

The Big Picture

... with

Jesse Ausubel

Vice President, Programs
Alfred P. Sloan Foundation



Jesse Ausubel is vice president at the Alfred P. Sloan Foundation, where he directs programs in basic science and technology. Ausubel also directs the Program for the Human Environment at The Rockefeller University; and is an adjunct faculty member at Woods Hole Oceanographic Institution. Associated from 1977 to 1988 with the National Academy complex in Washington, D.C., he was one of the principal organizers of the first U.N. World Climate Conference in 1979 and has authored and edited more than 150 publications on technology and environment.



"Big science" projects are rare in biology, but Jesse Ausubel has catalyzed two that aim to embrace the biodiversity of life on Earth. The first, the Census of Marine Life (www.coml.org) is a global network of scientists who are exploring the oceans and gathering data on the diversity, distribution, and abundance of all marine life forms. Even the millions of microbial species are being counted, by a team led by the MBL's Mitchell Sogin and Linda Amaral-Zettler. Next fall, the decade-long Census will roll out its results

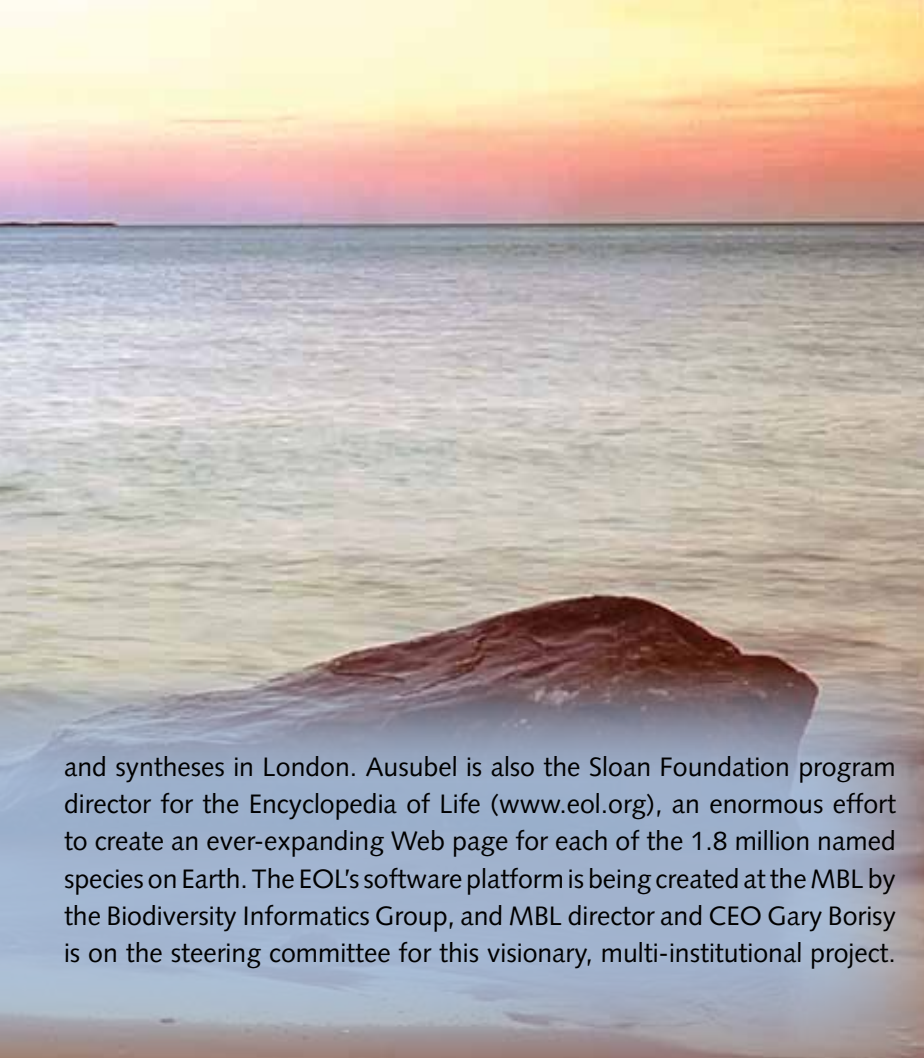
MBL What led you to your interest in "big science" biodiversity projects, such as the Census of Marine Life and the Encyclopedia of Life?

JA As a small child, I loved almanacs, encyclopedias, and atlases; by age 10 I had memorized the New York City subway system. I identify with the 18th century vision of science, of exploration and discovery and documentation. So naturally, I liked the idea of appreciating all life in the sea, or creating an encyclopedia of all species.

MBL Were you driven to launch these projects by environmental concerns?

JA In about 1990, I asked, "How much land could 10 billion people spare for nature?" Conventional wisdom projected that more people on Earth would leave less land for nature, while I was interested in the chance of a great restoration of wild nature. Clearly, sparing the sea equals sparing terrestrial habitat in importance. I was shocked to learn how little we know about what lives in the ocean. In marine biology, the models were better than the data. In seminars at Woods Hole Oceanographic Institution and MBL, researchers would present sophisticated mathematical simulations of ecosystems with very few measurements at the level of species, whether tuna or jellies. In fact, the expert consensus was that about 90 percent of the ocean was unexplored and poorly documented biologically.

In 1996, Fred Grassle, a benthic ecologist formerly at WHOI, and I began talking about this lack of observation of marine biodiversity. Something big needed to be done to generate more information on all life in the oceans, top to bottom, to generate more understanding and eventually more beneficence. From the World Climate Program and other early career experiences, I knew how to organize cooperative international scientific programs. After lots of consultations, many on summer days on Water Street in Woods Hole, the Census officially kicked off in May 2000.



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and syntheses in London. Ausubel is also the Sloan Foundation program director for the Encyclopedia of Life (www.eol.org), an enormous effort to create an ever-expanding Web page for each of the 1.8 million named species on Earth. The EOL's software platform is being created at the MBL by the Biodiversity Informatics Group, and MBL director and CEO Gary Borisy is on the steering committee for this visionary, multi-institutional project.

MBL How did the Encyclopedia of Life come about?

JA In late 2005, at a meeting in Frankfurt, the Census scientists raised the issue of how to standardize and provide access to the fast-growing information on the 200,000 or so named marine species. Would each Census team need to create its own software and user interfaces, its own species Web pages? This would be extremely inefficient, and bewildering for users of the information. The Census community emphatically asked me, as a manager of the program, for a convenient, open-access, open-source informatics framework.

A few weeks later, in a happy convergence, the president of the MacArthur Foundation, Jonathan Fanton, contacted me. Jonathan had received a one-page letter from Ed (E.O.) Wilson at Harvard about his concept for an online Encyclopedia of Life. Jonathan invited me to lead a feasibility study on the EOL for MacArthur, which I did in 2006 and 2007. We concluded that advances in software, including some developed in the MBLWHOI Library and in Mitchell Sogin's lab at the MBL, meant the EOL could happen fast and economically. Moreover, the Marine Census illustrated the demand for an EOL, both from researchers and the general public.

In practice, the EOL is a godsend, and not just for the Census. If every expert had to create the software that the EOL's Biodiversity Informatics Group has created, most species would never have pages. The growth of the EOL has been incredible. Within a year of Ed Wilson's letter to MacArthur, the MBL and other cornerstone institutions involved in the project had

funding commitments for \$45 million. With the leadership of MBL scientist David Patterson, the EOL site went public a year later, and now it contains more than 150,000 species pages with vetted content that have benefited about two million unique visitors. No other project in my career has moved as fast.

MBL When will the Census converge with the EOL?

JA Many marine species already have good pages, and by the crescendo of the Census in October of 2010, a large fraction of marine species will be vividly present in EOL. The Census is also working with Google Earth and National Geographic to share information through maps and new forms of visualization. The biodiversity community is moving toward a much more integrated vision of services, an “e-Biosphere” in which users will navigate seamlessly from species names to DNA sequences to historical literature to maps and images.

MBL What do you feel is the most important implication of global biodiversity projects such as these?

JA “Macroscopes” are joining microscopes as premiere tools for 21st century biology. For centuries, biology discovered by zooming into smaller and smaller things. Now, projects including the Census and the EOL enable us to discover and appreciate patterns and phenomena that before were too big to see. How do you understand the relatedness of all 200,000 forms of marine life? Or longevity across many taxa? Or the effects of climate change on the diversity of life in ecosystems? For such questions, science needs macroscopes, and happily the MBL and its sister institutions are creating them. •

