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Controlling biomolecules in living organisms using small molecule triggers has enormous potential for advancing basic research and therapeutic development. The Staudinger reduction, a famously mild reduction of azides to amines using phosphine reagents, provides a bioorthogonal means of doing so, but suffers from sluggish kinetics. Here, I report progress toward the development of phosphines and azides with faster kinetics to make the Staudinger reduction more useful for controlling biological processes. First, I discuss the synthesis and testing of model phosphines and azides used for the Staudinger ligation, a modified form of the Staudinger reduction in which the aza-ylide intermediate attacks an intramolecular electrophile instead of becoming hydrolyzed. Second, I report the synthesis and genetic encoding of *para*-(4-azidophenyl)ethoxycarbonyl and 1- azidoethoxycarbonyl amino acids using pyrrolysyl tRNA synthetase/tRNACUA pairs in mammalian cells. This work paves the way to site-specific incorporation of azido-amino acids into proteins, rendering them inactive until a phosphine trigger deprotects them via the Staudinger reduction.