Radioisotope Research Facility

Kunihiko Fukuda, *Professor and Director* Yukio Yoshizawa, *Assistant Professor*

General Summary

The Radioisotope Research Facility was established to support medical and biological research with isotopes. We have supported researchers by suggesting methods and practical techniques for experiments. Lectures and training sessions were held for researchers and for medical students and graduate students who are starting to work with radioisotopes. In 2009, 44 researchers from 12 departments used the laboratory in this facility. Major nuclides used for experiments were ^{32}P, ^{51}Cr, ^{125}I, ^{35}S, and ^{3}H.

Research Activities

The active site of exfoliative toxin A

Exfoliative toxins A and B (ETA and ETB) produced by *Staphylococcus aureus* cause staphylococcal scalded-skin syndrome. We have previously reported that the nitration of tyrosine residues causes both ETA and ETB to lose all toxicity. Site-directed mutagenesis was used to introduce mutations at either tyrosine (Tyr)-17–18 or Tyr-225–232. Substitution of any Tyr residues with phenylalanine destroyed ETA activity. The agglutination titer of mutated ETAs was $1/40^{th}$ that of native ETA. On immunodiffusion test, substitution of Tyr-17–18 or Tyr-225–232 resulted in a complete loss of immunoreactivity with anti-ETA rabbit serum, thus confirming that Tyr-17–18 and Tyr-225–232 are essential for the toxicity and antigenicity of ETA.

Development of techniques for determining radioactivity

Radon is a radioactive noble gas produced by the decay of radium present in soil and rocks. Radon is the second most common cause of lung cancer in the general population, after smoking. A reference level of 300 Bq/m^3 was proposed by the International Commission on Radiological Protection to minimize the health hazard due to indoor radon exposure. We have used silicone oil as a liquid scintillation solvent to measure radon indoors. The silicone oil is transparent, nonvolatile, physiologically inert, and heat-resistant. These properties are thought to be suitable for a scintillator solvent. Methylphenyl silicone HIVAC F-4 (Shin-etsu Chemical Co., Ltd., Tokyo, Japan) is an excellent liquid scintillation solvent for radon determination.

Study of resistance mechanisms in radiation-resistant organisms

Tardigrades show remarkable adaptability in extreme environmental conditions, such as high radiation. To study the mechanism of radiation resistance in organisms, we examined the effect of radiation on tardigrades. Tardigrades were collected from moss on the streets around The Jikei University and activated sludge from the Ariake Water Reclamation Center (Bureau of Sewerage, Tokyo Metropolitan Government). Tardi-

grades isolated from moss were identified by 18S-rDNA as *Microbiotus* and *Milnesium tardigradum*, and those isolated from activated sludge were identified as *Isohypsibius*. Because the drying tolerance of *Isohypsibius* differs from that of other tardigrades, we believe that comparing the effects of radiation on them with drying tolerance tardigrades will be worthwhile.

Determination of trace elements in cosmetics by radiochemical methods

There are many inexpensive cosmetics on the market whose adverse effects on health are frequently overlooked. Colorful cosmetics, particularly for eye makeup, often contain toxic heavy metals as pigments. To determine what metallic elements are present in cosmetics and to estimate their toxicity, eye cosmetics were analyzed with instrumental neutron activation analysis. The concentrations of Mg, Al, Sc, Ti, V, Cr, Mn, Fe, Co, Zn, Cs, and Ta in 30 eye shadows were determined. From cross-correlation of elemental abundances and the relationship with their color, we estimated the origin of the elements.

Publications

Minowa H, Yoshizawa Y, Takiue M. Cherenkov counting of carbon-14 using a translucent ceramic with high refractive index. In: Eikenberg J, Jaggi M, Beer H, Baehrle H, editors. LSC2008 Proceedings of International Conference on Advances in Liquid Scintillation Spectrometry. Tucson: University of Arizona; Radiocarbon 2009. p. 119–23.