Research plan with following academic staff

A. Food Chemistry

Hirotoshi TAMURA, Professor (tamura@ag.kagawa-u.ac.jp)

Functional foods and flavor chemistry.

Lina YONEKURA, Assistant Professor (lina-y@ag.kagawa-u.ac.jp)

Bioavailability and metabolism of bioactive compounds

B. Food Physics and Food Processing

Shoichi GOHTANI, Professor (gohtani@ag.kagawa-u.ac.jp)

C. Food Hygiene

Osamu KAWAMURA, Professor (kawamura@ag.kagawa-u.ac.jp)

Development and application of immunological methods for the detection of mycotoxins, and evaluation of their toxicology.

D. Nutritional Biochemistry

Tatsuhiro MATSUO, Professor (matsuo@ag.kagawa-u.ac.jp)

The effects of diet and exercise on substrate metabolism in animals.

E. Applied Microbiology

Yasuhiko ASADA, Professor (asaday@ag.kagawa-u.ac.jp)

Biochemistry and molecular biology of basidiomycetous mushrooms

Akira WATANABE, Associate professor (akiraw@ag.kagawa-u.ac.jp)

Biochemical analyses and applications of biological functions of basidiomycetous mushrooms

Haruhiko SAKURABA, Professor (sakuraba@ag.kagawa-u.ac.jp)

Structure-function analyses and applications of hyperthermophilic enzymes.

Naotaka TANAKA, Associate professor (ntanaka@ag.kagawa-u.ac.jp)

Studies of glycoproteins and glycosylation mechanisms in eukaryotic cells.

Mitsuaki TABUCHI, Associate professor (mtabuchi@ag.kagawa-u.ac.jp)

Molecular cb en-o[S)4(tr)-2(uc)-3(ture)]TJp idlis(u)-9)6(o)-9ns)-3(oe)-15(yP -5(i)5(de3(c)-5(et-5(org()5)-15et

G. Food Engineering

Hidefumi YOSHII, Professor (foodeng.yoshii@ag.kagawa-u.ac.jp)

H. Rare Sugar Science

Goro TAKATA, Associate professor (goro@ag.kagawa-u.ac.jp)

Research on rare sugar and oligosaccharide production using a microbial and enzymatic reactions from bio-resources.

Kenji MORIMOTO, Associate professor (morimoto@ag.kagawa-u.ac.jp)

Akihide YOSHIHARA, Assistant professor(yoshihara@ag.kagawa-u.ac.jp)

Rare sugar (various monosaccharides) production by microbial and enzymatic reactions.

I. Animal Science

Yoshiki MATSUMOTO, Associate professor (myoshiki@ag.kagawa-u.ac.jp)

Neurobiological aspects on Animal production science

A. Food Chemistry **Hirotoshi TAMURA**, Professor

Lina YONEKURA, Assistant Professor

The principal objective of studying the physiological effects of food components is to provide scientific basis for the promotion of a healthy life through the consumption of functional foods, as the healthyfood awareness quickly rises worldwide. Green tea, red wine and chocolate of high polyphenol contents are recognized by consumers as healthy foods and show rising sales numbers in worldwide markets. On the other hand, food flavor and texture may also contribute to better consumer choices and improved physiological effects of foods. On that line, we investigate the effects of food components and processing on the bioavailability and the biological effects of functional ingredients. The relationship between molecular structure and the functionality of the chemicals in foods are also under investigation in our laboratory. Research under the following themes are currently being carried out in our laboratory:

1) Studies on the chemistry and the bioavailability of food colorants.
2) Biological effects of plant metabolites on the suppression or prevention of cancer, obesity and allergy using animal cell lines.
3) Studies on chemistry and olfactory impact of food volatiles from various plants.

B. Food Physics and Food Processing **Shoichi GOHTANI**, Professor

1: Emulsification by Low Energy Method

Emulsification can be classified into physical and chemical method. The latter method is low energy method.

In physical method, emulsions are prepared by dispersing one phase in another immiscible phase under strong mechanical power, using high-shear stirring, high-pressure homogenizers and ultrasound generators. On the other hand, in emulsification by chemical methods (e.g., liquid-crystal emulsification, surfactant phase emulsification, and phase inversion emulsification), emulsion can prepared without such a strong mechanical power owing to the physico-chemical properties of the various type of molecular aggregates formed in oil-surfactant-water system.

We are investigating the low energy emulsification in food system, using food grade surfactants and edible oils.

2: Evaluation of Rheological Properties of Food System

Rheological properties is important for food system because the rheological properties influence the taste of food strongly and the food processing. We are investigating the rheological properties (e.g., viscosity, static viscoelastisity and dynamic viscoelassitisity) for emulsion, emulsion gel and the mixture gel for protein and polysaccharide in food system.

C. Food Hygiene **Osamu KAWAMURA**, Professor

The main subject of our study is mycotoxins. Mycotoxins are second metabolites produced by fungi that are harmful to both animals and human. These fungi may be plant-pathogenic or saprophytic, and can invade the food and feed supply during production, processing, transport, or storage. Almost mycotoxins are small molecule weigh compounds, so that, heat-stable. After food processing, mycotoxins are not decreased. Thus, various kinds of raw and processed foods and feeds can become contaminated. The incidence of mycotoxins varies among commodities, climatic conditions, and regions. The secondary contamination of animal products can result from animal consumption of mycotoxin-contaminated feed.

Generally, the contamination levels of mycotoxins in food are low, not so high. But, human takes the low level contaminated food for long time, so that, mycotoxins may mainly cause chronic effects such as cancer. Therefore, it is necessary that development of simple and high sensitive analytical methods for the detection of low level of mycotoxins in food. The immunological methods are simple and high sensitive, not need toxic organic solvent. In our laboratory, for clear the risk of mycotoxins, we make several monoclonal antibodies against mycotoxins and the immunoaffinity columns (IAC) coupled with these monoclonal antibodies. And then, we develop the simple and high sensitive analytical methods using IAC-linked HPLC methods; analyze a lot of various kinds of food on the market.

(1) Preparation of monoclonal antibody against mycotoxin.

(2) Development of the simple and high sensitive IAC-linked HPLC methods for mycotoxins in food and

biological fluids.

(3) Analysis of mycotoxins in commercial foods by the IAC-linked HPLC methods, and the risk assessment of the mycotoxins.

Now, our target mycotoxins are aflatoxins, ochratoxins, citrinin, zearalenones, and fumonisins

D. Nutritional Biochemistry **Tatsuhiro MATSUO**, Professor

Our laboratory training focuses on physiological functions of nutrients and interactions between nutrients and exercise in rats. We also encourage the development of written and oral communication skills through course work, seminars and group meeting presentations. The education of the student depends on Japanese basically. Nutrition students can specialize in basic nutrition, nutritional biochemistry, nutritional aspects of exercise, sensory and instrumental evaluation of food quality or nutrition and disease interactions. After graduation, students are prepared for scientific and technical careers in industry, educational institutions, government agencies and health care facilities.

Current study themes

1. Nutritional functions of rare sugars
2. Characteristic of the soy bean germ protein
3. Resistance exercise and muscles
4. Dietary fats and obesity
5. Glycemic index

Our laboratory is looking for graduate students.

E. Applied Microbiology **Yasuhiko ASADA**, Professor
Haruhiko SAKURABA, Professor
Akira WATANABE, Associate professor
Naotaka TANAKA, Associate professor
Mitsuaki TABUCHI, Associate professor

The research field of applied microbiology

A variety of microorganisms are very important for food purposes and industrial processes. The aims of the researches in the research field of applied microbiology are to elucidate the characteristic features of microorganisms precisely using biochemical, molecular biological and enzymological methods, and to apply and develop the microbial processes for various fields.

The microorganisms studied in this research field are mainly budding and fission yeasts, basidiomycetous mushrooms, archea and bacteria.

F. Food Protein Functionality **Masahiro OGAWA**, Professor

Research in the laboratory

Our research interests are to understand the structure-function relationship of proteins present in animal, plant, and bacteria, and to apply those proteins for the improvements of food quality and food safety. In particular, we are greatly interested in the animal proteins from egg, milk, and meat including fish. The following research themes are currently going on:

1. The functionality of antimicrobial egg-white protein lysozyme is improved through chemical approaches; furthermore, the structure and function of novel egg-white basic proteins that were discovered by our laboratory are investigated.
2. A potent antimicrobial enzyme in milk whey, that is lactoperoxidase system, is improved to exterminate Salmonella in food.
3. The tenderization of tough meat containing high collagen content is attempted using unique bacterial collagenolytic enzymes that were discovered by our laboratory.

Our research is expanding into plant enzymes related to phenolic compound synthesis. The activation of the enzymes may result in an increase in the production rate of phenolics, which is thought to be beneficial for human health.

We are also working on food development using rare sugar D-Psicose which is a non-calorie sugar with lower glycemic response. The food to develop includes sponge cake, butter cookies, pudding, ice cream, sausage, fish products, and so on.

G. Food Engineering **Hidefumi YOSHII**, Professor

Food

In our laboratory, the Food Engineering Laboratory, the main research subjects include the encapsulation of functional food compounds by spray drying and kneading, crystal transformation, and molecular encapsulation with cyclodextrins. We are also studying the formation of fuctional protein powders such as egg yolk antibody by spray drying and freeze drying. Other chemical and biochemical engineering-related topics such as the drying of food and kinetic analysis of food processing also interest us.

Research topics

1) Microencapsulation of food and pharmaceutical ingredients by spray drying
2) Encapsulation of AITC, lemonglass oil or d-limonene in natural Cyclodextrin
3) Dehydration of anhydrous sugars to hydrous sugars in ethanol.
4) Formation of nano sugar crystal by crystal transformation
5) Electrospinning of Cyclodextrin solution to form nano-cyclodextrin fiber.

H. Rare Sugar Science **Goro TAKATA**, Associate professor

Kenji MORIMOTO, Associate professor

Akihide YOSHIHARA, Assistant professor

1. The production method of various rare monosaccharides is developed, and especially hexoses and 1 or 6-deoxy-hexoses are produced via Izumoring and deoxy-Izumoring which are strategy of rare sugars production (Kenji Morimoto and Akihide Yoshihara). Also novel methods have been developed independent of Izumoring method using disaccharides as materials (Kenji Morimoto).
2. In order to utilize unused bio-resources effectively, we aim to study on preparation of oligosaccharides and monosaccharides from unused bio-resources, and conversion of those materials to valuable sugar products such as rare sugars and oligosaccharides containing rare sugar unit, using a microbial and enzymatic reactions. (Goro Takata)