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Activities of the Consortium for Medicine, Chemistry, and Physics at Osaka University

In the fall of 2015, the Graduate School of Science, Osaka University's Graduate School of Science, the Graduate School of Medicine, and the Center for Nuclear Physics cooperated to establish the project "Formation of an International Medical Center for Advanced Cancer Therapy by Medical Collaboration"as an estimate request project. Currently, one-third of cancer patients in Japan have so-called "advanced cancer,"which has invaded neighboring organs or undergone distant metastasis at the time of initial consultation. Its 5-year survival rate is less than 15%; therefore, new treatment methods need to be developed. In this context, radiopharmaceuticals are beginning to attract the limelight. A radiopharmaceutical is a medicine using a radionuclide (RI), and since it uses a beta-ray nuclide which is frequent from RI, there has been a problem of side effects being generated due to the influence on surrounding normal tissues. It appeared in nuclear medicine treatment using alpha-ray nuclides. Since α-rays have a range of about one cell in the body, they can be used to minimize radiation damage to normal organs and can be easily shielded against, eliminating the need for a special treatment room and enabling the use of treatment in regular hospitals. In 2016, in Japan, radium 233 (233RaCl, product name Zofigo) adapted to bone-metastasized prostate cancer was approved for the first time as a nuclear medicine remedy using alpha rays. This medicine is a radiopharmaceutical that can be administered on an outpatient basis.At Osaka University in Japan, the several medical collaboration project is being promoted to realize various advanced cancer treatments with drugs using α-ray nuclides. The option currently focused on the most is astatine 211 (211At).
211At is a short-lived nuclide that releases only α-rays with a half-life of 7.2 h, and it can be introduced into pharmaceutical molecules by covalent bonding since it is a halogen element. To date, studies have been undertaken to confirm the dynamics of 211At in the body of rats, to combine 211At with antibody drugs and virus-like particles used for cancer treatment, and with target compounds of amino acid transporters.All of these considerations can be carried out within the Osaka University Suita Campus. At the nuclear physics research center (RCNP) in the university, one of the leading accelerators in Japan is installed, so 211At can be efficiently manufactured. It is planned to be remodeled soon to be administered to people. In addition, it is close to the RI Center, which is a facility where purification and complexation of 211At can be performed, along with cell and animal experiments, as well as hospitals that can carry out clinical trials. It is a nuclear medicine remedy that is compliant with GMP manufacturing quality management regulations. Production planning is ongoing. It is expected that new medical innovations generated from such matching of science and medicine will lead to the development of drugs for dreams.

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