The aryl hydrocarbon receptor (AHR) was discovered through its dual roles in regulating the inducible expression of xenobiotic-metabolizing enzymes and in mediating the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in modern-day mammals. Because of this, for many years the AHR was of interest only to toxicologists. Much is now known about the role of AHR in toxicology, but this protein also has more fundamental roles in biology that are being revealed through studies in diverse animal species. The AHR is an ancient protein; AHR homologs exist in most major groups of modern bilaterian animals, including deuterostomes (chordates, hemichordates, echinoderms) and the two major clades of protostome invertebrates [ecdysozoans (e.g. arthropods and nematodes) and lophotrochozoans (e.g. molluscs and annelids)]. AHR homologs also have been identified in cnidarians such as the sea anenome Nematostella and in the genome of Trichoplax, a placozoan (early-diverging multicellular animal). Bilaterians, cnidarians, and placozoans form the clade Eumetazoa, whose last common ancestor lived approximately 600 million years ago (MYA). The presence of AHR homologs in modern representatives of all these groups indicates that the original eumetazoan animal possessed an AHR homolog. What was the function of this early AHR? How have AHR structure and function evolved since then? How can this knowledge inform our current understanding of AHR and its diverse roles in development, immunology, neurobiology, and toxicology? Some vertebrates (fish, birds, and even some mammals!) possess multiple AHRs—up to six in the case of some fish—with distinct AHR forms designated AHR1, AHR2, and AHR3 [in addition to the AHR-related AHR Repressor (AHRR)]. Here, we will provide an overview of AHR diversity, including multiple AHRs found in some species, and their orthologous and paralogous relationships. We will consider AHR evolution occurring on different time scales, possible ancestral and derived functions, and the role of various model species in informing our understanding of AHR biology. [We gratefully acknowledge long-term support from the National Institute of Environmental Health Sciences through R01ES006272 and P42ES007381, which have enabled our studies of AHR diversity, evolution, and function.]