



Figure 1 | A crown-of-thorns starfish (*Acanthaster planci*) devours coral, leaving behind white bones. Hall *et al.*³ sequenced the genomes of two of these starfish, with the aim of providing information that might help to control starfish outbreaks.

or both, including enzymes, components of COTS venom and signalling and structural proteins.

These analyses enabled Hall *et al.* to narrow down the list of COTS signalling proteins that might modulate behavioural responses to reproductive cues and predator avoidance in a lineage-specific manner. For instance, among the secreted proteins are a suite of ependymin-related proteins (EPDRs). The researchers showed that the gene family that encodes these proteins has undergone a rapid, lineage-specific expansion, giving rise to two copies of the set of genes, arrayed in tandem along the chromosome. These data lend support to the idea that EPDRs are recently evolved, COTS-specific communication molecules.

Another candidate family is the G-protein-coupled receptor (GPCR) proteins, which are known chemoreceptors⁶. Hall *et al.* find that GPCRs are highly enriched in external tissues, and some are expressed in a sex-specific manner, pointing again to a role in communication. Further analysis of the expression patterns of these proteins might help with the development of biocontrol technologies.

It remains unclear whether one or several factors trigger COTS population increases to densities that are lethal to corals^{1,2}. As a result, management and mitigation efforts have been hampered. Hall and colleagues' work clears the path to overcome such hurdles. In the future, analysis of the genomes of COTS populations from different regions of the world will better inform demographic models to tackle biocontrol by targeting region-specific genomic variants^{7,8}. These genomes will be crucial

during years of acute outbreak throughout the Indo-Pacific basin, enabling researchers to identify mechanisms of local adaptation that differ between aggressive and non-lethal *A. planci* populations for more efficient outbreak management^{8,9}.

The authors have produced a manageable list of proteins that should be tested for roles in chemical communication. These molecules can be biochemically evaluated for their cellular role in behavioural recognition of environmental cues, and bait compounds that mimic their activity can subsequently be developed. These COTS-specific baits could, in turn, enable faster and more-effective strategies for containing and ridding reef environments of overwhelming COTS outbreaks. As large groups of individuals are induced to aggregate, underwater robots specifically created for lethal injection of COTS could then be deployed across vast outbreak areas, replacing the human divers who currently perform this procedure¹⁰.

Hall and colleagues' study emphasizes the power of whole-genome data in combination with other cell- and tissue-wide analyses and experimental approaches, not only to study natural history⁵, but also for applied sciences such as pest control⁹. Containing COTS outbreaks suddenly seems a more attainable goal, at both regional and global scales. ■

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50 Years Ago

By now even schoolboys know that molecules of DNA are the embodiment of genetic inheritance... But DNA is not merely archival material. It also serves as an ever-present touchstone by which the biochemical integrity of an individual is sustained, and much of the excitement in molecular biology... has been concerned with the detailed understanding of how genetically determined molecules of DNA put their stamp on the chemical structure of the protein molecules manufactured by living cells... Yet there has remained the problem of knowing how the synthetic activities of living cells are regulated... In 1961 Jacob and Monod put forward a remarkably perceptive explanation... Unwanted or irrelevant pieces of DNA molecules, they said, are somehow switched off or rendered ineffectual by the intervention of smaller molecules manufactured under the aegis of other regions of the same DNA molecule... People talk of regulator genes, and of the repressor molecules the production of which they control.

From *Nature* 15 April 1967

100 Years Ago

It is noteworthy that English physicists have taken very little interest in the progress which has been made during the last ten years in atmospheric electricity... There can now be no doubt that the earth is giving off a constant stream of negative electricity which passes at least into the upper atmosphere, and probably into cosmic space. Are we justified in treating this... as something which will be explained in due time by the old laws of physics, or should we not recognise the possibility that we have here indications of a new property of matter?

From *Nature* 12 April 1917