HOLLAND LAB – RADIOCHEMISTRY & IMAGING SCIENCE

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SUMMARY & MISSION STATEMENT

Our lab designs new radioactive drugs for non-invasive imaging of key protein biomarkers of cancer. The mission is to develop new ways of installing radioactive elements into the structure of cancer-specific drugs, and at the same time provide full preclinical evaluation and translation of promising positon-emitting radiotracers for use in the clinic.

OVERVIEW

Our research is highly interdisciplinary. Projects lie at the interface of chemistry, biochemistry and translational molecular medicine. Our primary aims are to explore interesting new ways of attaching radionuclides to different chemical structures, and simultaneously to develop new imaging agents that can measure biomarker expression for use in monitoring anti-cancer chemotherapy. Chemical goals focus on designing new radiochemical routes for making radiolabelled drug molecules, peptides, proteins, antibodies and nanoparticles. We are particularly interested in the radiochemistry of ^{18}F, ^{64}Cu, ^{68}Ga, ^{90}Y, ^{89}Zr, ^{111}In, and ^{177}Lu for designing both diagnostic and therapeutic radiotracers. Our research involves organic and inorganic synthesis, computational studies of reaction mechanisms and metal ion bonding using density functional theory, synthesis and characterisation of radioactive molecules, and complete radiotracer development from cellular assays i*n vitro* to full imaging, biodistribution and pharmacokinetic profiling *in vivo.* Imaging goals focus on using positron-emission tomography (PET) to measure how oncogenic cellular signalling pathways change in response to chemotherapy. We collaborate with physicians at the University Hospital Zurich (USZ), and beyond, to ensure that our most promising radiotracers are translated efficiently so patients can benefit as soon as possible from our research, and from the latest technology.

SELECTED CANCER RELATED PUBLICATIONS

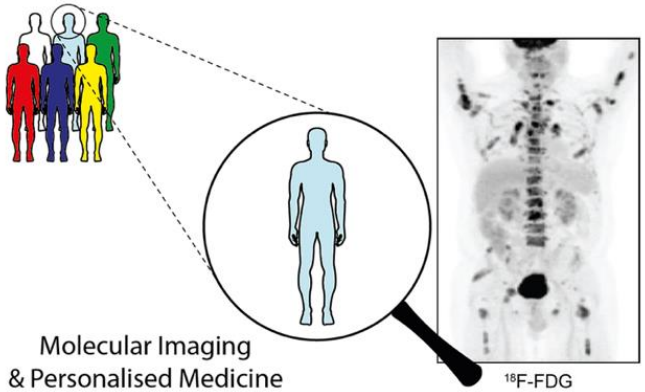
PET of signal transduction pathways in cancer. Holland JP, Cumming P, Vasdev N. **J. Nucl. Med.** 2012;53(9):1333-1336

Annotating MYC status with ^{89}Zr-transferrin imaging. Holland JP, Evans MJ, Rice SL, Wongvipat J, Sawyers CL, Lewis JS. **Nature Med.** 2012;18:1586-1591

Imaging tumor burden in the brain with ^{89}Zr-transferrin. Evans MJ, Holland JP, Doran MG, Cheal SM, Campos C, Rice SL, Carlin S, Mellinghoff IK, Sawyers CL, Lewis JS. **J. Nucl. Med. 2013**;54(1):90-95

Chelate-free metal ion binding and heat-induced radiolabeling of iron oxide nanoparticles. Boros E, Bowen AM, Josephson L, Vasdev N, Holland JP. **Chem. Sci**. 2015;6(1):225-236

Advanced methods for radiolabelling multi-modality nanomedicines for SPECT/MRI and PET/MRI; Lamb J, Holland JP. **J. Nucl. Med.** 2018;59:382-389



Molecular imaging techniques like positron-emission tomography (PET) combined with target-specific radio-pharmaceuticals offer a unique window on the biochemistry of diseases like cancer.