

## MODERN TECHNOLOGIES FOR THE PRODUCTION OF NUCLEAR MEDICINE ISOTOPES

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In modern nuclear medicine the main clinical information is obtained from observing the radiopharmaceuticals (by incorporating a radionuclide into the pharmaceutical) distribution in the patient body. These pharmaceuticals are a mixture of a biochemical agent and a radionuclide that emits gamma quanta or positrons [1]. Diagnostic imaging with single-photon-emitting radionuclides produces both planar images and single-photon emission computed tomography (SPECT) using a gamma camera. Radiopharmaceuticals labeled with positron-emitting radionuclides are used for positron emission tomography (PET). Nuclear medicine images depict anatomic, functional, and metabolic processes in human body [2].

Another important task in nuclear medicine methods is the targeted delivery of radiopharmaceuticals to cancer cells for the subsequent non-surgical treatment of the tumors. The combination of radionuclide imaging with radionuclide therapy in theranostics (therapy + diagnostics) can give an excellent result for effective early diagnosis and treatment of various localized oncological tumors and oncological diseases with minimal side effects [3]. Therefore, one can produce the radiopharmaceuticals with the following properties: half-life should be similar to the length of the medical procedure, the radionuclide should emit gamma rays (the energy of the gamma rays should be between 100 and 300 keV) together with emission of short-range charged particles (discrete spectrum for particles, no recoil nuclei are produced when these particles are emitted, and they have a high linear energy of transfer), the radionuclide should be chemically suitable for incorporating into a pharmaceutical without changing its biological behavior, the pharmaceutical should localize only in the area of interest, the radiopharmaceuticals should be simple to prepare and have the low production price [1,3].

In present overview, the technologies for the production of nuclear medicine isotopes (main components of novel radiopharmaceuticals) together with new nuclear materials and specific nuclear reactions are discussed. Also the experimental and theoretical studies of the (p, xn) reactions excitation functions in the energy range 6-40 MeV for the light and medium mass nuclear systems with production of the scandium, technetium and antimony radionuclides were carried out. Such radionuclides should be prospective for the Theranostics methods.

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2. D. Volterrani, P.A. Erba, et.al., Nuclear Medicine: Methodology and Clinical applications, Vol.1, Springer (2019).
3. V. I. Zhrebchevsky, et.al., Bulletin of the Russian Academy of Sciences: Physics, 2021, Vol. 85, No. 10, pp. 1128–1135.

### The speaker is a student or young scientist

No

### Section

1. Nuclear technology and methods in medicine, radioecology

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