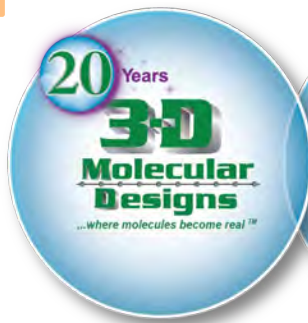


Physical & Chemical Properties of Water





Jim Lane

- Mahtomedi High School, Mahtomedi, MN
Augsburg University, Minneapolis, MN

Courses Taught

- Introduction to Biology (10th grade)
- Field Ecology and Conservation (11th and 12th Grade)
- Biomimicry and Molecular Modeling (11th and 12 Grade)
- Science Methods for Preservice Teachers (Graduate)

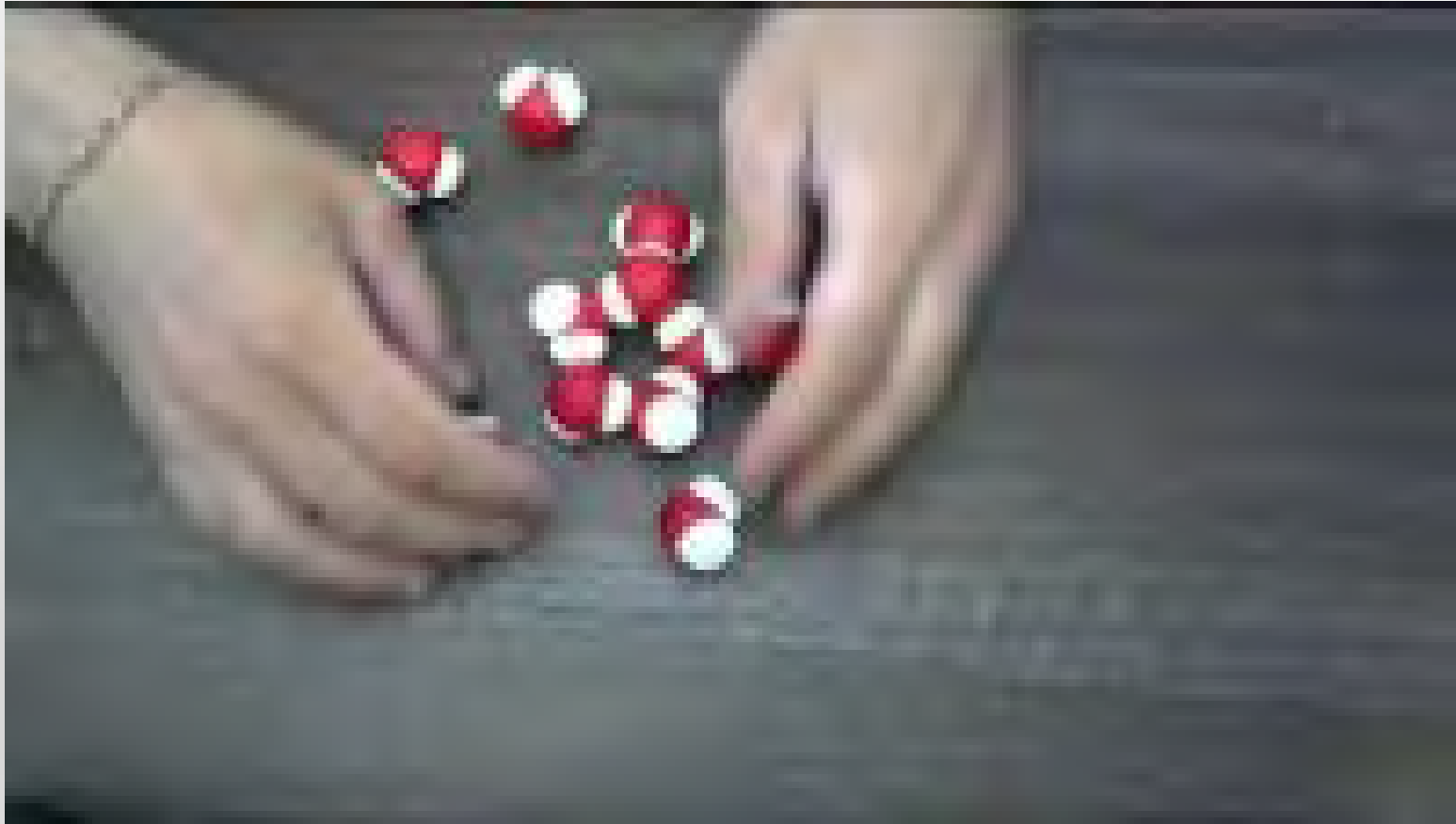
Knowles Teacher Initiative Senior Fellow
HHMI BioInteractive Ambassador Academy
Member



Introduction



Engaging the Model





Questions and Observations



What did you observe?



What questions did you come up with from these observations?



What are you curious to know more about?



Observations





Bond Types





Bond Types



What misconceptions could be addressed using this model?



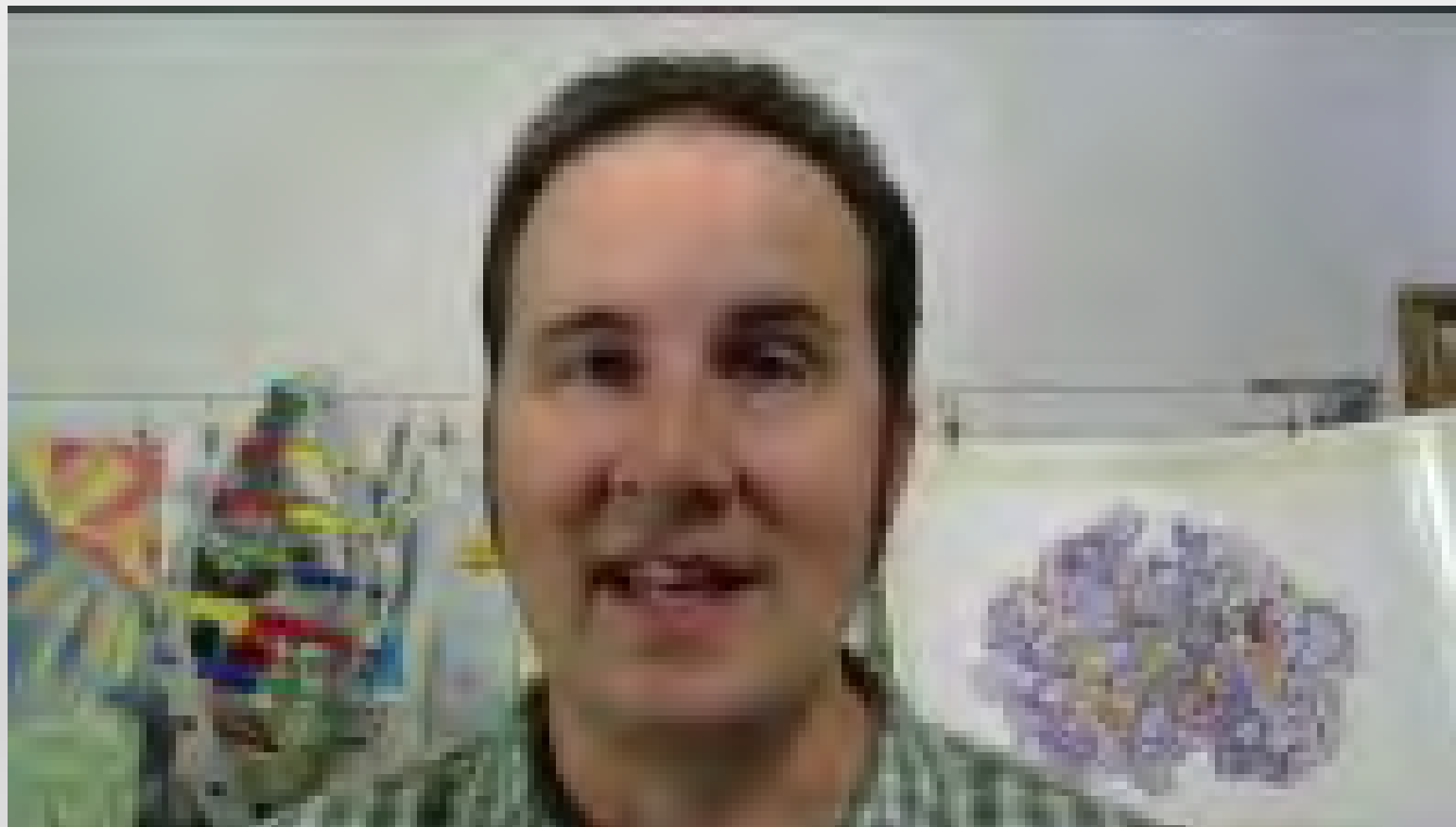
What content areas or topics could this model supplement?



What questions might student have about the model?



Solutions and States of Matter





Solutions and States of Matter





Solutions and States of Matter



How does this model change how you could teach about solutions and states of matter?



How does this support learning more complex ideas?



Polarity

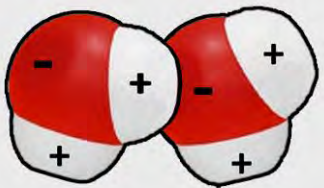


The Polar Nature of Water

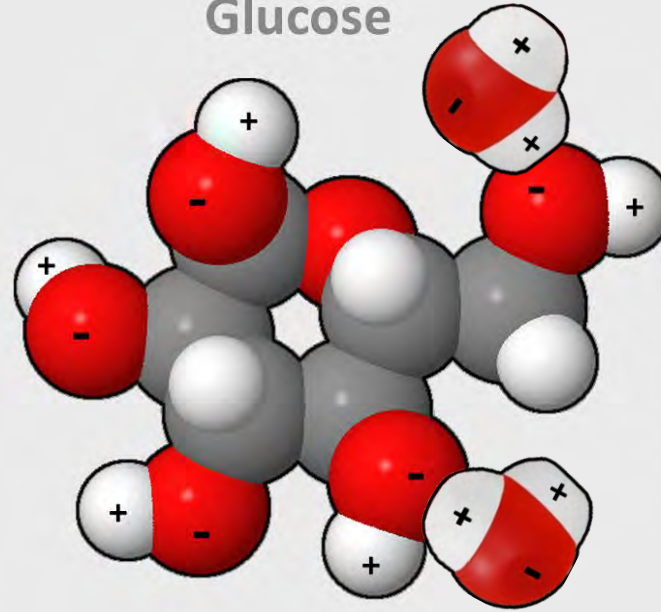
The shared electrons in a water molecule spend more time near the oxygen atom and less near the two hydrogen atoms, resulting in **slightly positive** and **slightly negative** regions.

This impacts how they interact with other molecules, forming **hydrogen bonds** when they get close to an opposite charge.

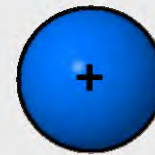
1. Study how two water molecules interact using the image shown below.
2. Drag the water molecule shown to the right to demonstrate how water molecules might interact with the other common molecules.



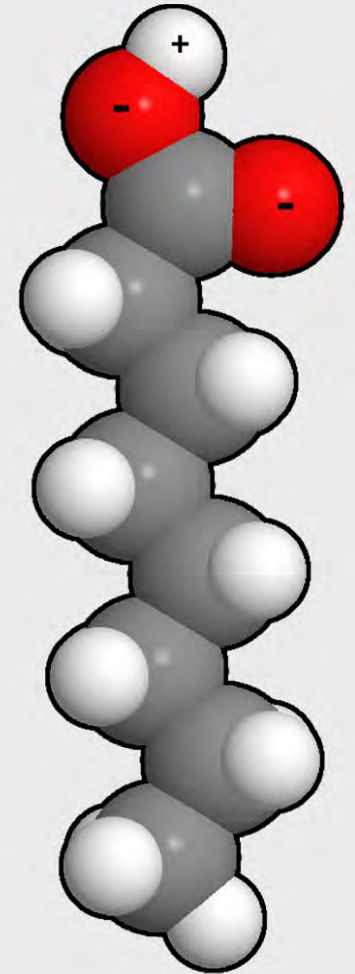
Glucose



Chloride
Ion



Sodium
Ion

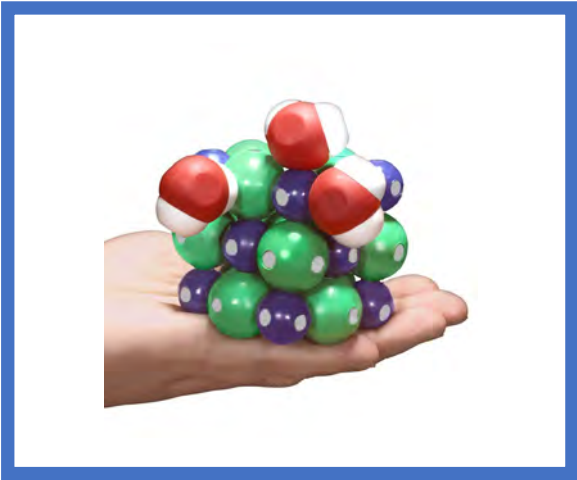
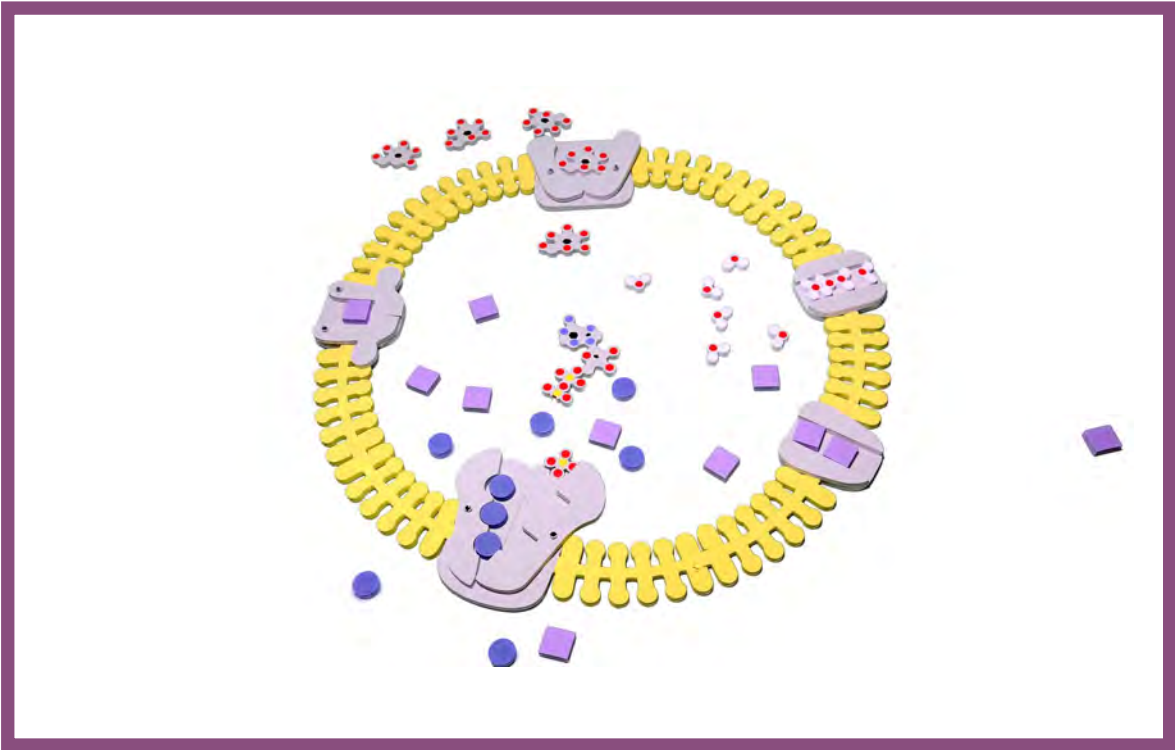


Fatty
Acid



Conclusion and Questions







Timothy Herman, PhD

- Director of the Center for BioMolecular Modeling at MSOE
- Founding Partner of 3D Molecular Designs
- B.S. in Chemistry from the University of Nebraska
- Ph.D. in Biochemistry from Oregon State University.
- Post-doctoral studies in Molecular Biology at Harvard Medical School.



2003 Nobel Prize in Chemistry

The Nobel Prize in Chemistry 2003 was awarded "for discoveries concerning channels in cell membranes" jointly with one half to Peter Agre "for the discovery of water channels" and with one half to Roderick MacKinnon "for structural and mechanistic studies of ion channels."



Peter Agre



Roderick MacKinnon

Appearance of Water Channels in *Xenopus* Oocytes Expressing Red Cell CHIP28 Protein

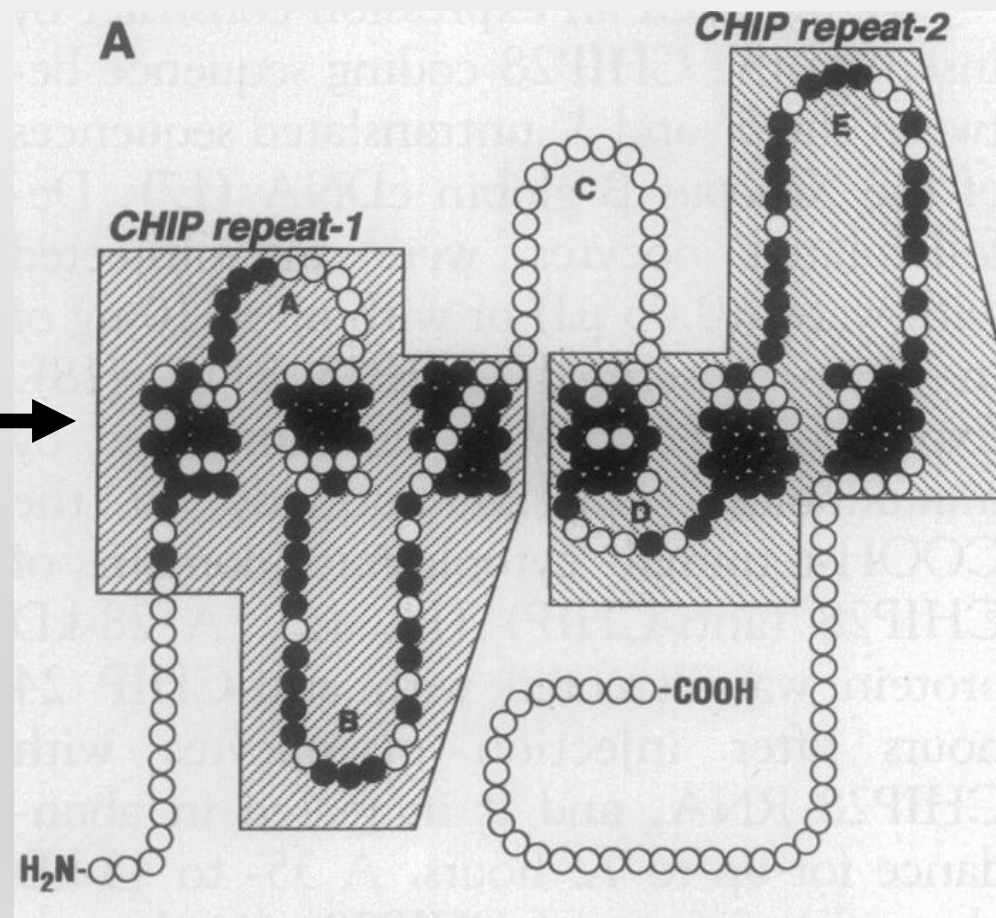
**Gregory M. Preston, Tiziana Piazza Carroll,
William B. Guggino, Peter Agre***

Water rapidly crosses the plasma membrane of red blood cells (RBCs) and renal tubules through specialized channels. Although selective for water, the molecular structure of these channels is unknown. The CHIP28 protein is an abundant integral membrane protein in mammalian RBCs and renal proximal tubules and belongs to a family of membrane proteins with unknown functions. Oocytes from *Xenopus laevis* microinjected with in vitro-transcribed CHIP28 RNA exhibited increased osmotic water permeability; this was reversibly inhibited by mercuric chloride, a known inhibitor of water channels. Therefore it is likely that CHIP28 is a functional unit of membrane water channels.

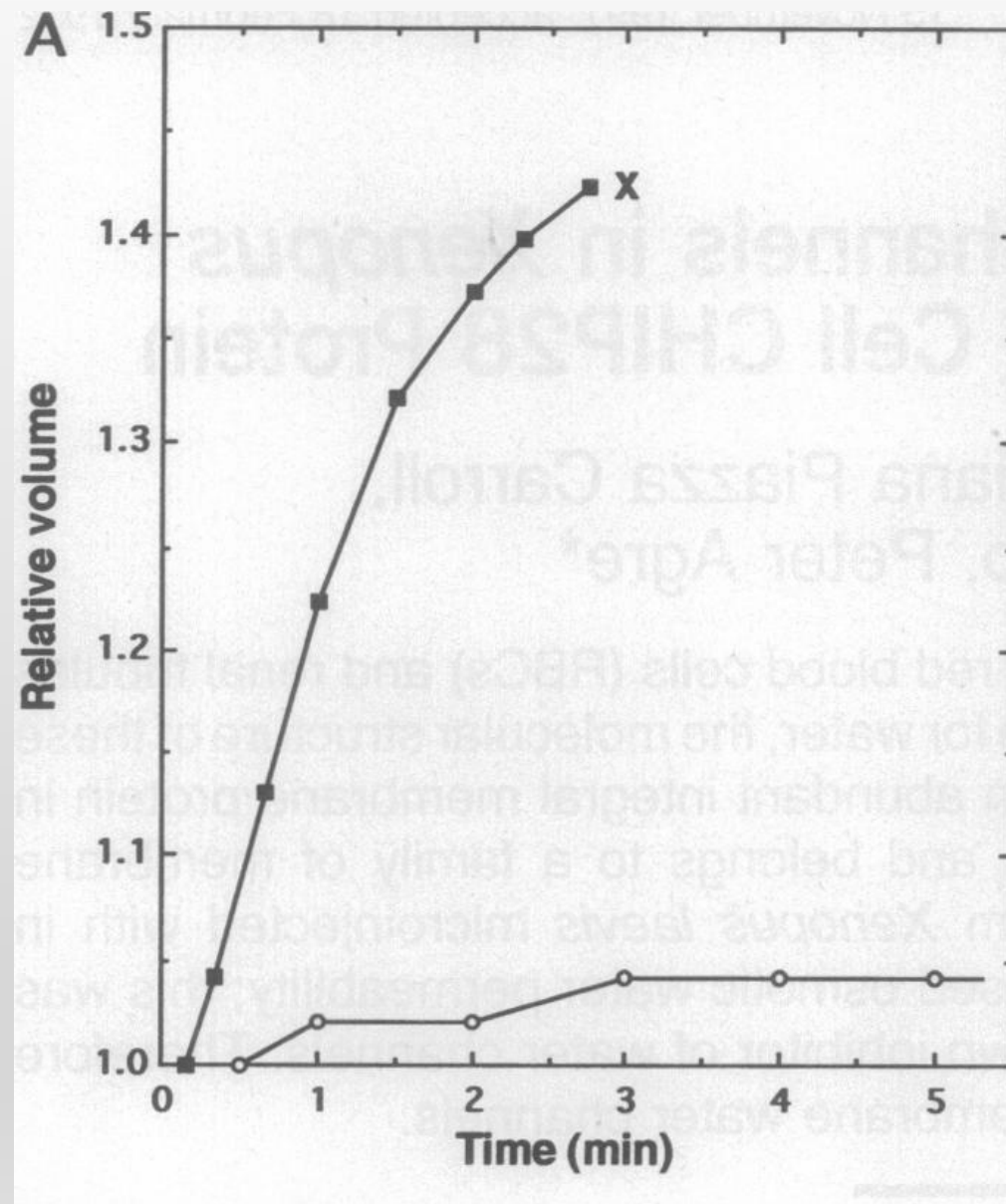
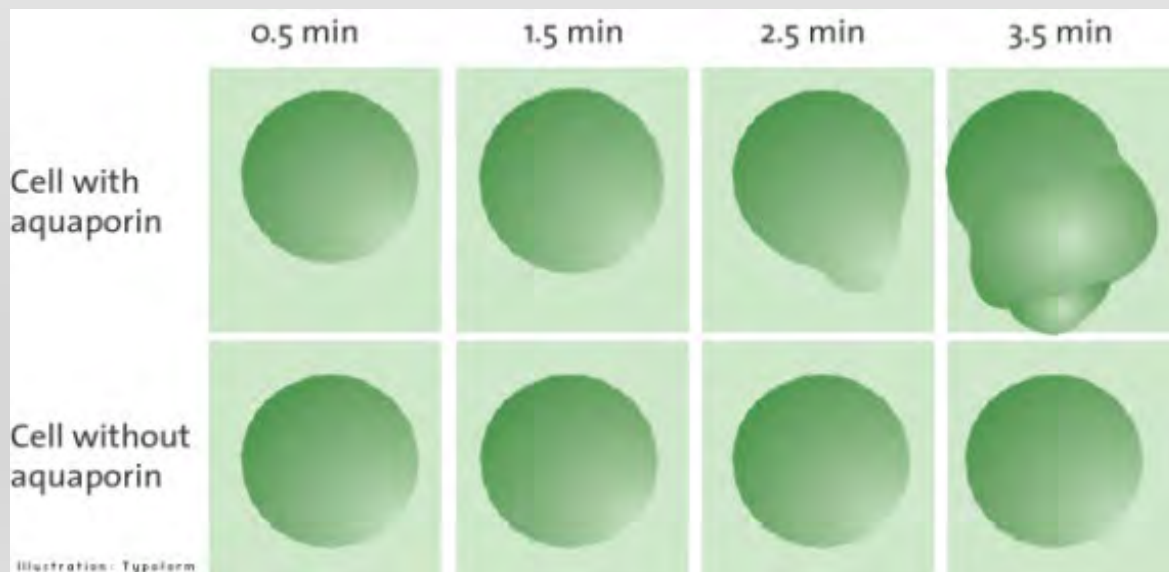
Science 256, 365-387 (1992)

1992 “Model” of Aquaporin

- Based on its Amino Acid Sequence
- 6 Transmembrane Helices
- 2-Fold Symmetry



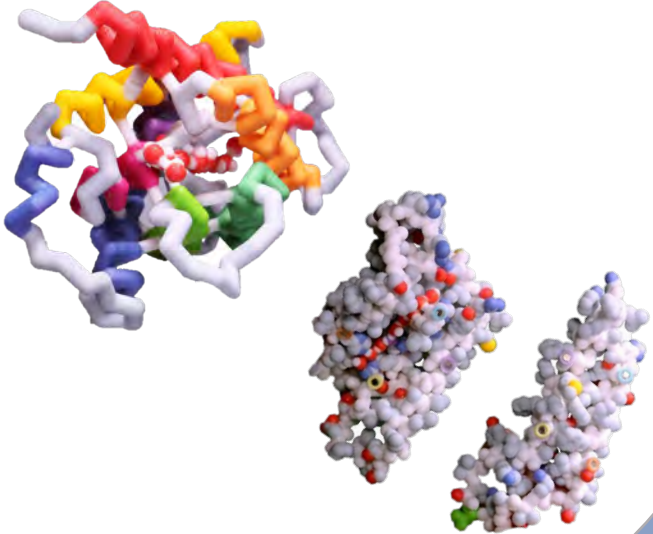
Micro-injection of aquaporin mRNA into frog oocytes





Peter Agre with Aquaporin Model





Thank you for attending!

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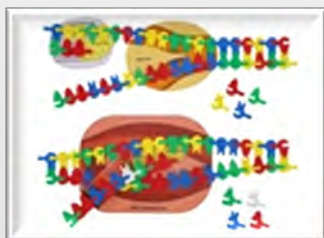
Student
Modeling Packs

Water Student
Modeling Pack





Invite your colleagues to register!



Transcription, Translation, & Sickle Cell Anemia

A Tale of Two Sisters, Modeling Transcription & Protein Synthesis

Wednesday, January 27, 2021 at 6:00 PM Central



Neurotransmitters, Synapses & Acetylcholinesterase

Modeling How Cells Talk – Making Sense of Synapses and Signals

Wednesday, February 10, 2021 at 6:00 PM Central



Proteins & the Protein Folding Problem

Proteins – Now that Everything has Changed

Wednesday, February 17, 2021 at 6:00 PM Central

<https://www.3dmoleculardesigns.com/Webinars4.htm>