

Evolutionary Morphology



Shigeru KURATANI Ph.D.

<http://www.cdb.riken.go.jp/en/kuratani>

Shigeru Kuratani received his masters and Ph.D. from the Kyoto University Department of Zoology. He spent the period from 1985 to 1988 studying comparative embryology in the Department of Anatomy, University of the Ryukyus, and 1988 to 1991 working in experimental embryology in the Department of Anatomy at the Medical College of Georgia before moving to the Biochemistry Department at the Baylor College of Medicine, where he was engaged in molecular embryological research. He returned to Japan in 1994 to take a position as associate professor at the Institute of Medical Embryology and Genetics in the Kumamoto University School of Medicine. He moved to Okayama University to assume a professorship in the Department of Biology in 1997, where he remained until he was appointed team leader at the CDB. He was appointed group director in 2005.

Staff

Group Director

Shigeru KURATANI

Research Scientist

Noritaka ADACHI
Tatsuya HIRASAWA
Naoki IRIE
Christian MITGUTSCH
Takayuki ONAI
Juan PASCUAL ANAYA
Fumiaki SUGAHARA

Technical Staff

Satoko FUJIMOTO
Tamami HIRAI
Yasuhiro OISI
Iori SATO

Student Trainee

Hiroki HIGASHIYAMA
Mana NAMETA

Intern

Jessica PLANADE

Part-Time Staff

Shigemitsu SHIBUYA
Kazuko YAMAMOTO

Assistant

Naeko MINAMI
Tomoko OYANAGI

Recent Publications

Hirasawa T, et al. The endoskeletal origin of the turtle carapace. *Nat Commun* 4.2107 (2013)

Wang Z, et al. The draft genomes of soft-shell turtle and green sea turtle yield insights into the development and evolution of the turtle-specific body plan. *Nat Genet* 45.701-6 (2013)

Oisi Y, et al. Craniofacial development of hagfishes and the evolution of vertebrates. *Nature* 493.175-80 (2013)

Ota K G, et al. Identification of vertebra-like elements and their possible differentiation from sclerotomes in the hagfish. *Nat Commun* 2.373 (2011)

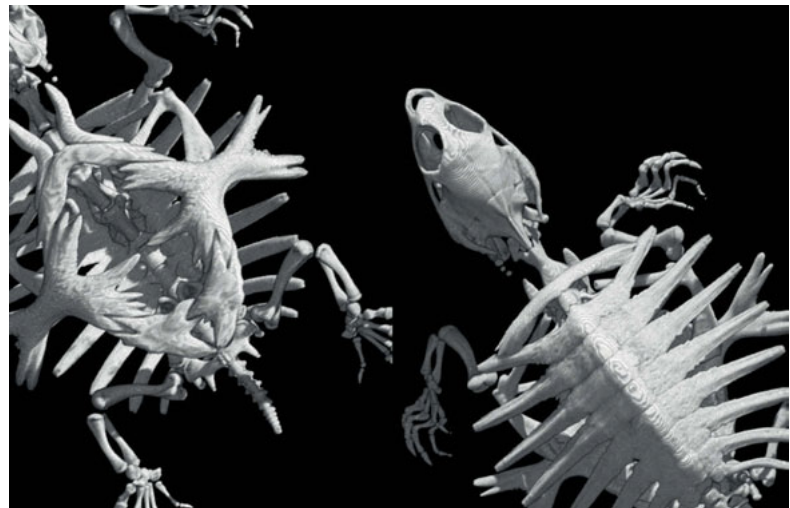
Nagashima H, et al. Evolution of the turtle body plan by the folding and creation of new muscle connections. *Science* 325.193-6 (2009)

Ota K G, et al. Hagfish embryology with reference to the evolution of the neural crest. *Nature* 446.672-5 (2007)

By studying the evolutionary designs of diverse animal species, I hope to gain a deeper insight into the secrets behind the fabrication of morphological designs. Integrating the fields of evolutionary morphology and molecular genetics, our lab seeks to expand the understanding of the relationship between genome and morphology (or body plan) through investigating the evolutionary changes in developmental processes, and also the process of evolution in which phenotypic selection shapes developmental programs. Our recent studies have focused on novel traits found in the vertebrates, such as the jaw, the turtle shell, and the mammalian middle ear. By analyzing the history of developmental patterns, I seek to open new avenues toward answering as-yet unresolved questions about phenotypic evolution in vertebrates at the level of body plans.

Through the study of evolutionarily novel structures, our lab has identified changes in developmental mechanisms that have obliterated the structural homologies between organisms as evidenced in such novel structures as the jaw in gnathostomes (jawed vertebrates) and the turtle shell. Developmental studies of the cranial region of the lamprey are intended to shed light on the true origins of the vertebrate head and neck, as lampreys lack a number of important features, including jaws, true tongues, and trapezius muscles, that are possessed only by gnathostomes. We aim to resolve the question of what primary factors have changed during evolution by comparing the developmental patterns that yield such innovations, and by the experimental construction of phenocopies in one animal that mimic structures in another.

The turtle's shelled body pattern appears at the end of a graded series of changes in the fossil record. Our lab's research into turtle carapace development addresses the developmental changes that resulted in this abrupt and dramatic morphological change, and is aimed at identifying genes that function differently in turtle and other amniotes, which it is hoped will provide a key to discovering the true targets of natural selection in the acquisition of a shell.



CT-scanned skeleton of *Pelodiscus sinensis* juvenile