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This is the first in a series of four papers in which the authors give a construction of what they describe as a “universal finite-type invariant for rational homology three-spheres”. They call this invariant the Århus integral of the rational homology sphere. The paper under review is an introduction to the whole series. This invariant is defined in terms of framed links with non-singular linking matrix, and the definition uses diagrams of tangles whose linking matrix is non-singular. The fact that such an object descends to an invariant of homology three-spheres is based on the fact that it satisfies the Kirby relations. In this paper, besides defining the invariant, the authors state its main properties. The proofs are postponed to the later paper. In this introductory paper, the authors discuss the relation of their work to several other works, which include the Chern-Simons path integral, Witten’s invariants, Axelrod-Singer perturbative 3-manifold invariants, Kontsevich configuration space integrals, the Reshetikhin-Turaev invariants and the $p$–adic 3-manifold invariant introduced by Ohtsuki. The authors state that their invariant is in fact a “universal Ohtsuki invariant”, and that up to a normalization, it is the same as the Le-Murakami-Ohtsuki invariant. The work here provides a new point of view on that invariant.

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