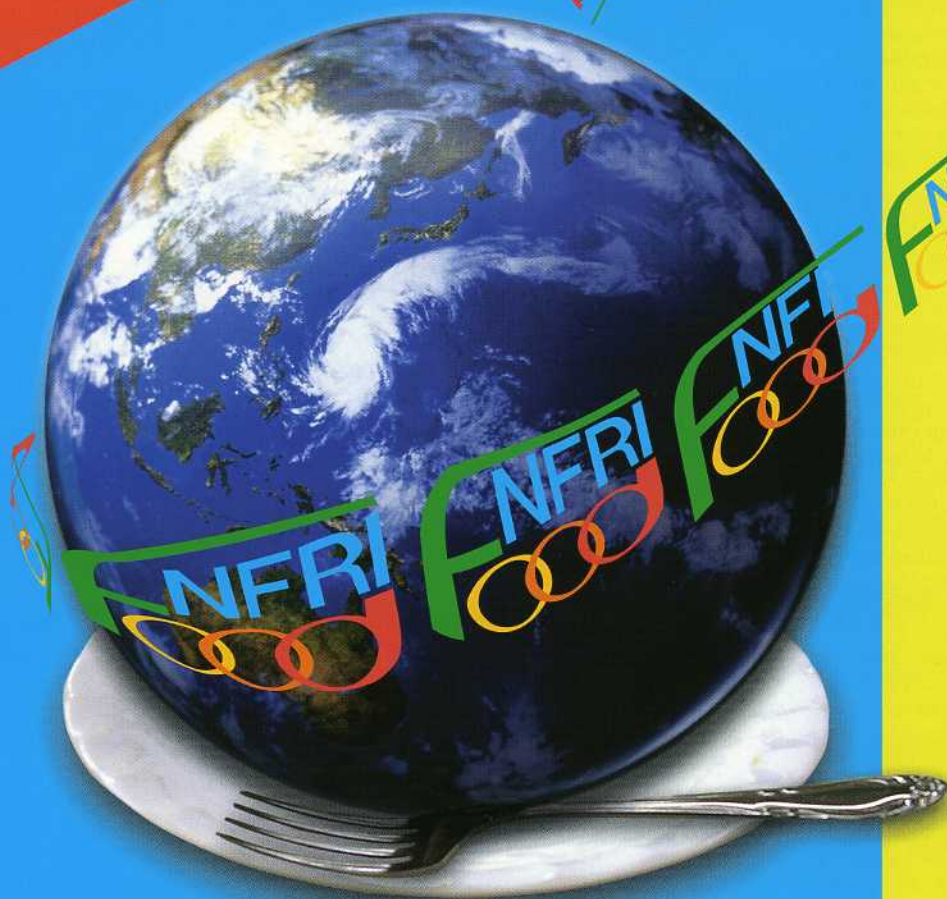


National Agriculture and Food Research Organization

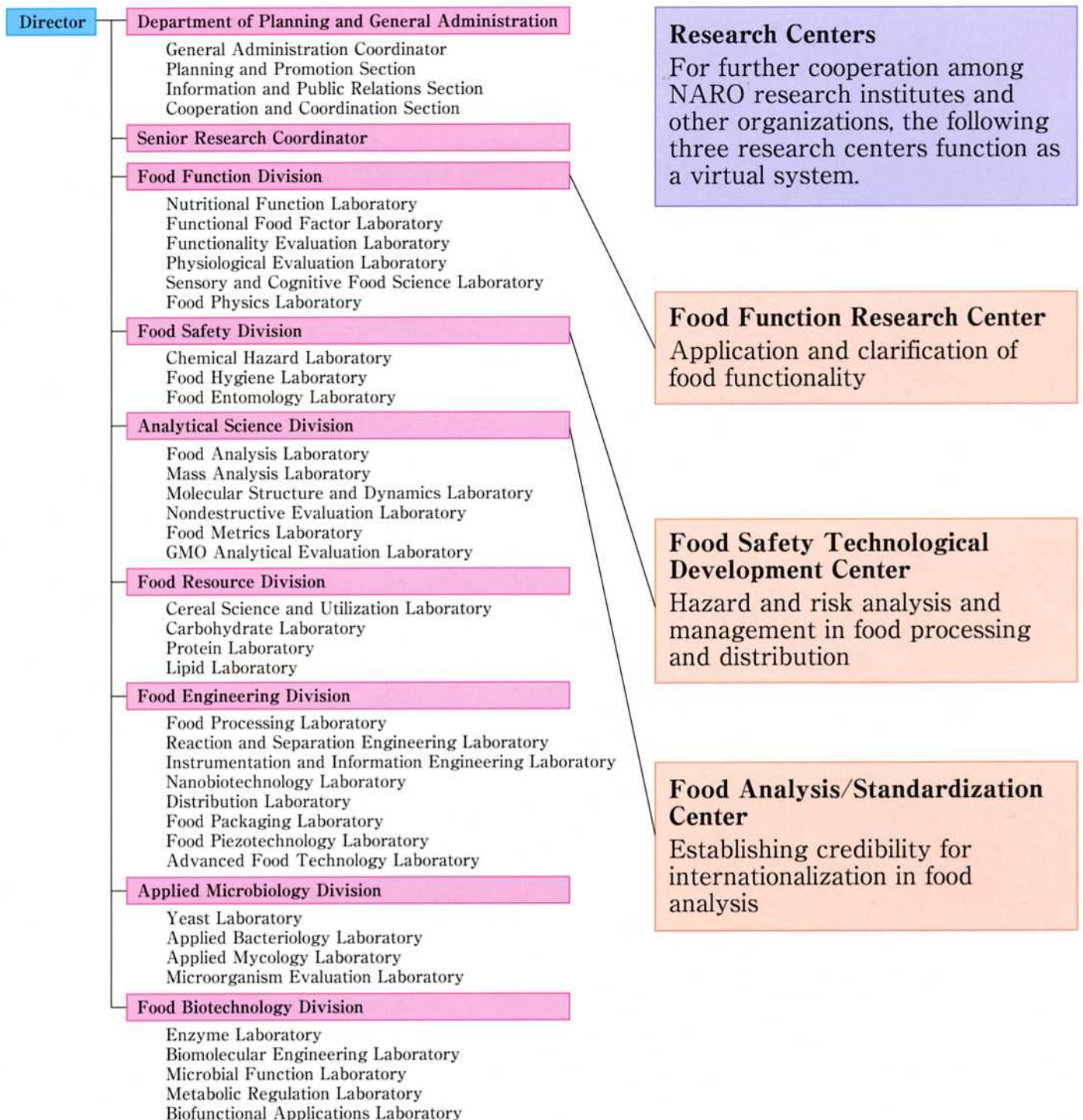
National Food Research Institute



Mission

The National Food Research Institute (NFRI), National Agriculture and Food Research Organization (NARO), is one of the Japanese incorporated administrative agencies supported by the Ministry of Agriculture, Forestry and Fisheries. NFRI is one of the leading food research institutes in Japan and conducts wide-ranging research in food science and technology, including food and health science, technological development for food safety, innovative food distribution and processing, and the exploration and application of biotechnology.

Through the above research activities, NFRI contributes to the establishment of a society with healthy and rich food, and a safe and secure food supply system.



Research Activities

Food Function Division

Mission

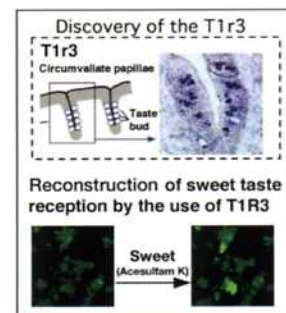
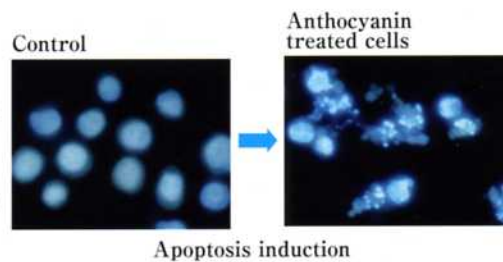
The Food Function Division engages in various research topics related to the food functions representing the role of food in supplying nutrients, affecting senses (smell, taste and texture), and increasing physical well-being by preventing nutrition-related diseases.

Laboratories

- **Nutritional Function Laboratory**
Investigation of the physiological activity of dietary factors in the regulation of energy and lipid metabolism.
- **Functional Food Factor Laboratory**
Studies on the phytochemicals of agricultural products for human health, including cancer prevention, obesity, and food allergies.
- **Functionality Evaluation Laboratory**
Evaluation of food functionality using nutrigenomics technologies and development of novel evaluation methods.
- **Physiological Evaluation Laboratory**
Clarifying the effects of food components on preventing diabetes using animal experiments.
Clarifying the mechanisms of digestion and absorption of functional food components.
- **Sensory and Cognitive Food Science Laboratory**
Study the mechanism of taste sensation, evaluation of tastants and cognitive processing of food attributes.
- **Food Physics Laboratory**
Studies on the physico-chemical properties of food, texture evaluation, and sensometrics.

Topics

- **Anthocyanins induce apoptosis in Human leukemia cells**
Pure delphinidin and malvidin, like the glycosides isolated from the bilberry extract, induced apoptosis in HL60 cells.
- **Discovery of the T1r3 receptor for sweetness and umami**
A cDNA clone encoding T1R3 was isolated from circumvallate papillae of the mouse tongue using degenerate primers.



Food Safety Division

Mission

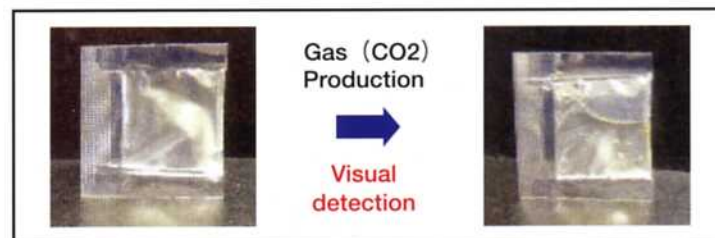
To ensure food safety, we research chemical and biological hazards, and develop technology to reduce risks.

Laboratories

- **Research Leader**
Develop a method for food irradiation detection and mycotoxin detection.
- **Chemical Hazard Laboratory**
Develop a method to evaluate and analyze chemical hazards, such as mycotoxins and heavy metals.
- **Food Hygiene Laboratory**
Detect and control micro-organisms that contaminate foods.
- **Food Entomology Laboratory**
Ecology, physiology and control of food insect pests.

Topics

- **Simple, safe and low-cost indicators for temperature control.**
Failure to control low temperatures could lead to risks associated with foodborne diseases. Our indicators, containing food additives of a baker's yeast, can be attached to products to warn of inappropriate temperature treatment.
- **Mycotoxin effects on lipid metabolism in liver**
Some mycotoxins course fatty liver in laboratory animals. Investigation on the changes of lipid metabolism caused by mycotoxins contributes to identifying the mechanism that accelerates fatty liver in humans.



Indian meal moth



Maize weevil

Analytical Science Division

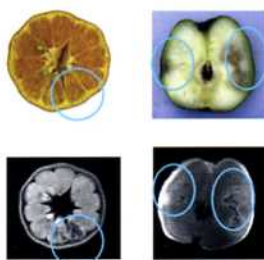
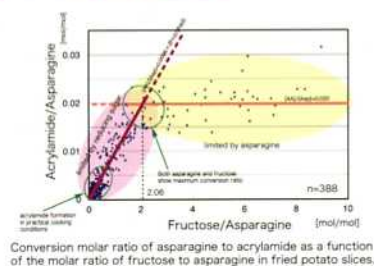
Mission

Study the development of sampling and analytical methods for food safety, quality assurance and labeling, and analyze the structure and state of food components.

Laboratories

- Food Analysis Laboratory: Determine the geographic origin of agricultural products by inorganic element composition, and develop a method to validate the combustion method for total nitrogen through collaborative study.
- Mass Analysis Laboratory: Focus on the detection and quantitation of compounds produced during the heating process, and structural analyses of physiologically active compounds using mass spectrometry.
- Molecular Structure and Dynamics Laboratory: Instrumental analyses, especially by NMR, of the chemical structure, molecular interactions, and state of food components. Measurement of water distribution and diffusion by MRI.
- Nondestructive Evaluation Laboratory: Development of a rapid and/or nondestructive technique, mainly using near infrared spectroscopy (NIRS), for chemical compounds in food.
- Foodmetrics Laboratory: Method validation and sampling study using statistical analysis. Imaging analysis of foods by MRI and texture analysis using statistical methods.
- GMO Analytical Evaluation Laboratory: Development of safety-evaluation and detection/quantitation methods of GMO.

Topics



Detection of internal fruit defects by MRI.

Bruising of mandarin orange and pear (La France).

Internal defects of fruits can be detected non-invasively by MRI. A small MRI composed of a permanent magnet and PC controller has been developed.

Food Resource Division

Mission

The main objectives of the Food Resource Division are the clarification of food properties, the development of novel methods for quality evaluation, and the utilization of various food materials, leading to the promotion of the self-sufficiency ratio of food in Japan.

Laboratories

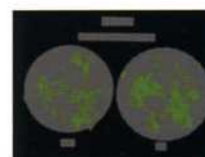
- Research Leaders focus on quality improvement of fruits and vegetables and the development of novel technology for cereals.
- Cereal Properties and Utilization Laboratory focuses on quality evaluation and utilization of cereal grains.
- Carbohydrate Laboratory focuses on the clarifying and evaluating carbohydrate properties, and developing novel technologies for the production of new carbohydrate materials.
- Protein Laboratory focuses on the clarification and evaluation of protein properties to enhance the utilization of natural protein resources, and to achieve a healthy dietary lifestyle for humans.
- Lipid Laboratory focuses on the stability, digestion, absorption, metabolism, and function of lipophilic bio-functional components to prevent lifestyle-related diseases through foods.

Topics

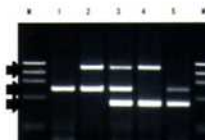
- Low-temperature milling of buckwheat or wheat (Research Leader)
- Cultivar identification technology of rice by PCR (Cereal Properties and Utilization Laboratory)
- Enzymatic conversion of amino-sugars (Carbohydrate Laboratory)
- Quality assay and utilization of soy proteins (Protein Laboratory)
- Function and metabolism of carotenoid (Lipid Laboratory)



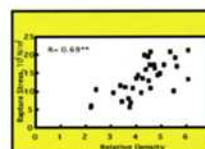
Low-temperature milling of buckwheat



Browning inhibition of lettuce by onion extract



Cultivar identification of rice by PCR analysis



Disulfide bonds of protein and strength of Tofu

Food Engineering Division

Mission

Development of food processing, distribution, nano-measurement, information, and other related technologies.

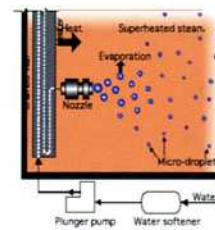
Laboratories

- Food Processing Lab: Advanced food processing and waste treatment system; Conversion of food and agro by-products.
- Reaction and Separation Engineering Lab: Membrane separation process. Biodiesel fuel production from waste edible oil.
- Instrumentation and Information Engineering Lab: Creation of agro-information industry based on SEICA. Visualization of food quality and food hazard substances.
- Nanobiotechnology Lab: Advanced measurement techniques of ultra-small structures.
- Distribution Engineering Lab: Utilization of transport simulator to improve food distribution.
- Food Packaging Lab: Modified-atmosphere packaging. Active packaging materials.
- Food Piezo-technology Lab: Pressure as an alternative food-processing parameter: physical properties, safety and functionality of food.
- Advanced Food Technology Lab: High electric field alternate current technology for inactivation of micro-organism spores. Microchannel emulsification.

Topics

- New process using aquagas (superheated steam with water droplets) for high-quality food. Evaluation of functional component behavior during cooking. (Food Processing)
- Membrane separation for purification of anserine and carnosine in chicken extract. Biodiesel production from waste edible oil under atmospheric pressure without catalyst. (Reaction & Separation Engineering)
- "SEICA" accountability for fruits and vegetables and related application. Development of a 3-dimensional spectral imaging system. (Instrumentation and Information Engineering)
- Development of scanning probe microscopy (SPM) based analysis methods. (Nanobiotechnology)
- Development of in-transit damage simulation using 3-dimensional vibrator. Life-cycle assessment of food from farm to table. (Distribution Engineering)

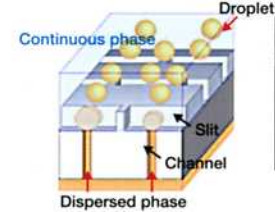
Aquagas production



Produce information database



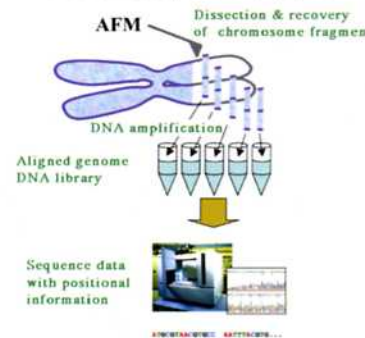
Microchannel emulsification



Transport simulator



SPM direct genome analysis



Applied Microbiology Division

Mission

Molecular analysis of food microorganisms and the application of microbial functions in food processing.

Laboratories

- Research Leader: Development of an enzyme to produce DFA I from Inulin.
- Applied Mycology Laboratory: Molecular biological analysis of the genes expressed in *Koji* mold used in Miso (soybean paste), *Shoyu* (Soy sauce), and *Sake* production.
- Yeast Laboratory: Molecular and cellular biology of baker's yeast and lactic acid bacteria.
- Applied Bacteriology Laboratory: Molecular analysis of the bacterial γ -polyglutamic acid (the sticky polymer of Natto) production.
- Microorganism Evaluation Laboratory: Molecular biological evaluation, detection, identification, and preservation of micro-organisms.

Topics

- Molecular mechanism of bacterial γ -polyglutamic acid production. Production of the sticky polymer of *Natto* is regulated by the density of the *Natto* bacteria, *Bacillus subtilis* (Fig. 1).
- Genome sequencing and analysis of *Koji* mold, *Aspergillus oryzae* (Fig. 2). About 12,000 genes were found in the genome of *Koji* mold. The telomere sequence of the *Koji* mold was different from that of other organisms. As the telomere region contributes to the stability of the chromosome, it can be used as a tool for artificial chromosomes.

Fig.1 Metabolism of γ -polyglutamic acid, the sticky polymer of Natto

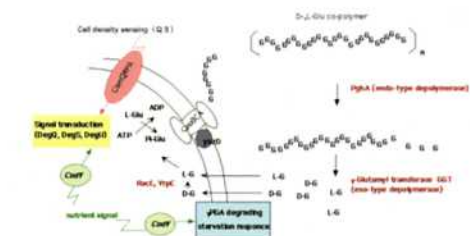
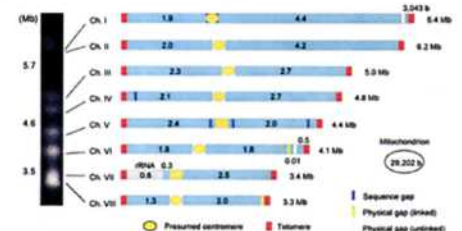


Fig.2 Genome sequences of *Aspergillus oryzae*



Food Biotechnology Division

Mission

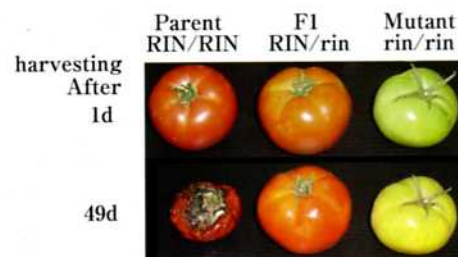
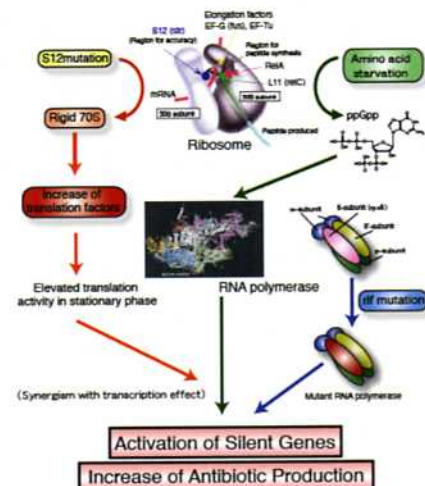
Clarify the biological function of living organisms, develop innovative biocatalysts, and improvement of systems using micro-organisms and biocatalysts for food material production.

Laboratories

- Enzyme Laboratory: Enzyme research for manufacturing foods and food ingredients.
- Biomolecular Engineering Laboratory: Molecular and cellular engineering of molecular function.
- Microbial Function Laboratory: Activation of bacterial dormant genes by modulating the ribosome or RNA polymerase, and its application to applied microbiology.
- Metabolic Regulation Laboratory: Metabolism and gene regulation in fungi and tomato.
- Biofunctional Applications Laboratory: Biofunctional applications for the effective utilization of unused resources.

Topics

- Establishment of cellobiose production process using cellobiose phosphorylase.
- Development of refolding system for the recombinant protein.
- Clarification of the gene expression mechanism relating to tomato maturation.
- Development of the process for xylooligosaccharides production using chimeric enzyme.



Access

By JR Joban Line

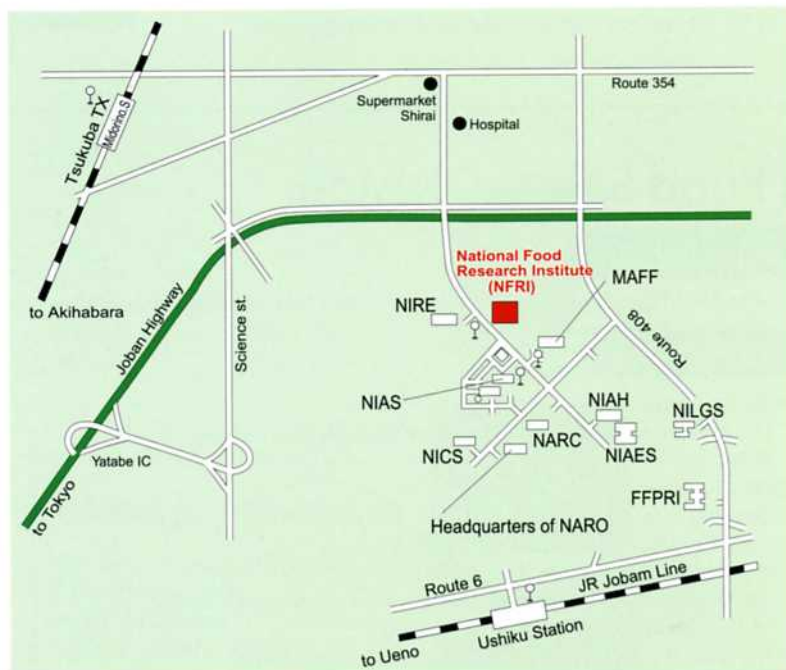
60 minutes from Ueno station in Tokyo to Ushiku station
(20 minutes from Ushiku sta. by bus)

By Tsukuba Express Line

15 minutes from Midorino station (15 min. from Midorino sta. by bus service)

By Car

Approximately 60 minutes from Tokyo down town to Yatabe IC by Highway



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