

# Bacterial Pathogenesis

## 1. Staffs and Students (April 2009)

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## 2. Purpose of Education

### Research education for postgraduate students

Our major research interests are to elucidate the bacterial evolution to escape from the host immune responses, and cellular defence mechanisms against bacterial infections. Especially, we focus (1) the analysis of pathogenic bacterial evolution, (2) molecular mechanisms of recognition systems and inflammatory induction against bacterial pathogens. To achieve our mission, we are analyzing complete genomic sequences of various bacterial pathogens and comparative genomics, including genus streptococci (*Streptococcus pyogenes* and *S. mutans*), *Porphyromonas gingivalis*, and cellular and molecular biological analyses for host responses.

In addition to those studies, we have supported a challenging research for developing a novel method of diagnosis for contraction, temporal conditions and prognosis of periodontitis through quantitative analysis of a novel cytopathic factor derived from a periodontopathic bacterium. Moreover, we lead a basic research to develop a medical nucleic-acid treatment using siRNA and RNA/DNA chimera against malignant cancer and infections.

These studies are collaborated not only with the other section of Tokyo Medical and Dental University, but also with Tokyo University, Tsukuba University, Osaka University, and Nihon University.

### Education for undergraduate students

We took part in an education module "Infection and Host Defenses" for 3rd year students in School of Dentistry, and 1st and 2nd year students in School of Oral Health Care Sciences, and teaching pathogenic bacteriology and virology. In the dental field, infectious diseases such as dental caries and periodontitis are still major concerns. In addition, the prevention of iatrogenic infections such as HIV, Hepatitis B and C viruses are also important for dentistry. Therefore, our mission is not simply to give knowledge of microbiology but give talent to apply knowledge to lead appropriate diagnosis and treatment at the clinics. On this point of view, our lectures covered not only oral microbiology but also systemic microbiology and clinical microbiology to understand the variety of infectious diseases.

## 3. Research Subjects

1. Bacterial whole genome analysis.
2. Analysis of bacterial survival strategy based on bacterial whole genome gene expression.
3. Comparative genomics for bacterial gene acquisition and evolution systems.
4. Molecular analysis of recognition system and inflammation responses against bacterial infection.
5. Molecular and functional analyses of Forsythia detaching factor from periodontopathic bacterium *Tannerella forsythia*.
6. Analysis for functions of nuclear bodies as regulators of cellular integrity and anti-viral protection.
7. Development of a new modifications of siRNA system as therapeutic solutions of infectious and neoplastic diseases and its new delivery systems.

## 4. Publications

### Original articles

1. Yamaguchi H, Nakagawa I, Yamamoto A, Amano A, Noda T, and Yoshimori T, An initial step of GAS-containing autophagosome-like vacuoles formation requires Rab7, *PLoS Pathog* 5: e1000670, 2009.
2. Yoshikawa Y, Ogawa M, Hain T, Yoshida M, Fukumatsu M, Kim M, Mimuro H, Nakagawa I, Yanagawa T, Ishii T, Kakizuka A, Sztul E, Chakraborty T and Sasakawa C, *Listeria monocytogenes* ActA-mediated escape from autophagic recognition, *Nat Cell Biol* 11: 1233-1240, 2009
3. Maruyama F, Kobata M, Kurokawa K, Nishida K, Sakurai A, Nakano K, Nomura R, Kawabata S, Ooshima T, Nakai

## Oral Restitution

- K, Hattori M, Hamada S, Nakagawa I, Comparative genomic analyses of *Streptococcus mutans* provide insights into chromosomal shuffling and species-specific content, *BMC Genomics*, 10: 358
4. Maruyama F, Nozawa T, Aikawa C, Sakurai A, Nakagawa I, Cost effective DNA sequencing and template preparation from bacterial colonies and plasmids, *J Biosci Bioeng*, 107: 471-473, 2009
  5. Ogawa M, Nakagawa I, Yoshikawa Y, Hain T, Chakraborty T, Sasakawa C, *Streptococcus*-, *Shigella*-, and *Listeria*-induced autophagy, *Methods Enzymol*, 452: 363-381, 2009  
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## Reviews

1. Nakagawa I. Bacterial whole genome analyses and their applications to prevention and treatment of infectious diseases. *Nippon Rinsho*, 67: 1120-1133, 2009
2. Nakagawa I. The autophagy as a defensive mechanism against infections. *Surgery Frontier*, 16: , 2009