$^{68}$Ga-PET: a powerful generator-based alternative to cyclotron-based PET radiopharmaceuticals

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PET (positron emission tomography) is a powerful diagnostic and imaging technique which requires short-lived positron emitting isotopes. The most commonly used are accelerator-produced $^{11}$C and $^{18}$F. An alternative is the use of metallic positron emitters. Among them $^{68}$Ga deserves special attention because of its availability from long-lived $^{68}$Ge/$^{68}$Ga generator systems which render $^{68}$Ga radiopharmacy independent of an onsite cyclotron. The coordination chemistry of Ga$^{3+}$ is dominated by its hard acid character. A variety of mono- and bifunctional chelators have been developed which allow the formation of stable $^{68}$Ga$^{3+}$ complexes and convenient coupling to biomolecules. $^{68}$Ga coupling to small biomolecules is potentially an alternative to $^{18}$F- and $^{11}$C-based radiopharmacy. In particular, peptides targeting G-protein coupled receptors overexpressed on human tumour cells have shown preclinically and clinically high and specific tumour uptake. Kit-formulated precursors along with the generator may be provided, similar to the $^{99}$Mo/$^{99m}$Tc-based radiopharmacy, still the mainstay of nuclear medicine.

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