



Ube

Creating new industries for next-generation medical equipment based on optical technologies using high-brightness white LEDs

Cluster Vision

Yamaguchi Prefecture's industrial structure specializes in basic materials. Taking advantage of its strength, Yamaguchi is aiming to promote cooperation between potential technological innovators such as companies manufacturing basic materials and potential sites of superior knowledge such as universities and to create new clusters uniting the two prefecture-wide in order to ensure that its industrial structure is internationally competitive. The focus of these efforts is a "Medical Innovation Cluster," and its specific emphasis is "Development of next-generation medical equipment based on optical technology using LEDs (Light Emitting Diodes)." A leading project related to cluster creation in this region is the construction of a strong research and development system, based on collaboration of industry, academia, and government, with Yamaguchi University at its core, along with promotion of regional innovation through use of R&D results in industry.

Project Overview

Our project is developing advanced medical devices/equipment designed to meet needs in a variety of medical fields such as prevention, diagnosis, and treatment using optical technologies such as high color-rendering (close to natural light) white LEDs developed independently at Yamaguchi University. With the active participation of local companies, companies outside the region, and universities and other research institutions, R&D is, through collaboration in medical engineering, proceeding with regard to the 3 themes below in order to develop and commercialize light systems for medical use, minimally invasive medical devices, and advanced diagnostic equipment.

< R&D Themes >

- ① Development of light systems for medical use based on high-brightness white LEDs.
- ② Development of minimally invasive medical devices based on high-brightness white LEDs.
- ③ Development of highly functional diagnostic equipment based on optical technology.

< Project Promotion System >

A Knowledge Cluster Headquarters was set up as a control center for project implementation and staffed by a President, a Project Director, Science and Technology Coordinators, and Commercialization Coordinators who manage the project from R&D to commercialization. A Headquarters committee is organized as the decision-making body for the whole project, under which a Planning Committee and an Evaluation Committee are also organized. Project is progressing with cooperation from outside advisers as well. The Yamaguchi Prefectural Government set up a "Knowledge Cluster Executive Committee," headed by the Governor of Yamaguchi, to promote the commercialization of R&D results and to promote cooperation with the Industrial Cluster Project. The Headquarters is located within the Collaborative Research Center of Yamaguchi University and works in close cooperation with its organizations.

Project Director
Hiroyuki Asada



Former Director, Yamaguchi Prefectural Industrial Technology Institute

Our Goal is to Create an Advanced Medical Devices/Equipment Cluster by Using the Knowledge Cluster Initiative as a "Primer."

Yamaguchi University is working on the research and development of advanced medical equipment/devices though long-standing collaboration between the School of Medicine and the Faculty of Engineering. The Faculty of Engineering has also been involved in independent research on high-brightness, white light-emitting diodes (LEDs). With these original technologies as a base, R&D is proceeding for their use in minimally invasive medical equipment/devices. With such roots, we spent two years as a pilot area for creation of a knowledge cluster and were officially designated a project area starting in fiscal 2004. After an intermediate evaluation in 2006, we focused on three themes consisting of 9 sub themes.

As our successes thus far, we successfully verified the high functionality of using a prototype white LED endoscope to observe the inside of a dog's stomach—this was a major stride towards practical use. We have also made progress on our other two themes, optical medical equipment and novel diagnostic systems. Yamaguchi University serves as the core of this project, and the university is linked with research institutes (the Yamaguchi Prefectural Industrial Technology Institute, the National Institute of Advanced Industrial Science and Technology, and others) along with the dynamic energy of private industry, including local companies. We are also working toward collaboration with the industrial cluster plan as well. So that we can serve as a trigger for innovation of Yamaguchi Prefecture's industrial structure (where basic raw materials currently account for 70% of all industrial shipments), we aim to create an advanced medical devices/equipment cluster within the Ube region.

Cluster Headquarters

- President.....Takuya Marumoto (President, Yamaguchi University)
- Project Director.....Hiroyuki Asada
- Chief Scientist(CS).....Tsunemasa Taguchi (Professor, Yamaguchi University)
- Deputy Chief Scientist(CS).....Masaaki Oka (Professor, Yamaguchi University)
- Science and Technology Coordinators.....Shinichiro Uchiyumi, Toshihiro Hamada, Hiromitsu Kibashi

Core Organization

Yamaguchi Industrial Promotion Foundation

Participating Research Organizations (Bold: Core Research Organization)

- Industry...Almould CO., ALOKA CO., Ube Industries, LTD., Koizumi Lighting Co., Sanjo Seiki Co., Ltd., Toyobo Co., Ltd., Fujinon Corporation, Choshu Industry Co., Ltd., Mitsubishi Chemical Corp., Yokogawa Electric Corporation, Olympus CO., etc.
- Academia...**Yamaguchi University**, National Fisheries University, etc.
- Government...National Institute of Advanced Industrial Science and Technology (AIST), Kanmon Medical Center, National Hospital Organization, Yamaguchi Prefectural Industrial Technology Institute

Main Results

1. Development of white LED excited by near UV light.

- ① We developed new phosphors and sealants and achieved a color-rendering index (Ra) of 96, which is the world's highest.
- ② We investigated mechanisms of improving luminous efficiency during crystal growth and obtained the world's highest level of external quantum efficiency for a near-UV LED (max. 405nm). Commercialization of an LED endoscope and general lighting system is expected in the future through further improvements in efficiency.

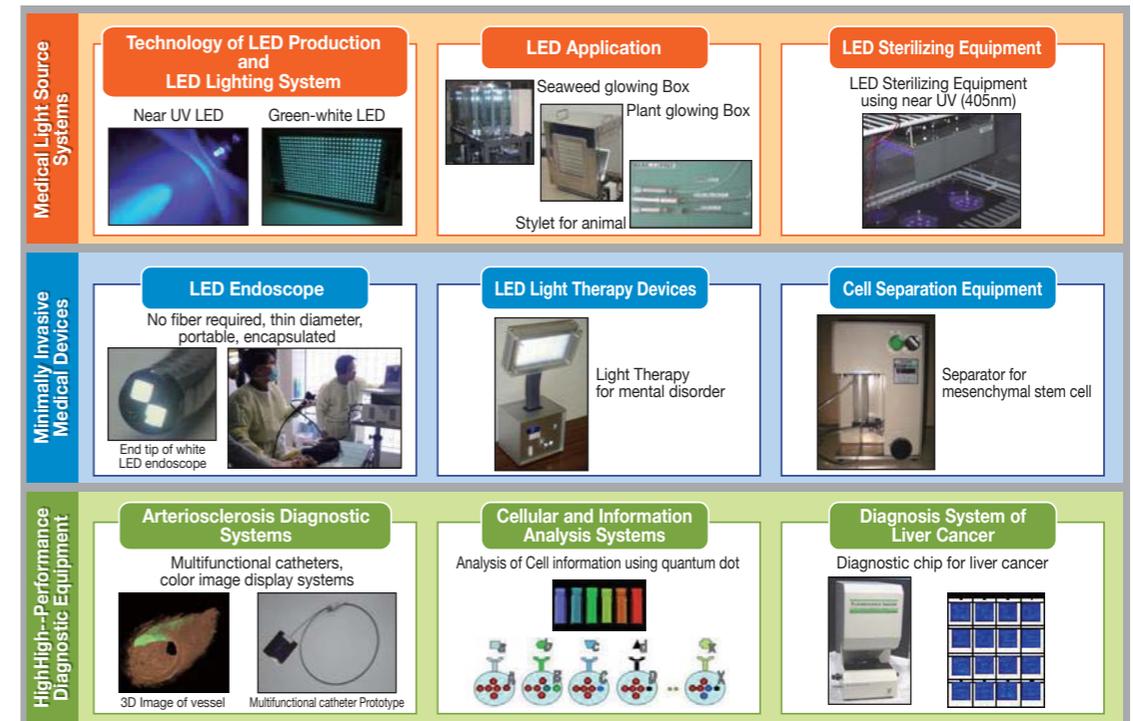


2. Commercialization of applications and products using LEDs

We commercialized various applications and products using white LEDs. A stylet developed as a local illuminator for veterinary care is being used as pharyngoscope light source for use in laboratory animals. In addition, LED light sources are also used in the marine products industry; one such product is an aquarium with LEDs that was developed for growth of seaweed and algae. Use of this aquarium allows efficient growth and cultivation of seaweed and useful algae using light.



Development of Next-Generation Medical Devices & Equipment Based on LEDs and Other Optical Technologies



Creation of a human-centered, people-friendly medical device industry based on LED and other optical technologies

Creation of an Optics, Lighting and Medical Industry Cluster