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World's First Development of Real-time Tissue Elastography for Ultrasonic Diagnosis by Imaging Tissue Hardness in Real-time

Under a joint development project with the University of Tsukuba, Real-time Tissue Elastography for imaging the hardness (i.e. elasticity) of tissue in real-time by ultrasound was developed and commercialized as the EUB-8500 ultrasonic diagnosis device.

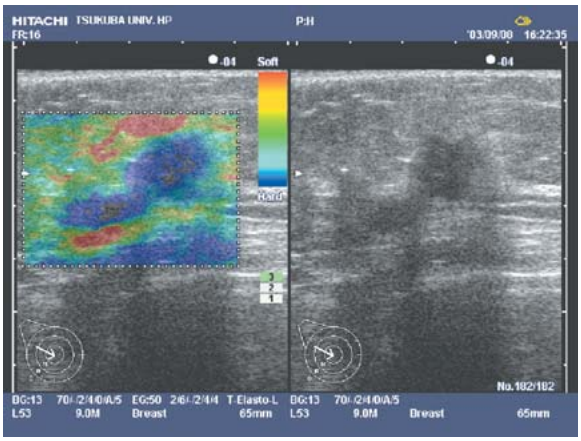
This ultrasonic diagnosis device transmits ultrasound waves into the body, and images the reflected sound waves generated in accordance with the difference in the propagation characteristics of sound traveling through tissue (acoustic impedance). Being extremely safe and providing diagnostic imaging in real-time, the ultrasound devices will find widespread applications—starting with abdominal examinations—in fields such as cardiovascular disease as well as obstetrics and gynecology.

In the region of the mammary glands, the difference in acoustic impedance is small, many times it can be difficult to clearly image tumors. Moreover, distinguishing between malignant and benign tumors and confirming diagnosis requires an invasive diagnosis technique such as needle biopsy or cytodiagnosis.

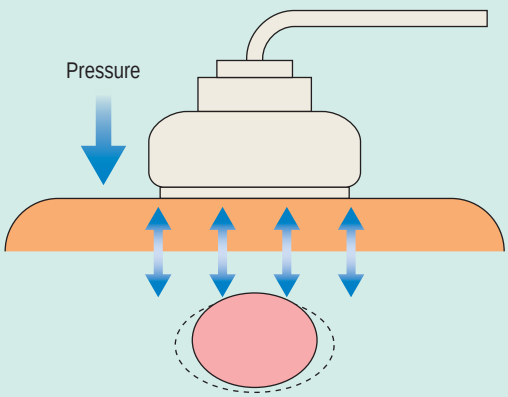
At the same time, the grade of malignancy of lesions and their tissue hardness are known to be mutually related. And as regards the mammary glands, research results have shown that a malignant tumor is two to three times stiffer than a benign one. With this background in mind, in collaboration with Dr. Shiina of the University of Tsukuba and Dr. Ueno of the same university, Hitachi Medical Corporation has jointly developed "Real-time Tissue Elastography"—a technique for imaging the hardness (i.e. elasticity) of tissue.

Simply operated by lightly pressing a probe to the surface of the body, this device can display the hardness of tissue in color in real-time. It applies the following principle: the deformation generated when the probe is pressed against the body surface is large for soft parts of tissue but small for harder parts. We have developed a high-speed method for calculating relative hardness (i.e. elasticity) from tissue-deformation data from the body, and for displaying the degree of that hardness in color.

As a result of this development—which narrows down the number of procedures needed for performing health checks—it is expected that the burden imposed on patients having to take secondary checkups will be lightened and that medical costs will thus be curbed. It is also expected that the physical as well as psychological burden on patients during health checks will be reduced.
(Hitachi Medical Corporation)



Example representation of mammary glands (invasive ductal carcinoma): As translucent expressions, the color image can simply confirm the location of ductal carcinoma by comparison with a black-and-white image.
Left: Real-time Tissue Elastography; right: black-and-white image
(Data provided by Dr. Ueno of the University of Tsukuba)



Pressure applied by probe

External view of EUB-8500

General Radiography Digital System Combined with FPD

General radiography digital systems were developed using CR (computed radiography). Due to the development of an FPD (flat panel detector), Hitachi has fabricated a general radiography digital system that emits low levels of radiation, has high image quality, and is highly efficient.

This new series has 3 models composed of an X-ray unit with a large FPD and a high performance image processing unit.

The concept is "All in one + α." The reason behind this concept is to get certain information needed to facilitate the study, to set up radiation conditions, and to display the exposed image quickly.

This series has a common FPD which is "17×17" FOV (field of view), 143×143 μm pixels (3,000×3,000 matrix), and are approximately 60% DQE (detective quantum efficiency). The series lineup consists of 3 types of models: universal, vertical, and horizontal. So, the customers can select the optimum system for their diagnostic objectives.

The console of this series is able to do the following: (1) receive some patient information and study orders from the RIS (radiology information system), (2) set examination conditions, (3) display images on monitor (approximately 3 seconds after radiation).

The aim of the universal system is to enable an examination environment without a cassette, and is able to study from multiple directions with a high degree of freedom.

The vertical and/or horizontal systems combined with a ceiling support tube are able to achieve high performance, for example synchronized movement with an FPD and a tube.

The main effect of using this series is increasing workflow efficiency because healthcare practitioners automatically receive patient information from RIS, examination orders, and parameters necessary for setup.

Furthermore, users will get high degree of examination efficiency because of rapid and efficient positioning during examination and the display of the image 3 seconds after radiation exposure.

(Hitachi Medical Corporation)

Universal type

Horizontal/vertical type

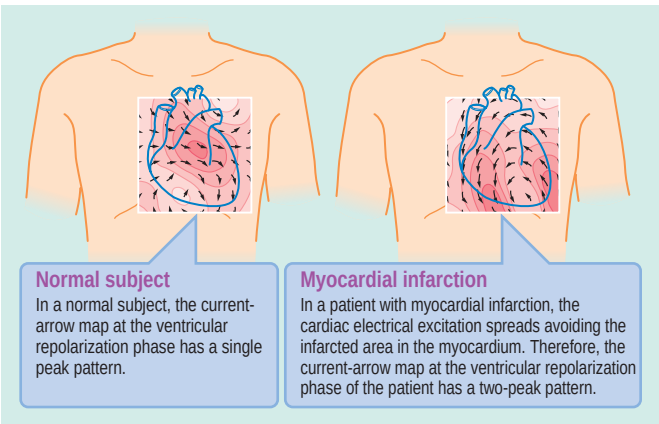
Advanced Permanent Magnet-type Open MRI System

This is an advanced 0.3T permanent magnet-type MRI system, developed by upgrading the previous AIRIS models.
Performance upgrades include not only hardware and software, but also system design, in which hardware upgrades allow for more powerful gradient field, increased console CPU speed, and the inclusion of a multifunctional patient table. The system, in addition to using new application package "ASCENDING 5.0," incorporates a variety of advanced techniques, such as the fat suppression technique used in CHESS (chemical shift suppression) and the interactive imaging technique used in ISC (interactive scan control). Furthermore, the system includes a new design for the gantry.
This is now on the market as a new standard for open MRI systems.
(Hitachi Medical Corporation)

Open MRI system

Magnetocardiograph

MCG (magnetocardiograph) developed by the Hitachi Group is the first in the world to be used as a commercial system.
MCG is a clinical diagnostic device used to conduct in-depth electrophysiological examinations of the heart. It uses a magnetic sensor array that measures the magnetic field created by the heart without touching the patient.
This MCG uses 64 sensors that can measure the magnetic field of the entire heart at once.
Clothed patient can undergo a cardiac examination in less than a minute without feeling any pain or discomfort.
This device is not only capable of pinpointing the location and type of arrhythmia, but can also accurately detect angina pectoris before they progress to myocardial infarction. In addition to those of adults and children, it can also easily examine fetal hearts.
Since fetuses are clad with vernix caseosa, which hardly conducts electricity, electrocardiographs cannot be used, and only ultrasound diagnosis has been available until now. With ultrasound, however, doctors can only know the morphological features of the fetal heart.
With fetal MCG, the advent of a new era of prenatal diagnosis is on the horizon.
(Hitachi High-Technologies Corporation)

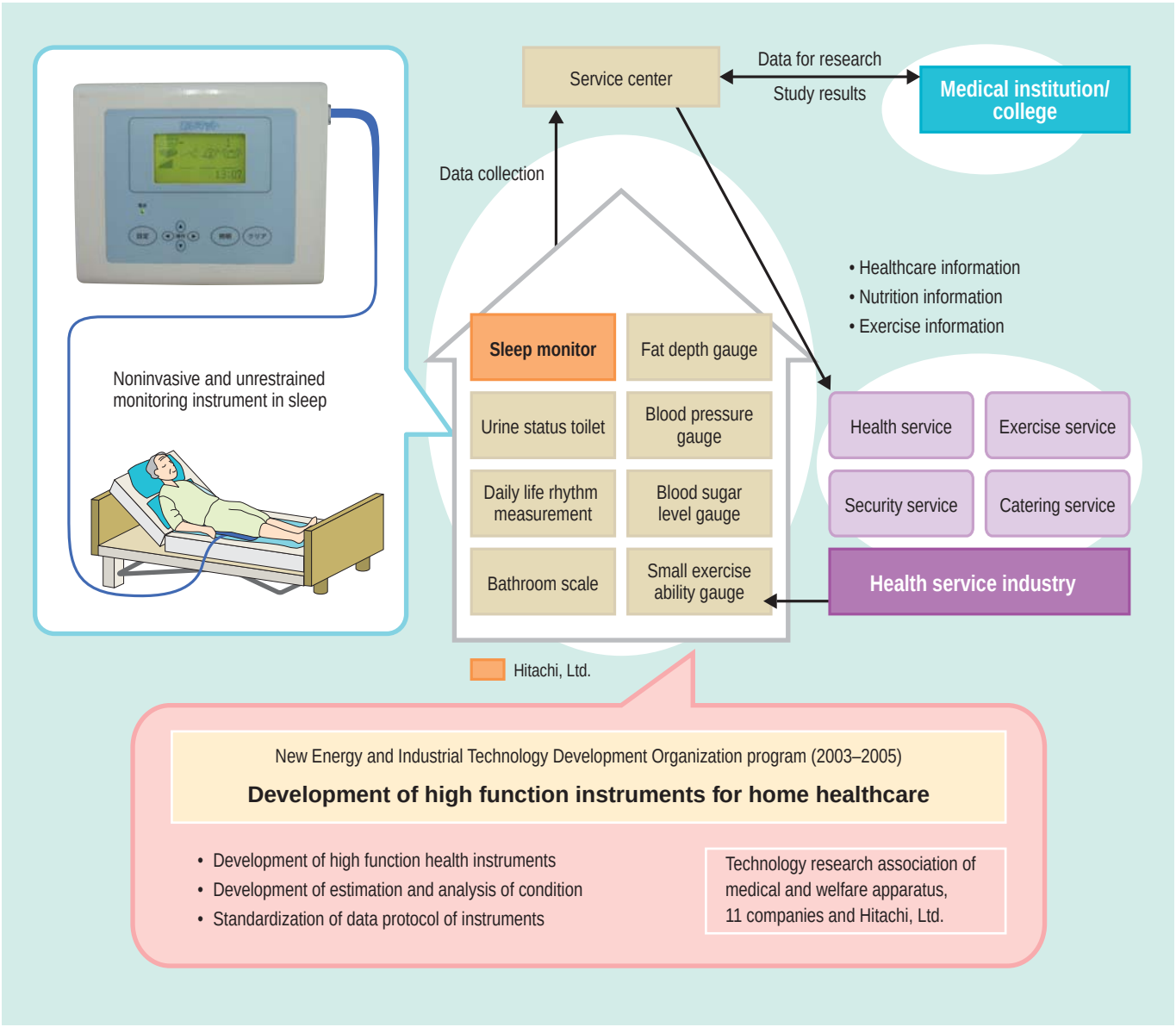


Current-arrow map (courtesy of Institute of Clinical Division, University of Tsukuba)


MC-6400 Hitachi magnetocardiograph

Noninvasive and Unrestrained Monitoring Instrument in Sleep; Technology Research Association of Medical and Welfare Apparatus

Plans for national health improvements and preventive care are advancing.
Noninvasive and unrestrained instruments for home healthcare are needed. A high function instrument was developed with the support of the New Energy and Industrial Technology Development Organization.
This instrument consists of data-processing equipment and a thin air-filled cushion connected by a plastic tube. The cushion is laid between a mattress sheet and mattress so that the vitals of a person can be measured in bed in a noninvasive manner.
This instrument is able to measure respiration, heartbeat, snoring, and body movement continuously using a super-receptive pressure sensor inside the air cushion.
This comfortable and simple method for monitoring sleep status can be used not only in daily life but also in various healthcare fields.
When various instruments measuring vital data connect with a common protocol, people can easily see their own health conditions.
[Applications]
(1) Instruments for insomnia, apnea research
(2) High function quality bed for comfortable sleep
(3) Total healthcare service development combined with other health services



Health services solution using high function instruments for home healthcare program

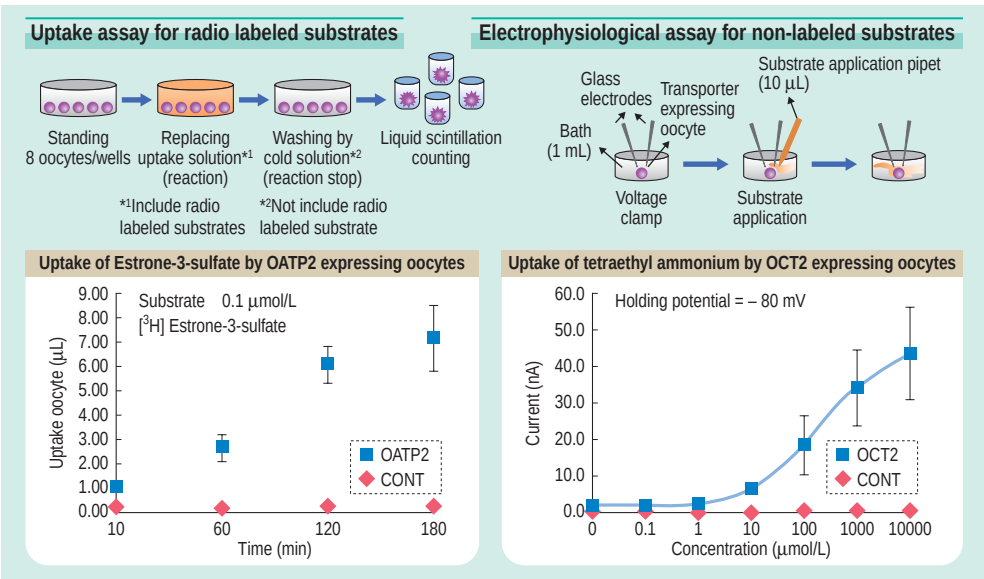
Liquid Chromatograph/Mass Spectrometer "NanoFrontier" Offers Many Solutions for Protein Analysis

In general, proteins are analyzed using an MS (mass spectrometer) after separating the sample using a nanoLC (nano-flow-rate liquid chromatograph).
However, not many manufacturers offer these two machines as a system. Therefore, the connecting part of both instruments was the key cause of trouble for high-sensitivity analysis, and advanced knowledge was necessary for users.
NanoFrontier combines these two machines. The nanoLC is able to separate the sample with a flow rate of 50 nL/min, and an IT-TOFMS (ion-trap time-of-flight MS) analyzes the proteins.
NanoFrontier improves upon previous systems for protein identification by amino acid array information by greatly reducing the difficulty of using the hardware, reducing the amount of necessary maintenance, and by using multi-step analysis and high-resolution evaluation techniques.
(Hitachi High-Technologies Corporation)

Liquid chromatograph/mass spectrometer "NanoFrontier"

Cell-based Assay System for Drug Transportation Systems

The pharmacokinetic characteristics of drugs that are substrates of these transporters influence pharmacological effects. Research has shown the important roles of transporters, and many pharmaceutical companies carry out studies on transporters. Recently, various gene encoding transporters have been isolated using expression cloning. Transporters affect drug uptake into and efflux from tissues that play key roles in the absorption, distribution, and secretion of drugs.
Hitachi, Ltd. developed a cell-based assay system for drug transportation systems using known genes. This assay is based on the Xenopus (African clawed frog) oocyte expression system, in which transporter functions are monitored by electrophysiological assay or uptake assay.
The Xenopus oocyte expression system has been used extensively to study the functions of membrane proteins, such as transporters, ion channels, and pumps, because of their low background level, high expression levels of proteins, and proper post-translational modifications. By developing an automated RNA (ribonucleic acid) microinjection technology and a two-electrode voltage clamp technology, Hitachi developed a cell-based assay system for drug transportation systems.
By using this assay system, discovery of new drug compounds with excellent pharmacokinetic characteristics can be expected.



OATP2: organic anion transporter 2 OCT2: organic cation transporter 2

Outline of cell-based assay system for drug transportation systems
(This data was obtained by collaboration with Prof. Sugiyama, University of Tokyo.)