fluorocarbon, dioxin, and PCB) can be decomposed and rendered harmless more effectively than that possible using conventional methods, as the proposed system does not depend on the type of liquid, and the plasma can be generated in a variety of liquids.



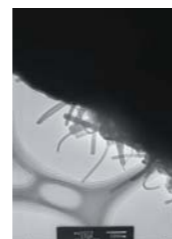
High-frequency in-liquid plasma generator

2. Material synthesis using in-liquid plasma

We succeeded in synthesizing polysilicon carbide with a smooth surface and minor graphite in silicon oil, carbon nanotubes in benzene solution containing ferrocene, and the deposition of diamond-like carbon film on carbon fiber in n-dodecane. High-density plasma can be efficiently generated in water, and we developed an in-liquid plasma device that can rapidly synthesize large quantities of various materials.



SEM image of polycrystal SiC film

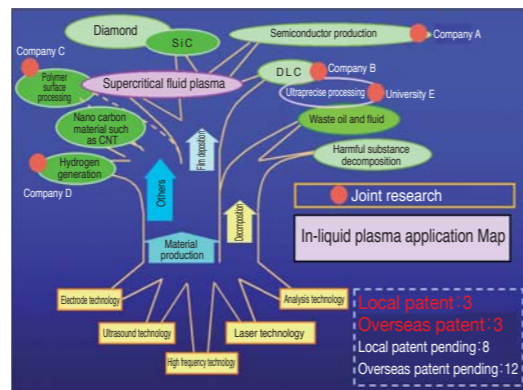


TEM image of carbon nanotube

Approaches after Completion of Project

1. Establishment of a center for studies of in-liquid plasma and promotion of joint research

A research project targeting application technology for in-liquid plasma was established with the cooperation of the Department of Engineering, Department of Science, Department of Agriculture, and The Integrated Center for Science at Ehime University. We have advanced R&D concerning the in-liquid plasma process, sono-process, and laser measurement technology. Moreover, joint research conducted with four companies has promoted the development of in-liquid plasma equipment and high-speed large-area semiconductor deposition technology. We have acquired three domestic patents and one patent in each of the US, South Korea, and China. Following completion of the City Area Program, many patents have been submitted.



In-liquid plasma application Technology map

2. Development of a conventional small decomposition device

The in-liquid plasma device was developed by inserting a special electrode into a conventional, commercially available microwave. It is proposed to mass-produce the device in the field of consumer electronics. Using this device, hydrogen with a purity of 80% was obtained from waste oils.

This device can produce hydrogen at the efficiency of about 30% of the electrolysis of alkali water solution. The device is expected to be used as a consumer-level hydrogen station.

3. Prof. Shinfuku Nomura and Assoc. Prof. Hiromichi Toyota from Ehime University, Graduate School of Science and Engineering, received the 40th Ichimura Technology-Contribution Prize. The originality and potential of the "in-liquid plasma technology" were praised by the judging committee.

●Starting Stage

(Fiscal Year 2002-2004)

Oita-Ken-ou Area

Development of Technology and Production Methods to Ensure Food Safety and Health, and Enhance the Quality of Senior Citizens' Welfare

- Major Participating Industry: Farmtech CO., LTD., GOTOTAIKI CO., LTD., NPO Beppu Hatto Onpaku, and others
- Research Organizations Academia: Oita University, Nippon Bunri University, Oita National College of Technology, and others
- Government: Oita Industrial Research Institute, and others

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Core Research Organizations
Oita University, Oita Industrial Research Institute



Life Sciences

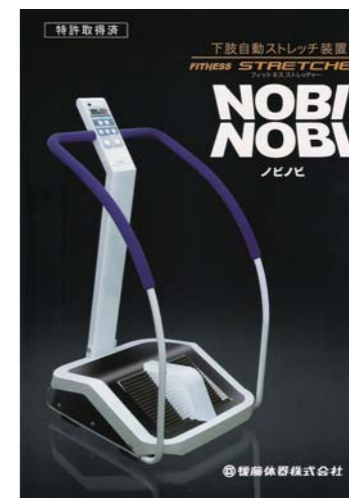
Main Results of City Area Program

1. We achieved success in the practical application of an auto-stretching device for the lower limbs, named the Fitness Stretcher NOBI NOBI !

We developed an auto-stretching device for the lower limbs, and succeeded in its practical application by which passive dorsiflexion and plantar flexion of the ankle joints are performed while standing.

We confirmed that dynamic stretching of the triceps surae improves blood flow via the muscle pumping effect. The flexibility of muscles associated with the ankle joints is also improved.

The device is effective not only in curing edema in the lower limbs but also in preventing venous thrombosis, which is likely to occur during prolonged sitting or lying.



auto-stretching device for the lower limbs

2. Foliar spray solution for reducing nitrate concentrations and enriching antioxidant concentrations within vegetables

An adequate amount of nitrate (NO_3^-) is required for plant growth. However, the transformation of nitrate (NO_3^-) into nitrite (NO_2^-) has been identified as a potential hazard to human health. The amount of residual nitrate in vegetables should therefore be minimized as much as possible. This study focused on aqueous solutions as foliar spray that can reduce the nitrate content in vegetables and simultaneously increase the level of antioxidants such as vitamin C and polyphenol. This study formulated the target solution, and then commercialized it as several foliar sprays. Over the course of development, we carefully estimated how the developed foliar sprays affect "food safety" marketing, with the cooperation of farmers and a large supermarket.



SAKUTOU Mg (a foliar spray solution as a nitrate reducer)

Approaches after Completion of Project

1. Launch of esthetics services using hot-spring mud (Fango)

Skin tests and questionnaires were conducted before and after the application of hot-spring mud (Fango) collected from Beppu Onsen, to enable scientific verification of the effect of Fango Esthetics on the skin and on healing.

Specifically, the method of Fango esthetics using the hot-spring mud from Beppu was established via the application of Fango Esthetics to more than 900 users. We obtained successful results, and secured trademarks for Esthetic services and related products.

In FY2005, following completion of the project, a facility to provide Esthetic services opened as a full-scale operation.



Fango esthetic treatment