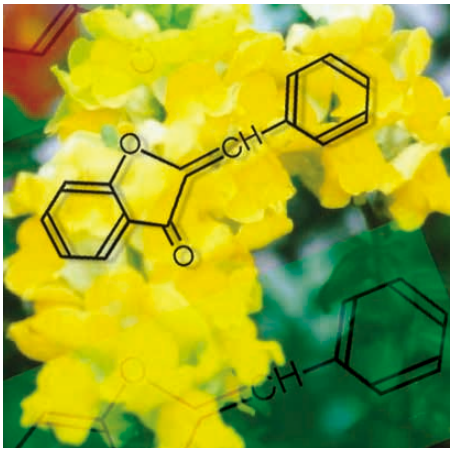
Understanding the structures, functions and controlling mechanisms of enzymes and applying this knowledge to other fields

Biomolecular Engineering　Applied Life Chemistry（Nakayama Laboratory）

Professor of Biomolecular Engineering at the Graduate School of Engineering
Doctor of Agriculture
Toru Nakayama

Graduated from Higashi-Katsushika High School (Chiba Prefecture) in 1977. Completed a doctorate at Kyoto University Graduate School of Agriculture, majoring in agricultural chemistry, in 1986, and started work at Suntory in the same year. Appointed assistant professor of the biotechnology course at the Tohoku University Graduate School of Engineering in 1998. Assumed current position in 2005.
"At elementary school I had my own microscope and I used to like studying water fleas and other microbes. Seeing something so small and self-contained moving about, I was enthralled by the mystery of it all."
The slogan of the Nakayama Laboratory is: Through experimentation we make new discoveries and find new ways forward.



Our research mainly deals with enzymes, metabolism, and their applications. Enzymes refer to biocatalysts that underpin all forms of biological activities. The body contains thousands of different enzymes, each performing a specific function. Enzymes are critically important—the absence of a single enzyme can cause the death of the organism. Our work involves identification of novel enzymes from living organisms such as plants and microorganisms and studying their functions and catalytic mechanisms, with a view to developing engineering applications.

Thanks to recent advances in bioscience and chemistry, we can identify and describe the mechanisms underlying vital biological phenomena, something that was previously thought impossible to decipher. But more importantly, we are now able to manipulate these biological processes. For example, we previously identified enzymes involved in biosynthesis of yellow color pigments in a certain yellow flower. This discovery provided the real breakthrough in 2006 that enables us to design novel yellow flowers using the enzyme genes. We will continue to study the strategies and mechanisms by which organisms harness the functionality of enzymes, and generate stocks of useful materials from plants and microorganisms for the ultimate benefit of humankind. The potential applications for such materials extend beyond engineering to a wide range of fields including medical science, pharmaceuticals, agriculture, food science, and environmental science.

Biomolecular research is a highly competitive environment, where leading research groups from around the world jostle for supremacy. Some days seem to be little more than an endless succession of testing and experimentation; but then there are the opportunities to share your findings with researchers from the other side of the globe and make new friends and acquaintances. We look forward to welcoming young and enthusiastic students to our laboratory.

Main research themes

- Exploring and developing applications for new biochemical reactions
- Structural analysis and molecular design of enzymes
- Identifying mechanisms for regulation of metabolism and transmission of intracellular information in higher plants
- Environmental microbiology and applied enzymology