Editorial

S Mahadevan, Chief Editor

Email:
mahi@mrdg.iisc.ernet.in

Understanding the principles that guide the transformation of a fertilized egg into a complex multicellular organism, with distinct structural and morphological features, has been an enduring challenge for biologists. Initially called embryology, the field is now known as developmental biology, an area that is witnessing intense research activity. The early embryologists were primarily concerned with observing and documenting the different morphological stages that organisms go through during development. The field of experimental embryology was born in the later part of the 19th century when active interventions were made on the embryo that resulted in perturbations in the developmental process, providing valuable insights. The field saw rapid advances during the second half of the 20th century when biologists used genetic analysis and succeeded in identifying genes that guide development, mainly using the fruit-fly as a model system. The power of molecular biology allowed identification of homologues of these genes in other organisms and enabled the structural and functional characterization of the corresponding gene products. Most of them turned out to be regulators that influence the expression of downstream target genes. Thus, the process of cell differentiation, whereby the early embryonic cells acquire different fates, resulting in different tissues, could be correlated to the expression of different subsets of genes.

Since all cells in the developing embryo carry identical genetic information, what are the causative factors for the differences in the subsets of genes expressed in different parts of the embryo? Are there gradients of chemicals (morphogens) that provide cues to the cells to adopt specific fates? What causes the differences in the concentration of the morphogens? Is it a simple case of diffusion? Biology attracted the attention of engineers and mathematicians who could look at the problem from a theoretical angle. The study of the living systems was no longer mere 'stamp collection'.

This issue of *Resonance* honours a pioneer of the field, Conrad Waddington, who made significant contributions to our understanding of the evolutionary forces that guide development, both at the theoretical as well as the experimental level. Waddington could demonstrate that there are substantial genetic variations among the so-called wild-type individuals of a population, though this not reflected in their appearance because of the buffering effect of gene interactions, a process he termed canalization. The article by V Nanjundiah takes us through the conceptual issues involved in the phenomenon of genetic assimilation proposed by Waddington. Two of Waddington's illustrious former colleagues – John Bonner and Morrel Cohen, both pioneers in their own disciplines, share their reminiscences on Waddington.

In this issue of *Resonance*, T Padmanabhan is starting another series entitled 'Dawn of Science'. In this series, Padmanabhan traces the origins of science and takes us through the major advancements in all fields of science – mathematics, physics, chemistry, biology, and engineering. The series is based on his articles that were published in the once popular science magazine *Science Today*, which is unfortunately defunct today. Readers of *Resonance* are offered a lucid account of science history that was enjoyed by an earlier generation that grew up reading *Science Today*. This issue also carries articles on the work that resulted in Nobel Prizes in Chemistry as well as Physiology or Medicine. I hope that *Resonance* is contributing to making an inspirational beginning to the new academic year!