

Ovothiol: A Potent Natural Antioxidant from Marine Organisms

Anna Palumbo¹, Immacolata Castellano¹, and Alessandra Napolitano²

¹Stazione Zoologica Anton Dohrn, Department of Biology and Evolution of Marine Organisms, Villa Comunale, 80121 Napoli, Italy

²University of Naples Federico II, Department of Chemical Sciences, Via Cintia 4, 80126 Napoli, Italy

Abstract

Ovothiols are histidine-derived thiols found in many marine invertebrates (*Paracentrotus lividus*, *Strongylocentrotus purpuratus*, *Arbacia lixula*, *Marthasterias glacialis*, *Astropecten aurantiacus*, *Octopus vulgaris*, *Loligo vulgaris*, and *Platynereis dumerilii*), as well as in algae and protozoa. Different aspects related to ovothiols are examined in this chapter, including their isolation, structural characterization, and detection. A survey of protocols for the chemical synthesis of ovothiols is summarized from the initial studies in the 1980s to more recently developed synthetic routes. A careful examination of the chemical properties of ovothiols and their reactivity toward biological oxidants is reported. The enzyme 5-histidylcysteine sulfoxide synthase (OvoA), which catalyzes the first step of ovothiols biosynthesis, has been recently characterized, providing some insights into the mechanism of ovothiol formation. The involvement of ovothiols in different biological functions, ranging from fertilization and reproductive behavior to redox state regulation and protection from oxidative stress, is reviewed. The synthesis of a variety of thiol derivatives is reported, together with the analysis of their antioxidant properties. Moreover, the studies reported in the literature on the biological activities of ovothiols and ovothiol derivatives with promising pharmacological applications are discussed.

18.1 Historical Background

The story of ovothiol has become gradually unfolded in the course of recent years since its discovery in sea urchin eggs in the 1980s [5]. Ovothiol is a thiohistidine methylated on the imidazole ring, the π -*N*-methyl-5-thiohistidine (see Note on Nomenclature in Box 18.1). It has been isolated from a variety of sources,