The Need for Late-Stage Functionalizations, and their Application

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The unnatural isotope fluorine–18 (^{18}F) is used as a positron emitter in molecular imaging. Currently, many potentially useful ^{18}F-labeled probe molecules are inaccessible for imaging, because no fluorination chemistry is available to make them. Syntheses must be rapid on account of the 110-minute half-life of ^{18}F, and fluorination should ideally be executed as the ultimate synthetic step. I will describe the development of novel, modern reactions directed at the synthesis of ^{18}F and ^{19}F containing complex small molecules. In particular, I will describe the approach to functionalize complex small molecules at a late stage, and the challenges associated with it, as well as the applications for late-stage C-H functionalization reactions to create molecular complexity for applications in catalysis, drug discovery, and medicine.

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