Studying sea snakes for underwater robot design

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The fascinating body structures of sea snakes which adapt them for life in water are being studied by University of Adelaide researchers as inspiration for a marine robot - the first of its kind.

Postgraduate mechanical engineering research student Amy Watson and a team of engineering, environmental science and computer science researchers will use the sea snake body shape and swimming motion to generate a design for a 'bio-mimetic' sea snake robot.

"Biomimetics or biology-inspired design is a rapidly growing field which uses the results of millions of years of trial-and-error experiments through natural evolution to produce a machine that's best-adapted for a particular environment," says Ms Watson. "The success of the sea snake's aquatic invasion is of interest to both evolutionary biologists and mechanical engineers."

Sea snakes are the only fully aquatic reptiles in existence. They evolved about eight million years ago from an Australian terrestrial snake ancestor that bore live young (rather than egg-laying), and most sea snakes are still found in Australia and South-East Asia.

"From the more or less cylindrical body with a tapered tail of land snakes, the true sea snakes have become efficient swimmers with ribbon-like bodies and paddle-shaped tails," says Ms Watson.

"In the transition from land-based to marine vertebrates, sea snakes have

acquired remarkable swimming capacity. We want to capture and analyse the body shape and movement to generate information that will enable a more efficient design for underwater vehicles."

The undulating locomotion of a snake-like robot will be much less invasive in the marine environment than a propeller-based machine and will be able to move through complex habitats more easily because of their streamlined shape, says Ms Watson.

"The first step in the process is to learn more about the anatomy of sea snakes and this project starts bone deep - with the spine," she says.

She is investigating the biomechanics of the sea snake spine using high-resolution CT scanning at Adelaide Microscopy and 3D simulation models of vertebrae to test the movement.

The range of motion between pairs of vertebrae located at different positions along the spine will be compared along the spine of a single snake and between snakes of different species.

More information: Ms Watson is presenting preliminary results and discussion around the implications for sea snake robot design at the University of Adelaide-hosted combined conference ACMM23-ICONN2014 on microscopy and nanoscience at the Adelaide Convention Centre this week. For further information see www.aomevents.com/ACMMICONN

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