

Proteic grace

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Rarely do we give a thought to the minute world within us that keeps us going. Yet were it not for thousands of proteins, we would not be able to breathe. Or walk. Or smell. Hear, see or even think. How would we go to the shops? Drive a car? Take the bus? Write a letter? Read the newspaper? Or make a cup of tea? When things are fine, we feel invincible. It takes very little though to remind us how fragile we really are. The tiniest of entities can ground us. A virus can cripple us. Cells gone haywire can kill us. Chemicals can indispose us. A faulty gene can condemn us. And, more often than not, this molecular havoc is caused by proteins whose function has been diverted, modified or lost. Textbooks can explain it to us and even show some of it to us but the elegance of it is rarely grasped, at least by the layman. That is why art – in all its forms – can be a unique way of shifting the tiny into the world of the big. Mara Haseltine, an American artist and sculptor, has done just that by shaping a handful of proteins, to show both their beauty but also perhaps their ugliness on a human scale.



'Waltz of the polypeptides' by Mara G. Haseltine

Courtesy of the artist
www.calamara.com

The daughter of a renowned molecular biologist, Mara has been bathing in the universe of small things since she was a little girl. Thanks to this, she has an understanding of the submicroscopic which is not given to all artists. And she has used this awareness to reproduce biological molecules of great beauty by creating a unique sculpting technique which merges advanced biotechnical analysis tools with cutting-edge computer-driven fabrication techniques to shape glass, bronze and plastic, which she further combines with traditional

methods of hand sculpting, landscaping and architecture.

A number of her sculptures portray the world of proteins. Besides sharing her father's curiosity for the infinitesimal, one of Mara's wishes is to show this world on a far larger scale and with aesthetics that could attract a public larger than the one you would flirt with in laboratories. It is an exquisite way of popularising science. One of her sculptures – named 'Waltz of the Polypeptides' – is a 70 metre long mixed media work of art which graces one of the lawns at Cold Spring Harbor Laboratory campus in New York. The visitor saunters along the edge and bears witness to the synthesis of a nascent protein – BlyS or B lymphocyte stimulator – with its mRNA and ribosomes. BlyS is essential in the development of B lymphocytes and seems to be involved in autoimmune diseases as well as B cell malignancies, which makes it a great therapeutic target. Visitors do not need to know this however. What they discover is the birth of a protein – the way it has been performed for millions of years.

Using the technique of stereolithography, Mara has also sculpted rhodopsin, a protein pigment essential for vision in dim light. Embedded in the lipid bilayer in retinas, opsin – the single polypeptide chain – and its chromophore are part of the process which translates light into visual information by way of a shift in rhodopsin's 3D conformation and subsequent phosphorylation. Defects in vision, such as severe visual impairment in children for instance or night blindness in pregnant women, are a

consequence of defects in opsin or its chromophore, or faulty interactions between them. Rhodopsin is a G-protein coupled receptor. These receptors know how to transduce an extracellular signal into an intracellular one and are therefore essential in the perception of our senses. Rhodopsin also happens to be the only G-protein coupled receptor whose 3D structure is known, making it a great subject for drug design.

A 1960 hero – the Follicle Stimulating Hormone or FSH – has also been shaped by Mara's hands. FSH is a glycoprotein capable of stimulating a large pre-ovulatory follicle which in turn is capable of ovulation, and its discovery has led not only to the design of fertility drugs but also to the happiness of many women. FSH was very fittingly purified by a woman, and it seems suitable too that a woman artist should be asked to mould a ribbon diagram of the hormone to celebrate 30 years of essential research by Aliza Eshkol. The result is striking and is suspended in the biotech company Serono, in Geneva...not far from where these articles are written.

A large scale reproduction of a portion of the SARS protease in polished bronze is one of Mara's most recent works of art and was created for 'Biopolis', Singapore's ScienceCity. The SARS (Severe Acute Respiratory Syndrome) coronavirus is a virus that causes a respiratory disease in humans. The portion

Mara chose to sculpt is located in the heart of the protease and portrays its active cleft. Active clefts are goldmines for scientists since they are what they can tamper with to enhance or check an enzyme's function. The sculpture baptised 'SARS Inhibited' celebrates the discovery of this essential region in SARS protease, a region which will be the target for the design of future drugs. As with the artist's 'Waltz of the Polypeptides', visitors can approach the sculpture and actually walk into the active cleft on a path of rough hewn stones in the shape of the protease inhibitor... a delicate illustration of how a portion of a molecule, and hence a tiny part of what is already very small, embraces both our fragility and the power of biotechnology.

Many more molecules will no doubt be fashioned by Mara. The sculptor captures the underlying beauty and subtleties of life at a level which is not seen by the naked eye, and offers her aesthetics coupled with scientific rigour to create interactive works of art. Proteins are both essential and singular. They are at the heart of what we are, and many are the scientists who spend a lifetime unravelling the intricacies of one or the other in an attempt to define what we call life, and design drugs to remedy where life has been perverted. On a par with DNA, proteins are one of the many wonders of life and it is always a unique experience to see them drift into the world of art.

Cross-references to Swiss-Prot

BLyS, Homo sapiens (Human): Q9Y275
Rhodopsin, Homo sapiens (Human): Q16414
Follicle-stimulating hormone alpha chain, Homo sapiens (Human): P01215
Replicase polyprotein 1ab, SARS human coronavirus: Q05002

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