Chair Bioorganic and Biophysical Chemistry

2.3.9 Laboratory : Bio-analytical and Physical Chemistry

Member :	Professor	Kenji Kano
	Associate Professor	Osamu Shirai
	Assistant Professor	Seiya Tsujimura
	Doctor's program	4
	Master's Program	11
	Undergraduate	4
	Researcher	3

A. Research Activities (2010.4-2011.3)

A-1. Main Subjects

a) Oxidation-reduction reactions relevant to biological phenomena

Structure and function of fructose dehydrogenase from acetic acid bacterirum (molecular cloning, structural analysis of active site, thermochemical and dynamic properties, electrode reaction, etc.). Single mutation of multicopper oxidaze and its function analysis. Interaction between the enzymes and various electrode materials. Purification of enzymes concerning alcohol oxidation.

b) Fundamental study of bioenergy conversion system and its application to biofuel cell

Multi-copper oxidases as very efficient catalysts for electrocatalytic reduction of dioxygen to water based on mediated and direct electron transfer mechanisms and its application to gas-diffusion bio cathode. Bioelectrocatalytic oxidation of saccharide using dehydrogenase. Bioelectrocatalytic oxidation of saccharide using saccharide dehydrogenase (mediated and direct electron transfer-type bioelectrocatalysis). Electron transfer at an enzyme-adsorbed and modified carbon and gold electrodes. Development of biofuel cell using enzymes and microbes.

c) Biosensor

Microarray electrode for biosensor. Enzyme modified electrod.

d) Fundamental study of transmission processes on biological electric signals

Mechanism on nervous transmission by use of liquid membrane cells. Electrochemical study on anesthetic functions.

e) Fundamental study on charge (ion and electron) transfers across biomembranes

Electrochemical analysis on ion transport across planar lipid bilayers in the presence of hydrophobic ions and ionophores such as ion channels, carrier compounds, etc. Ion transport across liposomal membranes. Electron transfer at the surface of supported BLM. Function of ion channels using planar bilayer lipid membranes (Effect of coexisting ions, Reaction mechanism of accelerator and inhibitor).

A-2.Publications and presentations

a) Publications

Books

- Enzyme Utilization Techniques, Makoto Komiyama Ed., STS, 2010, pp.106-111, Kenji Kano and Seiya Tsujimura

Original Papers(including book-reviews)

- Electron Transfer Pathways in Microbial Oxygen Biocathodes, Freguia, S., Tsujimura, S., and Kano, K., Electrochimica Acta, 55 (3), 813-818 (2010).

- Flavins Contained in Yeast Extract are Exploited for Anodic Electron Transfer by Lactococcus lactis, Masuda, M., Freguia, S., Wang, Y.-F., Tsujimura, S., and Kano, K., Bioelectrochemistry, 78 (2), 173-175 (2010).

- Site-directed Mutation at Residues near the Catalytic Site of Histamine Dehydrogenase from Nocardioides simplex and Its Effects on Substrate Inhibition, Tsutsumi, M., Tsuse, N., Fujieda, N., and Kano, K., J. Biochem., 147 (2), 257-264 (2010).

- Electrochemical Elucidation of the Facilitated Ion Transport across a Bilayer Lipid Membrane in the Presence of Neutral Carrier Compounds, Onishi, J., Shirai, O., and Kano, K., Electroanalysis, 22 (11), 1229-1238 (2010).

- Electrochemical Reaction of Fructose Dehydrogenase on Carbon Cryogel Electrodes with Controlled Pore Sizes, Tsujimura S., Nishina A., Hamano Y., Kano K., and Shiraishi S., Electrochem. Commun., 12 (3), 446-449 (2010).

- Stopped-flow Kinetic Studies on Reductive Half-reaction of Histamine Dehydrogenase from Nocardioides simplex with Histamine, Tsutsumi, M., Tsujimura, S., Shirai, O., and Kano, K., J. Biochem.,148 (1) 47-54 (2010).

- Bioelectrocatalytic Endpoint Assays Based on Steady-state Diffusion Current at Microelectrode Array, Noda, T., Hamamoto, K., Tsutsumi, M., Tsujimura, S., Shirai, O., and Kano, K., Electrochem. Commun., 12 (8), 839-842 (2010).

- Effects of Oxygen on Shewanella decolorationis NTOU1 Electron Transfer to Carbon Felt Electrodes, Li, S.-L., Freguia, S., Liu, S.-M., Cheng, S.-S., Tsujimura, S., Shirai, O., and Kano, K., Biosens. Bioelectron., 25 (12), 2651-2656 (2010).

- X-ray Crystal Analysis of Bilirubin Oxidase from Myrothecium verrucaria at 2.3 Å Resolution using a Twin Crystal, Mizutani, K., Toyoda, M., Kenta Sagara, K., Takahashi, N., Sato, A., Kamitaka, Y., Tsujimura, S., Nakanishi, Y., Sugiura, T., Yamaguchi, S., Kano, K., and Mikami, B., Acta Crystallogra. F, 66, 765-770 (2010).

- Flavin Mononucleotide Mediated Electron Pathway for Microbial U(VI) Reduction, Suzuki, Y., Kitatsuji, Y., Ohnuki, T., and Tsujimura, S., Phys. Chem. Chem. Phys., 12 (34), 10081-10087 (2010).

- Mediated Bioelectrocatalysis with Liposome for Multi-enzyme Linked System, Matsumoto, R., Kakuta, M., Goto, Y., Sugiyama, T., Sakai, H., Tokita, Y., Hatazawa, T., Tsujimura, S., Shirai, O., and Kano, K., Phys. Chem. Chem. Phys., 12 (42), 13904-13906 (2010).

Reports,others

- Electrochemical oxidation of glucose and its application to glucose sensors, Seiya Tsujimura, vitamins, 84 (5/6), 261-264 (2010).

- Biofuel cells, Kenji Kano, Chemistry and chemical industry, 63 (11), 897-899 (2010).

- E-oriented biotechnology, Kenji Kano, Norio Matsumoto, Masaharu Ishii, OHM, 2010 (5) 8-9.

- Reserch and developments of biofuel cell, Seiya Tsujimura, Chemical industry, 61 (2), 9-14 (2010).

b) Conference and seminar papers presented

- The 217th Annual Meeting of Electrochemical Society: 3 reports

- The 71th Annual Meeting of the Japan Society for Analytical Chemistry: 5 reports

- ACEC 2010: 1 report

- Gordon Research Conference: 1 report

- The 4th summer seminar of Kansai Branch of the analytical chemical society of Japan: 3 reports

- Public Seminar of Japan Bioindusry Association: 1 report

- The Autumn Meeting of the Electrochemical Society of Japan in 2010: 3 reports

- Annual Meeting of the Japan Society for Analytical Chemistry: 8 report

- the 61th annual meeting of the international society of electrochemistry: 1 report

- The 56th Annual Meeting on Polarography and Electroanalytical Chemistry: 4 reports

- The 78th Annual Meeting of the Electrochemical Society of Japan: 4 reports

- The Meeting of Japan Society for Bioscience, Biotechnology, and Agrochemistry in 2011: 5 reports

A-3.Off-campus activities 1

Membership in academic societies

- Kano, Kenji : The Electrochemical Society of Japan (an adviser of Kansai Branch), The Japan Society for Analytical Chemistry (a council member, an organizer of Kinki Branch), The Japan Society for Bioscience, Biotechnology, and Agrochemistry (a director), The Polarographic Society of Japan (a director), 2011 International Congress on Analytical Science, Local Orgnizer Committee Member, 2011 International Society of Electrochemistry, Local Organizer Committee Member

- Shirai, Osamu : The Electrochemical Society of Japan (an organizer of Kansai Branch), The Japan Society for Analytical Chemistry (an organizer of Kinki Branch), The Polarographic Society of Japan (the accountant director, a council, a secretary)

- Tsujimura, Seiya : The Polarographic Society of Japan (a council), The Japan Society for Bioscience, Biotechnology, and Agrochemistry (a delegate)

A-3.Off-campus activities 2

Research grants

1. Grants-in-aid for Scientific Research(KAKENHI)

- Scientific Research (C) : Shirai, Osamu : Analytical Method on ion transport across biomembranes by use of ion channels

- Excellent Young Researcher Overseas Visit Program : Tsujimura, Seiya : Development of porous functional enzyme electrodes modified by redox polymers and their application

- Grant-in-Aid for Exploratory Research : Kano, Kenji (Hideto Miyoshi) : Development of Electro-conductive Quinone-modified Electrodes to Realize Sensitive Assay of Respiratory Chain Enzymes

A-4.International cooperation and overseas activities 1

Membership in academic societies

- Kenji Kano: The Electrochemcal Society (Member), Analytical Biochemistry (Exective Editor), Journal of Electroanalytical Chemistry (Editorial Board)

- Osamu Shirai:

- Seiya Tsujimura: The Electrochemcal Society (member), Internationall electrrochemical society (member)

International meetings(country,roles)

- Kenji Kano：The 217th Annual Meeting of Electrochemical Society (Canada, Keynote lecture and Organizer), Gordon Research Conference on Fuel Cell (USA, Invited)

- Shirai Osamu：ACEC 2010 (Keynote lecture, Kumamoto Japan, Keynote lecture)

- Seiya Tsujimura:

A-4.International cooperation and overseas activities 2

Visiting Research Scholars

- researcher 1（Taiwan）

B.Educational Activities(2010.4-2011.3)

B-1.On-campus teaching

a) Courses given

- Undergraduate level: Biophysical Chemistry I (Kano), Biophysical Chemistry II (Kano), Introduction to Applied Life Science I (Kano and others), Applied Life Science (Kano and others), Analytical Chemistry (Shirai), Laboratory Course in Analytical Chemistry (Shirai, Tsujimura), Laboratory Course in Biophysical Chemistry (Shirai, Tsujimura)

- Graduate level: Bio-Analytical and Physical Chemistry (Kano, Shirai), Bio-Analytical and Physical Chemistry (advanced course) (Kano, Shirai, Tsujimura), Experimental Course of Bio-Analytical and Physical Chemistry (Kano, Shirai, Tsujimura).

B-2.Off-campus teaching etc.

Part-time lecturer

- Kenji Kano: Kyushu University, Department of Science, Bioelectrochemistry, Konan University, Department of Science and Technology, Bioelectrochemistry, Gunma Universiry, Department of Technology, Bioelectrochemistry

B-3.Overseas teaching 1

International students

- International students : Doctral 1 (Taiwan)