Multi-tasking proteins protect sea urchins from multitudes of pathogens

Antibiotic resistance in bacteria is a deadly problem for human health, yet these pathogens arise and persist due to the misuse and over-prescription of the same classes of antibiotics. Wouldn't it be better if there was a single anti-pathogen molecule that could attack microbes in multiple ways? If so, it would be nearly impossible for pathogens to become resistant simultaneously to a single protein that has multiple anti-pathogen activities. New results on a single protein called rSp0032 that functions in the immune system of the purple sea urchin shows that it can bind to several different species of microbes including a marine bacterial species, a human commensal and a human pathogen, as well as single-celled fungi called yeast. rSp0032 binds very tightly to a range of targets on these vastly different microbes, including several types of cell wall sugar structures and the flagellae that bacteria use to swim. Importantly, rSp00032 is a member of a diverse family of these sea urchin proteins that are all similar but slightly different. When several of these proteins are active at once, they may exhibit multiple, overlapping microbial binding activities. Thus when hundreds of different versions become present in the body fluid of the sea urchin (equivalent to our blood stream) during an immune response, pathogens are unable to find new ways to block or avoid the collective binding activity of this class of proteins. The outcome is a very effective and flexible neutralization of pathogens by the sea urchin immune system. This is particularly important for sea urchin survival because of the huge numbers of microbes in the ocean. The question for the future will be whether these sea urchin proteins can be harnessed for treating people who are infected with bacteria that are resistant to typical antibiotics.

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