Essere viventi (Being living beings)
Being fearfully and wonderfully made: the wonder of interdependence

Rimini, Tuesday August 18th - "Every organism becomes itself thanks to something which is other than itself". This is the short preview by Giorgio Dieci, Professor of Biochemistry of the University of Parma and member of the Euresis Association, as an introduction to the talk by Scott F. Gilbert, emeritus Howard A. Schneiderman Professor of Biology, Swarthmore College, founding father of the branch of biology that studies the mechanism of growth and development of living beings.
Gilbert - Dieci continues - has recognized and studied the relational character of this mechanism. He wrote the reference book *Development Biology* in 1985, which has reached today the 12th edition. In the 2012 edition of Rimini Meeting his collaboration was particularly widespread and impactful, and it was followed by a multidisciplinary symposium held in San Marino.
Dieci remembers that "in that occasion he charmed everyone telling how symbiotic relationships are determinant for biological development", and his career is dotted with recognitions and prizes. He is considered - Dieci insists - the founder of the evolutionary biology of development (EVO DEVO) and contributes to the understanding of biology in its relationship with ecology (informally, ECO EVO DEVO). Dieci remembers also a famous paper where Gilbert, who also studies the history of biology and religion, quoted Abraham Heschel (the author of the title of Meeting 2020) several times and immediately asks Gilbert - connected from Oregon- the first question: how can biology have to do with sublime?
Gilbert goes directly to the central point: communicating the idea of being fearfully and wonderfully made, the wonder of interdependence. "Sublime is not always there, we have to feel it. And it's not simply beauty, it's more: it amazes and frightens. You", continues, addressing the audience, "are not only an individual: you are a set of subsystems, you are a biome".
He enunciates the answer starting from the different meanings of individuality: the genetic one, the immune one, and the evolutive one, natural selection. However, they are all wrong. We have to accept that a so called "individual" is, in fact, a holobiont: an animal, or a plant, together with a community of symbiotic beings which is part of it. According to his studies, animals cannot exist without these symbiotes. "Half of our cells is not genetic, is made of microbes. Every pore of our skin is a subsystem."
Compared to around twenty-two thousand genes - Gilberts explains - which make up the whole genetic heritage, there are eight millions genes belonging to symbiotes. For human beings the birth canal introduces different bacteria than those normally present, for instance in the first nutrients. There are bacteria that cannot be digested by the baby, but they have to colonize his intestine. For some insects, there are exchanges between colonies.
The absence of some bacteria causes diseases. Human and bacteria physiology are connected, therefore we have to talk about biometabolism, meaning interaction among bacteria. This interaction is not limited to the first days of life, but continues for the full development. The beauty of orchids is due to a fungus which invades the seeds and provides nutrients and this is the only way the seed gets to the necessary maturation.

Gilbert's argument continues further, very concrete and rich of examples, also related to human kind. To summarize, development is a holobiontic function. "We become with others" he confirms, "and not because we are consenting adults".
Dieci points out that, being made this way, anatomically and physiologically, with an interpenetration of components that exceeds the boundaries of the individual, is baffling, because it upsets all the common thinking about biology. Moreover, it asks the question about the immune system, which in the common thinking should protect us from bacteria. Gilbert answers, with simple examples, that immunity is one of the many functions of a holobiont. "Animals without germs have insufficent physiology. Phylosphically it is a distress of the classical idea of the immune system, which is basically different according to where bacteria come from". For Gilbert, "an immunological individuality exists, but it's not the classical one. The immune system is a system of bouncers".
Dieci asks again: what does that mean for the evolution of life on the Earth? Gilbert starts from a quote of another scholar: "Life has spread nor through conflict, but through cooperation" (Margulis), and makes the example of the evolution of herbivorous, which have a stomach specifically built (by some interactions with bacteria) to digest plants, something much more complex than digesting meat, and, additionally, the problem of fighting toxins, which many plants have, is solved.
Now, it's the moment of fast and dense final considerations. For Gilbert Nature can instill wonder in us, but after that, curiosity comes. It's not by chance that the English word *wonder* contains asking, awe and amazement. "It's this mix between awe and amazement that allows us to understand sublime". Therefore, the meeting ends with a thought on two words. One is the Russian word *ostranenie* (extraneousness). The other one, used by Heschel, is *radical amazement* ("waking up and look at the world in a non obvious way", Gilbert translates). The conclusion, "to be spiritual we need to be full of wonder", raises long and thunderous applauses.