## Chemistry of Contrast Media

## Biologicals

### Development of antibody-based probes for molecular imaging

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Learning Objectives:

- Delineate ideal properties of an antibody-based imaging agent
- Evaluate suitability of cell surface biomarkers as imaging targets
- Compare radiolabeling isotopes and methods for imaging applications

Antibodies can be produced to recognize essentially any target of interest with nanomolar affinity, making them an ideal class of molecules for the generation of molecular imaging agents. However, the use of classic mouse monoclonals for in vivo imaging has many limitations including immunogenicity, slow kinetics and clearance, etc. Recently, antibody engineering has been harnessed to produce targeting agents based on humanized and human antibodies, with tailored pharmacokinetics for rapid imaging. Antibodies can be engineered for site-specific conjugation and labeling, and clearance can be directed through hepatic or renal routes. When labeled with positron-emitting radionuclides (such as I-124, Zr-89, Cu-64, F-18), engineered antibody fragments can be employed for high resolution, sensitive, quantitative imaging by PET. ImmunoPET can be utilized for phenotypic assessment of cells and tissues in living organisms, including patients, in oncology and other diseases. Antibody-based imaging can also be applied to detection of immune cell subsets (such as CD8 T cells or macrophages), for monitoring immune responses. ImmunoPET provides a broad approach for imaging cell surface phenotype in vivo, and stands to play an expanding role in the detection and management of cancer and other diseases, for assessing key factors such as target expression, internalization and catabolism, and response to therapy and mechanism of response. Molecular imaging applications of engineered antibodies have been extended to incorporation of optical tags, by dye conjugation or generation of fusion proteins. Finally, engineered antibodies provide a versatile platform for development of targeted multimodal imaging agents including nanoparticle-based diagnostics and therapeutics.

Relevant Publications:

1. Olafsen, T. and Wu, A.M. (2010) Antibody vectors for imaging. Seminars in Nuclear Medicine, 40:167-181.

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