FACT SHEET

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ARTICLE: Striving for normality: whole body regeneration through a series of abnormal generations

AUTHORS: Ayelet Voskoboynik, Noa Simon-Blecher, Yoav Soen, Baruch Rinkevich, Anthony W. De Tomaso, Katherine J. Ishizuka, and Irving L. Weissman

CORRESPONDING AUTHOR: Ayelet Voskoboynik, ayeletv@stanford.edu

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What is the main finding of the study? Why is it novel?

This study describes a regeneration phenomenon in a human vertebrate ancestor, a chordate called the marine sea squirt. In some circumstances, this animal can be made to regenerate its entire body from its own blood vessels. Regeneration occurs over multiple generations of individuals that are initially abnormal, but gradually regain normal patterns, and eventually converge (within a few generations) into a completely normal animal. This is a major breakthrough in regenerative medicine; it could lead to tissue engineering dictated by a "genetic program" that may already exist in chordates (organisms with some level of spinal column development).

What are the clinical implications of this research?

This study establishes a model that permits scientists to work out how abnormal tissues and damaged organs can be reprogrammed back into a normal body plan. Finding these capabilities in a vertebrate ancestor suggests a new pathway for restoring lost, missing, or damaged organs.

Does this study have implications for the treatment of diseases, disorders, and/or injuries?

Missing limbs, scarred hearts, broken spines, and wounded muscles try to repair themselves. They usually do a poor job. If the sequence described in the sea squirt can be worked out and applied to humans, it would be a major leap forward in regenerative medicine.

Outside of the main finding, what does this study suggest?

Regeneration of a whole organism from blood vessels is a remarkable example of plasticity extending from the cellular level to that of the organism. The unknown mechanisms underlying the convergence to a normal body through a series of abnormal generations may shed new light on forces and mechanisms that set the developmental plan of an organism

About the sea squirt:

Although it may look similar to sponges, worms, or plants, it is actually much more closely related to humans than any of these organisms. Sea squirt larvae have primitive spinal cords, distinguishing them in the greater chain of life and on the evolutionary ladder. Specifically, sea squirts, like humans, belong to a group of animals called chordates, and many scientists believe that sea squirts approximate what the very first human chordate ancestor may have been like 550 million years ago. By studying this modern-day representative of this human evolutionary ancestor, researchers are able to identify fundamental principles of complex processes, such as healing and organ regeneration, on which new treatments are based.