Department of Coral Reef and Biological Science
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Kazuhiko SAKAI
Tel  +81-980-47-6074
E-mail:sakaikz_at_lab.u-ryukyu.ac.jp
Ecological and evolutionary ecological studies of reef corals
I am studying ecology and conservation biology of corals including:
1. Population and community dynamics of corals in the field at islands in the Ryukyu Archipelago
2. Population genetics of corals in the Ryukyu Archipelago
3. Evolutionary ecology of corals under the climate change
I am also supervising aquaria experiments on the effects of high temperature, eutrophication, and ocean acidification on corals at Sesoko Station.
I will accept good proposals of cooperative research on corals and coral reef organism other than corals on the above view point.

Saki HARII
Tel  +81-980-47-6073
E-mail:sharii_at_lab.u-ryukyu.ac.jp
Biology and ecology of coral reef organisms
My researches are focused on reproductive biology and symbiosis of scleractinian corals by field surveys and laboratory experiments including culturing and molecular techniques. I am especially interested in larval dispersal and onset and maintenance of symbioses of early life stage of corals for understanding sustainability of coral population and their adaptation to new environments and/or climate changes. I am also interested in impacts of climate changes on corals and coral communities.
I would like to collaborate with those who are interested in biology and ecology of reef organisms as well as environmental changes of coral reefs.

Tohru NARUSE
Tel/Fax  +81-980-85-6560
E-mail: naruse _at_ lab.u-ryukyu.ac.jp
Taxonomy of marine invertebrates
Shallow water environments of the Ryukyu Archipelago are showing a diverse biota. However, its too high biodiversity as well as strong relation to tropical fauna, which was difficult for Japanese scientists to study until recently, have caused our limited grasp of the diversity. Given this situation, I am currently working on the biodiversity of mainly decapod
crustaceans, and other marine invertebrates as well, of the Ryukyu Archipelago and surrounding areas.
I may accept proposals of taxonomic projects of marine invertebrates that includes material from the Ryukyu Archipelago.

Hideyuki YAMASHIRO
Tel +81-980-47-6072
E-mail: hyama_at_lab.u-ryukyu.ac.jp
Coral reef organisms are threatened by local and global environmental changes. Description and elucidation of the characteristics of the organisms inhabiting coral reefs are urgent.
I am focusing on coral and coral-associated organisms with aquarium breeding observation, laboratory experiments and field research. The main research topics are as follows.
(1) Elucidation and description of coral diseases/syndromes
(2) Elucidation of the maintenance mechanism for parasitic/symbiotic organisms on/in corals.
(3) Others: decalcification, phototaxis, skeletal pigment of corals.
Collaborated research such as laboratory or field research for coral and coral-associated organisms would be welcome.

Masaya MORITA
Tel +81-980-47-6215
E-mail: morita_at_lab.u-ryukyu.ac.jp
Reproductive biology of coral and tropical animals
I am interested in the relationship between reproductive behavior and sperm evolution. Gametic traits might have been strongly influenced by the diversification of reproductive behavior. However, it is still not obscure that the molecular basis of the evolution in response to the diversification of the behavior. To elucidate above questions, I am studying sperm evolution from following aspects, a) field observation of behavior, b) protein analysis, c) molecular evolution of reproductive proteins including sperm proteins.
I would like to study with researchers who are interested in reproduction and have fun to collaborate with the person who are interested in marine organisms in Okinawa.

Shin WATANABE
Tel +81-980-85-6560
E-mail: nabeshin_at_lab.u-ryukyu.ac.jp
Joint research relationship between adaptability to environmental stress and ecological niche in mangrove tree species
Mangroves are constituent trees and shrubs of tropical and subtropical intertidal forest communities. Since distributed in brackish water, mangrove trees have been studied numerously on the tolerance against osmotic stress and accompanying salinity stress. However, because generally it seemed to be thought that major mangrove species adapt its special roots by forming aerenchyma to flooding environment, there are few case studies by physiological or molecular biological methods about flooding-tolerance of mangrove seedlings having very close relationship with the succession of mangrove forest. That the flooding by tidal rhythm makes the soil in which mangrove forest distributed anoxic or hypoxic, causes very severe condition in acquisition of energy for the root system. Beneath the severe condition, some mangrove seedlings, which the morphological adaptation in root is insufficient, might result in the death in the case the flooding stress past the margin of the physiological safety. In other words, the difference of the tolerance against flooding stress in seedling stage of different mangrove species is not only the factor limited the distribution of individual seedlings, but also the main factor determining the ecological niche of individual species. The purpose of the study is to reveal what mechanism of physiological adaptation is important for the flooding tolerance in the seedlings stage of each major mangrove species as well as to reveal the relationship between the difference of flooding-tolerance in different mangrove species and the ecological niche.

I am interested especially in circadian rhythm and flooding tolerant in mangrove tree species, metabolome analysis in other tropical plants.

Department of Biodiversity and Evolutional Biology

Kazunori YAMAHIRA
Tel   +81-98-895-8937  FAX  +81-98-895-8966
E-mail:yamahira_at_lab.u-ryukyu.ac.jp

Studies on latitudinal gradient in species diversity of fishes
Most medaka fishes (genus *Oryzias*) are distributed in tropical regions of South to Southeast Asia. Such a latitudinal gradient in species diversity is believed to be caused by the difference in species diversification rates between the temperate and tropical regions.

Paying attention to the change in population characteristics with climatic adaptations and the latitudinal difference in the intensity of sexual selection as primary factors of latitudinal gradient in species diversification rates, I am trying to verify them using *Oryzias* spp. as a model system. Also, I am interested in phylogeography of freshwater fishes in Indonesian islands and in species diversity of coral reef fishes in that region.

Mamoru TODA
Tel/Fax  +81-98-895-8936
**Taxonomic diversity and biogeography of terrestrial animals**

The Ryukyu Archipelago, an island chain located along the Pacific margin of the Asian continent, has undergone a series of tectonic movements, which have caused repeated isolations and connections of the islands to each other, as well as to the continent. Such paleogeographical dynamics may have provided non-volant terrestrial animals with opportunities for land-bridge dispersals and subsequent isolations, and this resulted in development of many endemic taxa there. Each of these taxa can provide an excellent topic for biodiversity study. Using the Ryukyus as a model case, we are doing taxonomic, phylogenetic, and phylogeographical investigations on various non-volant terrestrial animals for better understanding how insularization play a role in species diversifications and fluctuations of local faunal biodiversities.

**Akiyo NAIKI**
Tel  +81-980-85-7030
E-mail: naiki_at_lab.u-ryukyu.ac.jp

**Plant systematics and reproductive biology**

Systematics of Rubiaceae, reproductive interference from alien to native plants, and ecology of heterostylous plants are studied using field research and laboratory works. Researchers studying on systematics and/or reproductive biology of angiosperms are welcome to cooperative projects.

**Yoshie TERASHIMA**
Tel  +81-980-85-7034
E-mail: yoshie_at_lab.u-ryukyu.ac.jp

**Analysis of relations between fungi and other organisms**

Abundant species of fungi that are seldom found in the temperate region inhabit Okinawa islands located in the tropical and subtropical regions. We are promoting the researches on the relations between these fungi and other organisms such as forest trees and insects as the following:

1. Symbiotic relation between ectomycorrhizal fungi and forest trees in genera *Castanopsis* and *Pinus*,
2. Symbiotic relation between fungi and termites,
3. Function of fungi and wood decay.
4. Physiological and ecological researches on bioluminescent mushrooms.

Researchers who would like to study on fungi with us are welcome to cooperative study programs, not necessarily on the above subjects.
Tokushiro TAKASO
Tel +81-98-895-8965
E-mail:ttakaso_at_lab.u-ryukyu.ac.jp

Reproductive morphology of tropical plants
Development and function of reproductive organs in tropical plants are studied with special reference to pollination mechanisms. Research materials are mainly a cycad, mangrove plants and seagrasses. Current interests are the mechanism of sperm discharge in the cycad and pollination mechanisms of the mangrove plants and seagrasses.

Gaku TOKUDA
Tel +81-98-895-8543
E-mail:tokuda_at_comb.u-ryukyu.ac.jp

Lignocellulolytic mechanisms in xylophagous insects
Using xylophagous insects, I study the roles of hosts and microbial symbionts in lignocellulose digestion. I primarily focus on termites, because these insects are among the best-known lignocellulose degraders, and significantly contribute to the carbon cycle in tropical and subtropical forests. In my laboratory, the digestive processes of insects, including digestive enzymes and metabolites, are examined by means of morphological, biochemical, and molecular biological techniques. In addition to this, I am interested in collaborative projects on the utilization of wood biomass inspired by the digestive system of termites.

Yumiko NAKAJIMA
Tel +81-98-895-8942 FAX +81-98-895-8944
E-mail:yumiko28_at_comb.u-ryukyu.ac.jp

The trends of transposable elements in the genome of many species
We have two main subjects of the study for collaborating.
1. Investigate the role of the transposable elements affecting the evolution of the host genome
2. Develop the application for taking advantage of some transposable elements as the “Migration Trace Indicator” among the different population of the same species or between the so related species.

First aim of our laboratory is to analyze the influences of the transposable elements exert upon eukaryotic genome evolution. It implies how the changes of the environmental condition such as temperature or intensity of the UV affect the trends of transposable elements like increasing or decreasing the copy number, gene expression level, or jumping
frequency of them. To solve these problems, we will adopt the statistical, theoretical way and also the experimental approach. From this point of view, we will welcome to accept researchers for collaborating with us who are interested in the whole of transposons itself and jumping mechanisms and so on.

The second aim is to take advantage of the sequences of transposable element as the “Population Migration Indicator”. For this purpose, we will utilize the genome information of some model organisms and polymorphisms of the related species with them and analyze from the Population Genetical approaches.

Key words.
mariner-like element: MLE, R1, R2, Southern Blot Analysis, northern Blot Analysis, Real Time PCR, Micro array, Drosophila, Bombyx mandarina, Lepidopteran Insect

Department of Infectious Diseases

Goro MATSUZAKI
Tel  +81-98-895-8968
E-mail:matsuzak_at_comb.u-ryukyu.ac.jp
Research of immune response against tuberculosis

Tuberculosis caused by Mycobacterium tuberculosis infection is one of the most important infectious diseases especially in tropical and subtropical area. Prevention of the mycobacterial infections is a top priority issue in public health world wide. To develop a new vaccine against tuberculosis, it is important to clarify immune regulation mechanism against the mycobacterial infections. In the TBRC, analyses of immune response against M. tuberculosis infection using mouse infection models are carried out using a biosafety level 3 (P3) animal facility. Application on collaborative research projects on tuberculosis, especially those on immune regulation is recruited now.

Takeshi ARAKAWA
Tel/Fax  +81-98-895-8974
E-mail:tarakawa_at_comb.u-ryukyu.ac.jp
Development of a novel vaccine platform technology for improved protection against infectious diseases of humans and animals

In a report in Nature Genetics, recombinant technologies to develop vaccines against various infectious agents are ranked in the top-three high-order biotechnologies essential to improve human health in developing countries. Research on adjuvants and delivery systems is critically important for the utility of recombinant vaccine antigens because proteinaceous antigens are often very weakly immunogenic in the absence of extraneous adjuvants or
delivery systems. We have recently developed a novel vaccine platform technology called Tricomponent Immunopotentiating System (TIPS for short), which may be an efficacious antigen delivery system for the design of new vaccines against various infectious diseases of humans and animals.

Masayuki UMEMURA  
Tel/Fax +81-98-895-8971  
E-mail: umemura@comb.u-ryukyu.ac.jp  
The elucidation of host defense mechanisms of intracellular pathogens infection and the architecture of cytokine-network in which it centered on IL-17.  
IL-17 is a pro-inflammatory cytokine that enhances generation, activation, and migration of neutrophils. Recently, IL-17A has been reported to provide protections against various pathogens, including mycobacteria species. We have previously reported that IL-17 involves in the immune response against mycobacterial infection through neutrophil recruitment and enhancement of Th1 response. Although IL-17 is generally considered as Th17 cell product, we identified that TCR γδ T cells are the major IL-17-producing cells in vivo. Furthermore, the lack of IL-17 resulted in reduced IFN-γ production by mycobacteria-specific CD4+ T cells and impaired granuloma formation after mycobacterial infection. Our data suggest that IL-17 is an important inducer of optimal Th1 response and protective immunity against mycobacterial infection.  
Our research areas of interest include basic immunology with a particular emphasis on the elucidation of mechanisms of protective immunity against pathogens such as mycobacteria and listeria etc.

Department of Applied Biological Information

Hirosuke OKU  
Tel/Fax +81-98-895-8972  
E-mail: okuhiro@comb.u-ryukyu.ac.jp  
Application of bioresources for human health and agriculture  
This group aims to utilize bioresources in the tropics and subtropics for environment conservation and human health. We screen environment stress-related genes in mangroves to develop stress-tolerant crops, and to increase agricultural productivity. Our focus is on the biological function of triterpenoids in mangrove trees. These lipids increase with salt stress, and our research group has proposed its putative role in the protection of plant from salt stress for the first time. Another research topic is the application of biological activity from subtropical natural resources to treat lifestyle-related diseases such as obesity,
atherosclerosis and cancer. One recent study put much focus on the cancer-specific toxicity of natural compounds. Among these, nitidine has been isolated and characterized as a cancer specific anti-cancer agent. Continuing research work in this field may open up the possibility for the development of safe and better cancer chemotherapy with no side effects.

Hironori IWASAKI  
Tel/Fax +81-98-895-8095  
E-mail: hiwasaki_at_comb.u-ryukyu.ac.jp  
**Study of antitumor activity derived from subtropical bioresources**  
In recent years it has become apparent that antitumor drugs are often more effective when given in combination than when given singly. In particular, herb medicine has undergone a revaluation in view of its more natural effects for complementary and alternative medicine. However, because of treatment with herbal medicine, same as crude material, induces various bioactivity, it is difficult to identify tumor suppressive activity of individual components. We aimed to screen for tumor cell specific sytotoxicity from subtropical bioresources, and to determine the usefulness of complementary tumor suppression by

Naoya SHINZATO  
Tel +81-98-895-8975  
E-mail: naoya-s_at_comb.u-ryukyu.ac.jp  
**Molecular microbial ecology and applied microbiology**  
Microorganisms living in natural environments that are thought to be mostly uncultururable are focus of my research. In particular, I am studying their community structures, physiological properties, and interactions among the microbes using culture-independent approaches as well as conventional culture-dependent techniques. The mutualistic interactions between protozoa and their bacterial- and archaeal endosymbionts found in anoxic environments are also one of my prominent research subjects. In addition, I am collecting various microbes from natural environments in Okinawa region to contribute both to basic and applied studies. Corroborative researches on microbial symbiosis or microbial resources in Okinawa region would be welcome.

Adjunct Researcher of TBRC

Akihiro TAKEMURA  
Tel +81-98-895-8993  
E-mail: takemura_at_sci.u-ryukyu.ac.jp
Perception and transduction of environmental cues in fish and corals
Organisms in coral reefs can perceive periodical changes in cues in environments and transduce them as internal stimuli in order to repeat reproductive and behavioral cycles. From aspects of chronobiology and reproductive biology, I focus on physiological mechanism on diurnal, tidal, semilunar, lunar, and annual cycles of fish and stony corals. I will accept collaborative researches on physiological studies in relation to periodicity of life events in any organisms in coral reefs.

Takashi NAKAMURA
Tel  +81-988-95-8897
E-mail:takasuke_at_sci.u-ryukyu.ac.jp
Ecological and physiological studies of coral reef organisms
   My research focus is on interactions among environment, corals as well as surrounding reef organisms those depending on corals. Researches are conducted around Okinawa Island and Sekisei lagoon near Ishigaki Island mainly for field dive survey in addition to rearing experiments and lab-based experiments to fill the gaps between field observations and physiological aspects of the targets. I'm also leading a project with Palau Republic involving research and technological collaboration in order to strengthen the conservation of Palau’s Coral Reef Island Ecosystem (also known as “P-CoRIE” project in Palau). I will accept good proposals of collaborative survey on the interactions among coral reef organisms and environment

James REIMER
Tel  +81-98-895-8542
E-mail: jreimer_at_sci.u-ryuku.ac.jp
Marine invertebrate systematics and ecology
Homepage: www.miseryukyu.com
Love of the ocean + interest in biology + drive to research = our laboratory. Please visit our laboratory homepage for more details: www.miseryukyu.com.
Current research organisms: Zoantharia, octocorals, fire coral, Symbiodinium, sponges, sea anemones, amphipods, Dendropoma.
Current research themes: diversity, taxonomy, symbiosis, sexual and asexual reproduction, evolution, toxins in Palythoa, coastal development.
Our laboratory is always open to collaboration on any of the above subjects, or any other potentially interesting research topic. Please e-mail us for further discussion!
Hirohide TOYAMA
Tel +81-98-895-8805
E-mail: toyama_at_agr.u-ryukyu.ac.jp

Theme: Analyses of microbes involving in Awamori brewing

Genome analyses of black koji moulds, *Aspergillus luchuensis* strains which are now used in industry for Awamori brewing are done, and comparative analyses to those obtained from isolated strains in Okinawa and other places. Awamori brewing using Kuro Koji, which is steamed rice grains covered with black koji mould, is considered to be an original technique established in Okinawa from circumstantial evidences, however, there is no objective evidence or old literature indicating that Okinawa is the origin of Kuro Koji. We will show that *Aspergillus luchuensis* strains now used in Awamori brewing are evolutionally closer to those found in nature in Okinawa than those found in other places, which will become a scientific evidence of the origin of Kuro Koji.

Comparison of growth and fermentation abilities of Awamori yeast under different conditions to those of other yeasts such as Sake yeast is done, and unique characters of Awamori yeast will be found. Genome analysis of Awamori yeast will be performed and the gene(s) which cause(s) the unique characters of Awamori yeast will be identified.

Flavor and taste of Awamori varies among breweries, even though Thai rice as the starch material and microbes of black koji mould and Awamori yeast using for Awamori brewing are the same among them. One of the reasons might be difference in microbes in Awamori Moromi, fermenting mash, other than black koji mould and yeast. Therefore, total DNA is extracted directly from Awamori Moromi from different breweries, and 16S rDNA gene fragments are amplified by PCR with a set of specific primers, and then the obtained DNA fragments are sequenced by next generation sequencer. The ratios of genera of bacteria are illustrated and compared among the breweries. Also microbial floral change in Awamori Moromi will be analyzed by similar analyses.