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Cracked Skin and Crocodile Scales

Researchers have discovered how the scaly skin pattern on crocodile faces and jaws is created. Mammalian hairs, bird feathers, and many reptile scales grow from genetically-controlled processes, but the crocodile's head scales don't follow this nearly universal rule. Instead, crocodile face and jaw scales seem to emerge from the physical cracking of skin, which creates distinct, random, non-overlapping polygonal shapes. Unlike the cracking of dry human skin, which is typically caused by dehydration, crocodile skin cracking is likely caused by the stress the animals' stiff skin experiences during the rapid growth of the embryonic face and jaw.

Michel Milinkovitch and colleagues use three-dimensional computer graphics and developmental biology techniques to study scale generation in crocodiles. Dermal pressure receptors or DPRs are tiny, round, pigmented sensory organs splattered across the crocodile face and jaw that detect surface pressure waves, allowing the animals to swiftly orient themselves -- even in darkness -- toward a prey disrupting the water surface. The researchers found that patterns of DPRs are generated and destined for the face and jaws when the crocodile is still an embryo. Moreover, the dome-shape of these organs starts to form before any scale appears. As the crocodile develops, grooves appear and interconnect (while going around the DPRs) to form a continuous network across the developing skin. The process generates polygonal scales, which each contain a random number of DPRs. The results open a new window into exploring the delicate interplay between genetic determinism and physical self-organization during biological development.