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Jellyfish [File].(Photo by: INIMAGE)

Israeli researchers decipher how jellyfish shoot poisoned arrows

By JUDY SIEGEL-
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Unlocking the mysteries of the jellyfish's burning mechanism.

The gelatinous creatures are everywhere in the Mediterranean Sea – and their number around the world is increasing – but until now, scientists have not understood the mechanism of the jellyfish's burning mechanism.

Researchers at Haifa's Technion-Israel Institute of Technology and the University of Haifa have explained for the first time the unique mechanism of *Rhopilema nomadica*, the most common variety whose large swarms are encountered in the waters and on the beaches of this country. They reached the Mediterranean in the 1970s.

According to Prof. Uri Shavit of the Technion's Faculty of Civil and Environmental Engineering, "the jellyfish attacks its prey or its enemy by injecting toxic material by thousands of microscopic syringes located on each of its arms. The jellyfish belongs to the family of predators that feed on plankton and defend themselves with cells containing syringes that are actually poisoned arrows.

Although they do not have eyes, ears or even brains, they have survived for 600 million years and undergone almost no developmental changes. They are thus among the most ancient complex creatures that have not been eradicated to this day, Shavit said.

The mechanism of elongation of the needles was deciphered by Shavit with Technion Prof. Gilad Yossifon of the Faculty of Mechanical Engineering and Dr. Tamar Lotan of the University of Haifa's Charney School of Marine Sciences. Their findings have just appeared in the *Journal of the Royal Society Interface*.

Inside a chamber called nematocyte is the syringe needle, which is packed and folded into itself inside a spherical capsule with a diameter of about 10 microns; a micron is one millionth of a meter. In response to chemical changes in the environment or physical contact, pressure increases in the capsule and the needle is emitted at a tremendous acceleration of more than 107 meters per second per square – several times the acceleration of a rifle bullet.

The needle's firing mechanism, from a folded position in the capsule to its full length has been studied by many researchers around the world. The conventional explanation is that the needle is

removed and fires the poisonous material following the formation of a force called osmotic potential. This force pushes the needle and liquid like a pump pushing water up. The pressure exerted in this process is enormous – 150 atmospheres – or enough to push water up to the top of a building 1.5 kilometers high.

But researchers found that the driving force is not limited to the capsule alone. In fact, it is an enormous osmotic mechanism that develops at the needle's moving end. This mechanism releases the needle and pulls it behind it like a locomotive pulling train cars behind it.

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