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Editorial Desk

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Most things in the universe are not static. Things change all the time, some very slowly and some amazingly fast. In order to comprehend the mechanics of how nature works, understanding the dynamics of change and factors that cause the change is all too important. An Ordinary differential equation (ODE) is the mathematical tool to deal with things that change with time.

In this issue, each paper is an ode—of a different kind—to the dynamic changes that occur in biological cells, *phenotypic plasticity* in particular. Plasticity in this context refers to the ability of a cell to change its response under environmental effects. It is not the permanent change in the state of a material object as engineers understand it. Phenotype is a set of observable traits for a given genotype. The phenotypes are interpreted as stable equilibrium states in a metaphorical landscape. A landscape is a convenient graphical visualization technique and a suitable mathematical formalization of a dynamic system.

The cover image of this issue shows what is known as Waddington's landscape. It was devised by Conrad Waddington, a polymath who was primarily a developmental biologist and a paleontologist, who spent his early years in India. He laid the foundations of *epigenetics*, the field of biology that deals with heritable phenotypic changes without any alteration in the underlying gene sequences. Waddington imagined cells as marbles rolling down a hill along curvy grooves, which he called *creodes*, and coming to rest at different points, each of which represents a particular phenotype. Creodes are developmental pathways for cells to make transition from one stable state to another. Bifurcation of paths, provision to assume multiple states starting from a single state, and eventual fate of a cell could be analyzed using this approach.

Engineers do this all the time using an energy function. An elastic structure can assume multiple states as it undergoes nonlinear deformations, buckling of a column being the simplest example. Being familiar with such concepts, I was curious to see how biologists view their dynamic systems. There are similarities and there are differences. A hidden similarity is the intriguing concept of *homeorhesis* that is different *homeostasis* that most biologists happily subscribe to. Homeorhesis refers to a steady trajectory rather than a single stable point in the Waddington landscape, not unlike a limit cycle in the phase space. One striking difference is that biologists do not seem to be concerned about the unstable equilibrium—the top of the hill in a landscape. Another difference is that the energy function or the landscape for cell transitions does not yet have irrefutable physical basis unlike the dynamical systems that physicists, chemists, and engineers are accustomed to.

Exciting biologists, chemists, engineers, mathematicians, and physicists with multidisciplinary topics is the primary objective of this journal. The theme of this issue, guest edited by Mohit Kumar Jolly, Annapoorni Rangarajan, Erik W. Thompson, and Brett Hollier, eminently serves this purpose. I thank the guest editors, authors, and the reviewers for their time and effort in putting this issue together.

In the last three months, not unlike phenotypic changes, our social and professional lives have also undergone a rapid transformation in response to the viral pandemic. Some talk of BC (before coronavirus) and AD (after domestication) eras of the concept of a workplace ("Working Life has Entered a New Era", Bartleby, The Economist, May 30, 2020). It is amazing how quickly this phenotype has taken root as most of us quickly adapted to working from home (WFH). The characteristics of WFH are unmistakable: reduced or no commutes to the office, online meetings, uploading and downloading of enormous data, prolonged staring at the computer screen or a gadget display, and perhaps increased productivity as the margins of working hours and work days have blurred. Will this phenotype of the home-office be stable enough to

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last long? Or will it slip back to its original state leaving no trace of it? Some think, justifiably so, that the past three months have definitely etched a new creode in the landscape of the workplace.

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