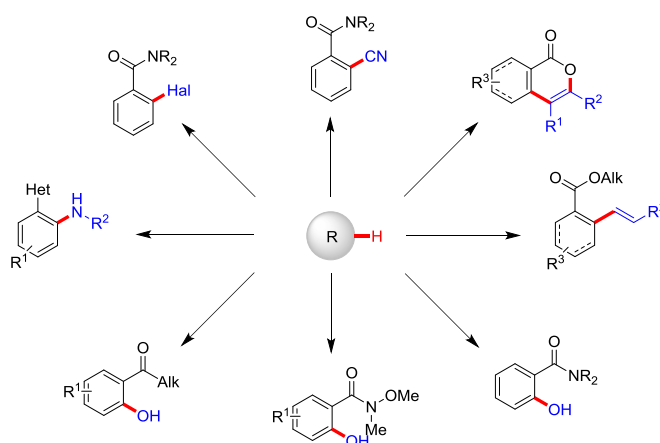


# Homogenous Catalysis for Sustainable Synthesis

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Homogeneous transition metal catalysis is the key technology for sustainable molecular syntheses. While hydroamination reactions enable the atom-economical addition of unactivated amines onto unactivated carbon-carbon multiple bonds,<sup>1</sup> C–H activation has surfaced as an increasingly potent tool in molecular syntheses,<sup>2</sup> with transformative applications to natural product chemistry,<sup>3</sup> pharmaceutical industries<sup>4</sup> and material sciences,<sup>5</sup> among others. In this context, secondary phosphine oxides and carboxylates have been identified as powerful additives for positional selective C–H arylations and alkylations with versatile ruthenium(II) complexes,<sup>6</sup> displaying complementary chemo- and site-selectivities as compared to palladium,<sup>7a</sup> nickel,<sup>7b</sup> cobalt,<sup>7c</sup> iron,<sup>7d</sup> copper<sup>7e</sup> or manganese<sup>7f</sup> catalysis. Detailed mechanistic insights into the working mode of the key C–H ruthenation step set the stage for ruthenium(II)-catalyzed twofold C–H bond functionalizations as well as step-economical oxidative alkyne annulations.<sup>8,9</sup> The oxidative C–H bond functionalization strategy proved broadly applicable and enabled, among others, ruthenium(II)-catalyzed oxygenations, nitrogenations, cyanations and halogenations, as well as *meta*- and *para*-selective arene diversification.<sup>10</sup>



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