STRUCTURAL BIOLOGY AND HUMAN PERCEPTION.
USING OUR SENSES TO BETTER UNDERSTAND THE DETAILS OF CELL BIOLOGY

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The results of studies of structural and cellular biology are most often displayed as images. We know our molecules and systems because we see them, having 'translated' chemical and physical information (numerically encoded) into visuals.

Thanks to biochemistry and other techniques we also know how they behave, with which other components they interact and where they are, in the various cellular environments.

The art and science of scientific visualization is, at this time, more and art than a science. We think that this imbalance can be adjusted to some extent, and have started a program aimed at harmonizing the visual tools used (colors, signs, textures etc.), based on principles of semiotics and communication design[1,2].

One of the difficulties related to biological representations is linked their minute size, way beyond our perceptive capabilities. It was shown[3] that, while for large sizes we can relate to distances that can be (at least approximatively) perceived, for objects in the sub-millimeters range, our inability to comprehend 'small things' lead us to categorize them as 'generally small'. How much bigger is a cell relative to a virus? And a bacterium? Is a tRNA bigger or smaller than an actin monomer? Even among us, not everyone will be sure about the correct answer 😊!

To address this issue, we have devised the perceptive scale, at the same scale of 10 million times[5] (TMT), and engaged in the fabrication of tangible models[4] that help people to better understand them in several settings, from schools to museums and (possibly) laboratories. I will bring some prototype examples.

1. Colors in the representation of biological structures. (2022) https://doi.org/ 10.1515/jib-2022-0021
2. Colors and visual strategies in structural and cellular biology. (Conference report, in preparation)
3. Understanding Scale: Powers of Ten. (2007) http://www.jstor.org/stable/40188687.
4. Computational Fabrication of Macromolecules to Enhance Perception and Understanding of Biological Mechanisms. (2019) https://doi.org/10.2312/STAG.20191369
5. Towards a perceptive understanding of size in cellular biology. (2017) https://doi.org/10.1038/nmeth.4300