Developmental Biology in India

Guest Editors

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Fig. 1. Sketch showing the places in India from where the contributions to this Special Issue have come. *Credit: Sashank Rao (outline from www.amcharts.com)*

Preface

The past and present of developmental biology in India

This issue of *The International Journal of Developmental Biology (Int. J. Dev. Biol.)* is devoted to contributions to developmental biology from India. The articles have been organized thematically, beginning with historical accounts and personal reminiscences, followed by surveys of areas to which the authors' own contributions have been substantial, and ending with reports of original research. The articles selected for the 'history' section are by those who have witnessed events from close quarters, and in most cases have contributed to the work in question. The range of articles is vast but cannot claim to be comprehensive. Some areas may have been left out inadvertently, either because we were unable to find anyone to cover them, or maybe in part because of not looking in the right place. Other areas are missed out because, much to our regret, authors did not deliver promised manuscripts on time. In short, the Special Issue is indicative of what went on and is going on in the field of developmental biology in India, but it does have gaps.

The early known accounts available in ancient Indian literature relate to how human embryos develop, organs form, and sensory capabilities arise. The descriptions are overlaid with explanations that are partly observation-based and partly esoteric. They can be found in the *Garbha Upanishad*, a minor component of the philosophical texts known as the *Upanishads*, which in turn are part of the *Vedas* (dating from ca. 1500 to 1000 BCE; http://www.ece.lsu.edu/kak/GarbhaUpanishad.pdf). Over the centuries, a great deal of practical knowledge related to plants and animals, including information related to fertilization and growth, must have accumulated. Many rulers, prominent among whom was the Mughal emperor Jahangir (1569-1627), were keen observers of nature and some even carried out experiments (see, for example, Joseph Needham's 1934 book "A history of embryology" (ISBN 978-1-107-47554-0) and Ebba Koch's article in the *Journal of the Royal Asiatic Society*, Third Series 19 (3): 293-338, 2009 - https://doi.org/10.1017/S1356186309009699). Unfortunately, the paucity of accessible research and documentation in the relevant areas means that much of the knowledge garnered in India during ancient, medieval and pre-modern times remains hidden from us.

Jumping to the twentieth century, embryology began in India, like everywhere else, with detailed descriptions of how embryos develop. This subsequently paved the way for experimental embryology, which led to the study of the consequences of imposing various non-natural conditions on embryonic development. When it resulted in a departure from the norm, that is, the course of embryonic development was abnormal, one could speculate on the regulatory mechanisms that had been perturbed. These studies largely used methods of microscopy, histology, physiology and biochemistry. Things have changed dramatically over the past few decades and now embryology is just one, albeit important, part of developmental biology. Developmental biology now encompasses everything from gametogenesis to aging and death. As with developmental biology in the rest of the world, genetics entered the picture very late (and, it should be added, genetics-based approaches are underrepresented in this Special Issue). Mechanistic studies are only now picking up, though much of the interest here has to do with examining novel phenomena exhibited by 'soft matter' rather than with understanding development *per se*.

India has a vigorous developmental biology community. A large number of Indian laboratories are currently engaged in studies of animal or plant development. Developmental biologists are spread all over the country as parts of colleges, universities and research institutes. Also, developmental biology forms a substantial component of curricula at college and university levels. A large number of practicing developmental biologists, perhaps the majority, are members of the Indian Society of Developmental Biologists (InSDB). The Society was established in 1977 with a view to encouraging academic exchanges between those working on different aspects of development. The InSDB is an active organization and holds conferences and workshops on developmental biology-related topics. Speakers from outside India have consistently featured in InSDB meetings, and that has given Indian workers direct exposure to contemporary thinking in international research.

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We hope that this collection will provide the reader with a bird's-eye view of the contributions made by Indian developmental biologists over the last few decades. The articles in the latter part indicate future directions and plans of members of the community. With bright and committed young people entering the field, and a range of unicellular, invertebrate and vertebrate systems being studied with state-of-the-art techniques, developmental biology in India can look forward to a bright future.

The idea of bringing out this Special Issue was first mooted several years ago by Juan Aréchaga. It did not proceed further at the time, but was fortunately revived recently. We are grateful to him and the Editorial Team at *The International Journal of Developmental Biology* for giving us the opportunity to offer a flavor of Indian developmental biology to the global scientific community. This endeavor became possible only due to the support of the contributors and the referees; our heartfelt thanks to them.

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