Various functions of microorganisms attract for establishment of low-carbon society, because of their effective and eco-friendly nature. We should ahead progress “green refinery” by metabolic controlled fermentation, and process development of clean and effective fine chemical production utilizing special functions of microbial enzymes.

Our laboratory was established in 2006 for expanding the practical science aiming at contribution to the development of industry. In pursuit of innovative breakthrough, we would like to construct the unique laboratory ranked as the core of applied microbiology.

### Green sustainable chemistry utilizing special functions of microbial enzymes

<table>
<thead>
<tr>
<th>Renewable resources</th>
<th>Fossil resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bio method</strong></td>
<td><strong>Extraction method</strong></td>
</tr>
<tr>
<td>Biomass</td>
<td>Fenugreek seeds</td>
</tr>
<tr>
<td>high yield, high productivity, low environmental burden</td>
<td>low yield, low productivity</td>
</tr>
</tbody>
</table>

4-Hydroxyisoleucine possesses useful physiological activities like anti-diabetes. For its production, bio method is superior to extraction method and chemical synthetic method, because renewable biomass resources are effectively converted with highly functional enzymes.

By screening microorganisms widely, enzymes having special functions are acquirable. Obtained microbial enzymes are improved to be used as industrial biocatalyst, by gene cloning and introduction of mutations.

**Biomass resources** (Sugars and amino acids)  
**Useful compounds** (4-Hydroxyisoleucine)

**Gene cloning**  
**High functionality**

**Bacillus thuringiensis**
### Key words

*Industrial microbiology, applied microbiology, microbiology, enzyme, microbial conversion, enzymatic conversion, screening, stereospecificity, regiospecificity, genetic engineering, genetic modification of enzyme*

### Recent publications

**β-Aryl-β-amino acid aminotransferase from *Variovorax* sp. JH2 is useful for enantioselective β-phenylalanine production.**

**Extracellular oxidases of *Cerrena* sp. complementarily functioning in artificial dye decolorization including laccase, manganese peroxidase, and novel versatile peroxidases.**

**A novel family of bacterial dioxygenases that catalyse the hydroxylation of free L-amino acids.**
FEMS Microbiol. Lett., 331 (2), 97-104

**Characterization of *Bacillus thuringiensis* L-isoleucine dioxygenase toward the production of useful amino acids.**
Appl. Environ. Microbiol., 77 (19), 6926-6930

**A novel L-isoleucine metabolism in *Bacillus thuringiensis* generating (2S,3R,4S)-4-hydroxyisoleucine, a potential insulino tropic and anti-obesity amino acid.**

**A novel L-isoleucine metabolism in *Bacillus thuringiensis* generating (2S,3R,4S)-4-hydroxyisoleucine, a potential insulino tropic and anti-obesity amino acid.**
Linoleic acid isomerase in lactobacillus plantarum AKU1009a proved to be a multi-component enzyme system requiring oxidoreduction cofactors.

Metabolic engineering of Escherichia coli to produce (2S,3R,4S)-4-hydroxyisoleucine.

Two laccase isoenzymes and a peroxidase of a commercial laccase-producing basidiomycete, Trametes sp. Ha1.
New Biotechnol., 27:317-323

Microbial production of conjugated γ-linolenic acid from my-linolenic acid by Lactobacillus plantarum AKU 1009a.

Microbial production of conjugated fatty acids.
Lipid Technol., 21: 177-181

Novel l-isoleucine hydroxylating enzyme, l-isoleucine dioxygenase from Bacillus thuringiensis, produces (2S,3R,4S)-4-hydroxyisoleucine.

Screening, purification, and identification of the enzyme producing N-(L-α-L-asparty1)-L-phenylalanine methyl ester from L-isooasparagine and L-phenylalanine methyl ester.
Kira I, Asano Y, Yokozeki K (2009)

Enantioselective ester hydrolase from Sphingobacterium sp. 238C5 useful for chiral resolution of β-phenylalanine and for its β-peptide synthesis.

Synthesis of Optically Active α-Methyl Amino Acids using Biotransformation as a Key Step. ACS Symposium Series, 1009 (Asymmetric Synthesis and Application of α-Amino Acids),
American Chemical Society, p. 394-406
Metabolic diversity in biohydrogenation of polyunsaturated fatty acids by lactic acid bacteria involving conjugated fatty acid production

Hyperproduction of 3,4-dihydroxyphenyl-L-alanine (L-Dopa) using Erwinia herbicola cells carrying a mutant transcriptional regulator TyrR

Fatty acid desaturation and elongation reactions of Trichoderma sp. 1-OH-2-3
J. Am. Oil Chem. Soc., 86: 227-233

Selective production of cis-9,trans-11 isomer of conjugated linoleic acid from trans-vaccenic acid methyl ester by Delacroixia coronata

Gene cloning, purification, and characterization of α-methylserine aldolase from Bosea sp. AJ110407 and its applicability for the enzymatic synthesis of α-methyl-L-serine and α-ethyl-L-serine

Gene cloning of α-methylserine aldolase from Variovorax paradoxus and purification and characterization of the recombinant enzyme

Purification and gene cloning of α-methylserine aldolase from Ralstonia sp. strain AJ110405 and application of the enzyme in the synthesis of α-methyl-L-serine
Appl. Environ. Microbiol., 74: 7596-7599

Cloning of the gene encoding α-methylserine hydroxymethyltransferase from Aminobacter sp. AJ110403 and Ensifer sp. AJ110404 and characterization of the recombinant enzyme

Screening of microorganisms producing α-methylserine hydroxymethyltransferase, purification of the enzyme, gene cloning, and application to the enzymatic synthesis of α-methyl-L-serine
An enzymatic breakthrough in the industrial production of oligopeptides
Yokozeki K (2007)
Speciality Chemicals Magazine, 27: 44-45

Highly diastereoselective chemoenzymatic synthesis of (2’R)- and (2’S)-2’-deoxy[2’-2H]guanosines

Screening and industrial application of unique microbial reactions involved in nucleic acid and lipid metabolisms
Biosci. Biotechnol. Biochem., 70: 574-582