Marine Microbial Biodiversity and Drug Discovery

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The world's oceans are the center of global biodiversity with 34 of the 36 Phyla of life represented (by comparison, the terrestrial environment is represented by only 17 Phyla). Much of this diversity is found in the macroscopic plants and animals, which reach very high densities on coral reefs and in the IndoPacific Ocean. The major biodiversity in the oceans, however, does not reside in the plants and animals, but in the enormous diversity of microbial life that has yet to be fully defined. One milliliter of ordinary seawater contains one million microorganisms which are mostly uncultured and unknown. The surfaces and internal spaces of plants and animals are unique habitats that have been colonized by microorganisms as part of complex adaptations for survival. Lastly, the bottom sediments, which are the repository of all organic matter in the ocean, are inhabited by a diversity of microorganisms the complexity of which is only now being appreciated. Bacteria and fungi perhaps form the major classes found, but there are numerous other groups that are essentially undefined. Given the successful history of terrestrial microorganisms in the development of new drugs (over 120 marketed today!), a systematic investigation of marine microbes is fully warranted. But, in order to achieve success in this endeavor, obstacles to the discovery and culture of these organisms must first be overcome. In recent studies, we have examined the actinomycete bacteria from a diversity of marine sediment and coral reef habitats. To our surprise, we encountered a significant number of unknown actinomycetes, which appear to exist only in the marine environment. These new bacteria form at least 13 new groups which appear unique at the generic level. Chemical studies of these bacteria have now shown that these microbes produce a significant number of unique and highly bioactive secondary metabolites. Of these, members of the new genera *Salinispora* and *Marinophilus* have been studied in greater detail. Strains from these two groups have yielded clinical candidates for the treatment of cancer and drug resistant infectious diseases. Given the need to discover new treatments in these areas, the discovery of a new resource for these chemically-rich bacteria is of significant medical importance. An overview of these studies, highlighting new sampling tools, phylogenetic identification methods, and chemical studies, will be the main content of this presentation.