

**Creative fusion of scientific methods with mathematics
and computing**

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The birth of the Scientific Method in the 17th century is considered as an unprecedented breakthrough by humankind in the discovery of new knowledge and inventions. The scientific method primarily emphasizes on proving the validity of a hypothesis through a systematically designed experiment. In the process of conducting scientific experiments, the results generated are analyzed statistically, to substantiate a hypothesis thereby forming a scientific theory. In the 17th century, Francis Bacon identified induction as the method of reasoning in science, and Newton extended the idea of induction with the hypothetico-deductive reasoning. Since then, Newton's approach to Scientific Method has been practiced. From its inception, the scientific method has been influenced by developments in fields such as mathematics, statistics and computing. The penetration of developments in other disciplines into science has primarily been required by the challenging, hazardous, costly, and time consuming nature of experimental design in Scientific Method. In other words, developing experiments to prove multiple hypothesis has become a challenge. One classic example is the challenge faced by Faraday and Wright brothers when they experimented and proved their hypotheses on electricity and flying machines. Historically, Mathematics happened to be the first giant to address practical issues in experimental designs. Developments in Mathematics in 18th and 19th centuries greatly influenced the Scientific Method and paved the way for Theoretical Physics. In simple terms, theoretical physics can formulate and verify theories by mathematical techniques such as differential equations. Many theories in Quantum Mechanics and Theory of Relativity were developed under the umbrella of theoretical physics. Such theories have been subsequently proven by experiments.

Emergence of the field of computing in the latter part of the 20th century has marked yet another breakthrough in knowledge discovery and inventions. Undisputedly, computing is identified as a subject area in which significant developments have been reported in 60 years. The latest advancements in all other disciplines including natural sciences, medicine, engineering, entertainment, and social sciences have been influenced by the developments in computing. More importantly, computing has introduced new means of designing experiments as computer-based simulations in research in almost all disciplines. Computer-based experiments have been cost effective, time saving, hazard free, and even provided insight for experiments in unseen dimensions. It has now been a tradition to go for computer based simulation (in-silico) before going into actual experiments (wet-lab). For example, designing of complex machines such as aircrafts and ships are now modeled and tested in computer-based simulators before being tested through real world experiments. Presently, the computer has become the most versatile laboratory for research in all disciplines. More importantly, computing can facilitate not only experimental design but also hypothesis development, sampling, data collection, data analysis and presentations in scientific research. In conclusion, it is emphasized that creative fusion of mathematics and computing with scientific method has discovered a new dimension for research and development for humankind.