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Integrative Biology: Making biology predictable toward the new bioeconomy

Until recently, reductionism has been the dominant scientific approach. Despite the contributions made by this singular approach to science, it has also caused a delay in better elucidation and solutions to scientific phenomena or problems. Most scientific advances were made in predictable fields such as physics, chemistry, and engineering, but little in unpredictable biological sciences. Therefore, a multi-dimensional and disciplinary scientific approach, such as integrative biology, has been needed. Integrative biology helped in making biology predictable, thus reducing unintended consequences, which are common in biological processes such as genetic investigation. The impact of integrative biology has been maximized with synthetic biology-An application of integrative biology. This new scientific approach has enhanced the importance of integrative biology for problem solution, as well as for implementing scientific and technological research in various fields including medicine, life sciences, biotechnology, environmental science, food and agriculture, energy, and space investigation. It is important to establish the fundamental differences and similarities between integrative and synthetic biology. Even though both can be considered complementary scientific approaches, they differ in their specific applications. Integrative biology, in addition to being an attitude, brings together different scientific disciplines, including physical and biological, to an interface where they interact avoiding dominance of one over the other, thus attaining balance in order to solve problems without unintended consequences. Synthetic biology, on the other hand, brings together different disciplines, including physical and biological sciences, mathematics, engineering, and computational sciences, away from the interface and toward one side-genetic processes-in order to be used for designing, assembling, and developing specific genetic parts and/or functions in cellular systems. Thanks to synthetic biology being part of my research on integrative biology, I have been able to accelerate my scientific creative process, having produced twelve inventions in the last five years using a smaller budget, as compared to only six inventions in the ten previous years with a larger budget. Thus, integrative biology is also a cost-effective approach. Since integrative biology makes biology more predictable, this will strengthen the new bioeconomy.

Biography

R. G. Cuero, Ph.D. in Microbiology from Strathclyde University, UK, M.Sc. in Plant Pathology from Ohio State University, USA, and a B.Sc. from Heidelberg University, USA. He is a former Distinguished Professor and Research Scientist of Texas A&M University System on the Campus of Prairie View, Texas. Currently, he is founder, scientist and Director of the International Parks of Creativity, which main aim is invention/discovery (www.parkofcreativity.org). He is a former research associate for the USDA. He has many scientific inventions and publications. He has received numerous scientific recognitions, and he has received several Honorary doctor degrees. He has received the NASA Brief Technology Award for his inventions to NASA. He has written a book on creativity.

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