

Nuclear Medicine in Finland

The Finnish Society of Nuclear Medicine was founded in 1959, but practical work in nuclear medicine started more than 10 years earlier. The first *in vitro* studies in late 40's were performed to study P-32 distribution in serum in hepatic diseases.^[1] The first thesis was to study TSH with P-32 as indicator of the thyroid response to the hormone.^[2] I-131 was also introduced for diagnostic purposes in the same year. The first treatment for toxic goiter was given in 1954 in Maria Hospital in Helsinki, and this was the beginning of radionuclide therapy in Finland.^[1]

In Finland (population 5.3 millions) there are five university hospitals with full nuclear medicine services, all of which are equipped with PET/CT. One of the leading European radiopharmaceutical companies, MAP Medical Technologies Oy, has three production sites in Finland, so the access to the radiopharmaceuticals is good in spite of long distances within the country. There is nuclear medicine activity in approximately 40 laboratories in Finland. The cyclotron facilities for radiopharmaceutical production are located in Turku and Helsinki.

Nuclear medicine research has been active throughout the years in Finland, but it has been focusing to Turku, Kuopio and Helsinki.

Turku is internationally known for its PET Center. They installed their first multipurpose 20 MeV cyclotron in 1974. As early as 1980, they had developed a target for $^{11}\text{CO}_2$ production^[3] and two years later $^{18}\text{F}(\text{F}_2)$ production.^[4] They got their first whole body PET-scanner in Turku in 1988, after that a revolution in clinical PET studies happened. At that time there were not many PET centers worldwide. Multiple clinical studies on neurotransmission,^[5] cardiac^[6] and tumor metabolism^[7] and drug research were carried out in Turku, some of these were really breakthrough studies in clinical nuclear medicine. Now, there are 4 PET scanners, and excellent facilities for preclinical correlative imaging. The PET Center is very active in international collaboration

globally; there is fruitful researcher exchange between multiple institutions in e.g., Europe, USA and Japan.

In Kuopio, substantial work has been carried out in receptor- and transmitter-binding radiopharmaceutical development, mainly for SPECT-imaging purposes. Radiochemistry development^[8] and mathematical modeling^[9] were the prerequisites for molecular nuclear medicine applications in cardiology,^[10] neurology^[11] and psychiatry.^[12]

In Helsinki, in diagnostic nuclear medicine, early research focused on RIA methods. One of the early breakthroughs in 1975 was the establishment of a new method for radioiodination of proteins and peptides.^[13] This led to multiple scintigraphic applications.^[14] The clinical research in 80's and 90's focused on neurology^[15] using various SPECT ligands and on oncology^[16] using more than 20 different monoclonal antibodies. Substantial development in 80's was made in cell labeling methods.^[17]

In radionuclide therapy in Finland, the next milestone since radioiodine was the introduction of ^{90}Y in the treatment of rheumatoid knee joints by Dr. Rekonen in 1972.^[18] This was later continued by introducing another isotope, ^{165}Dy , by Dr. Hannelin. Sm-153-EDTMP therapy was brought by Dr. Kairemo to Finland from Australia in 1989, and early clinical trials were started in 1990.^[19] Radioimmunotherapy was introduced in Finland in 1994 for treating successfully intraperitoneal carcinomatosis, and for this purpose 3-D-dosimetry program was developed.^[20] An interesting approach has been radiochemotherapy in head and neck cancer using In-111-BLMC, a tumor-targeting synergistically cytotoxic and radiotoxic compound, which was used in clinical trials.^[21] This invention led to multiple inventions of creating multi-potential intelligent targeted nanoparticles for drug delivery.^[22] Radioimmunotherapy was also applied clinical pediatric oncology, e.g., for treating hepatoblastoma.^[23] Peptide receptor therapy was initiated in Finland in 2000, and practical 4-D dosimetry routine applications of Lu-177 treatments was introduced in 2010.^[24]

World Association of Radiopharmaceutical and Molecular Therapy (WARMTH) has successfully organized 6 International Conferences at locations like Limassol-2005 (Cyprus), Ulaan Baatar-2007 (Mongolia), Goa-2008 (India), Cartagena-2009 (Colombia), Cape Town-2010 (South Africa), Kuwait-2011 (workshop)

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and Ho Chi Minh City-2011 (Vietnam). Now, the 7th International Conference on Radiopharmaceutical Therapy (ICRT-2012) will be held in Levi, Finnish Lapland from 25-29 November 2012. All the local organizers look forward welcoming you in Finnish Lapland at the WARMTH Congress.

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