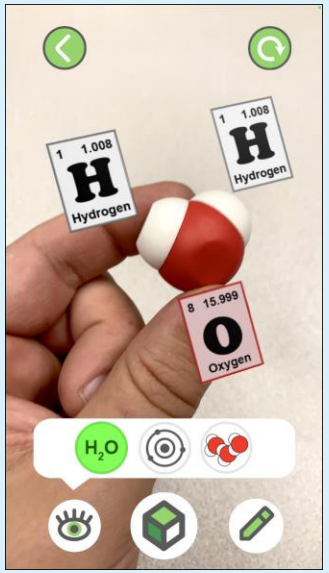
3d molecular designs
Transforming Science Learning

Enhancing Molecular Models with Augmented Reality (AR)

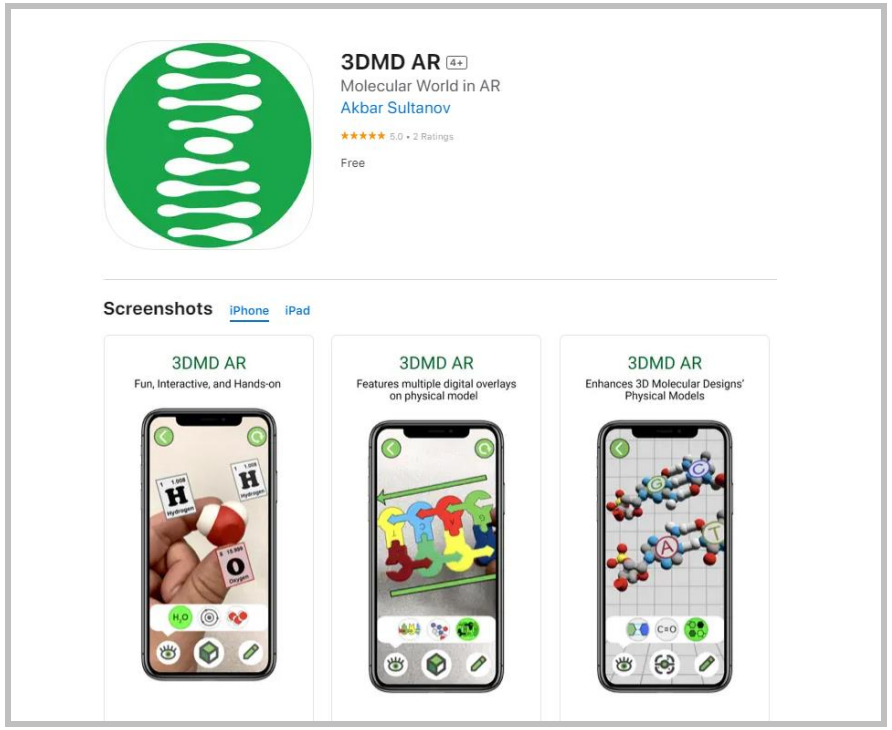
Mark Hoelzer, MFA
3D Molecular Designs



Before we dive in. . .

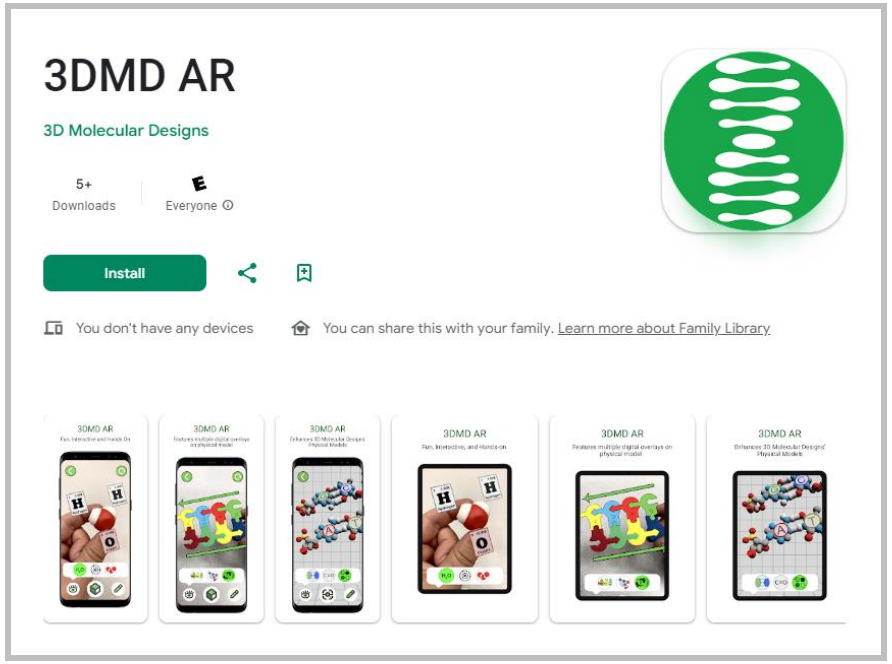
Apple App Store (iPhone/iPad)

https://apps.apple.com/us/app/3dmd-ar/id6450119774



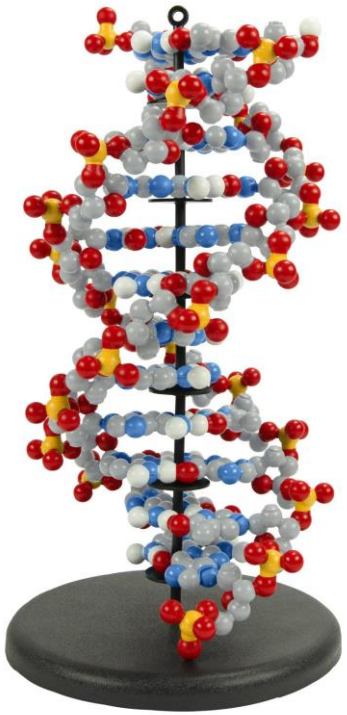
Google Play Store (Android)

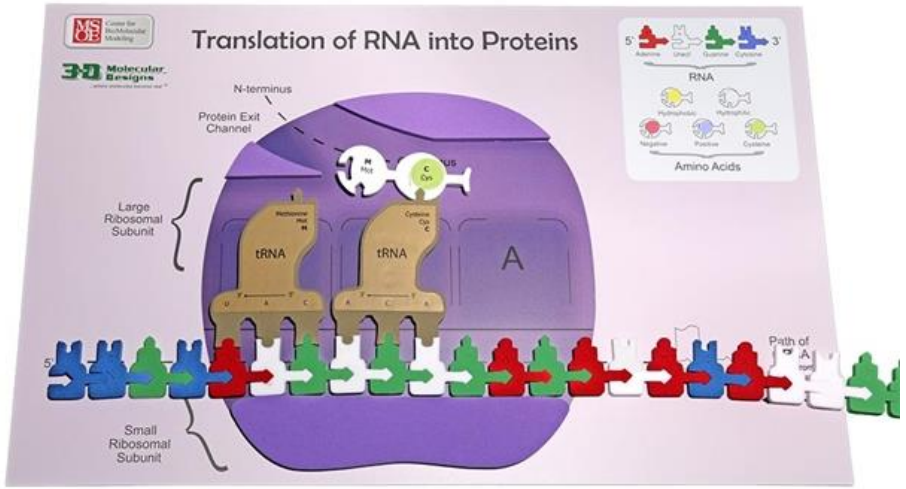
https://play.google.com/store/apps/details?id=com.ThreeDMolecularDesigns.ThreeDMDAR



3D Molecular Designs makes

Physical Models of molecules and proteins





Physical Models have inherent strengths and limitations

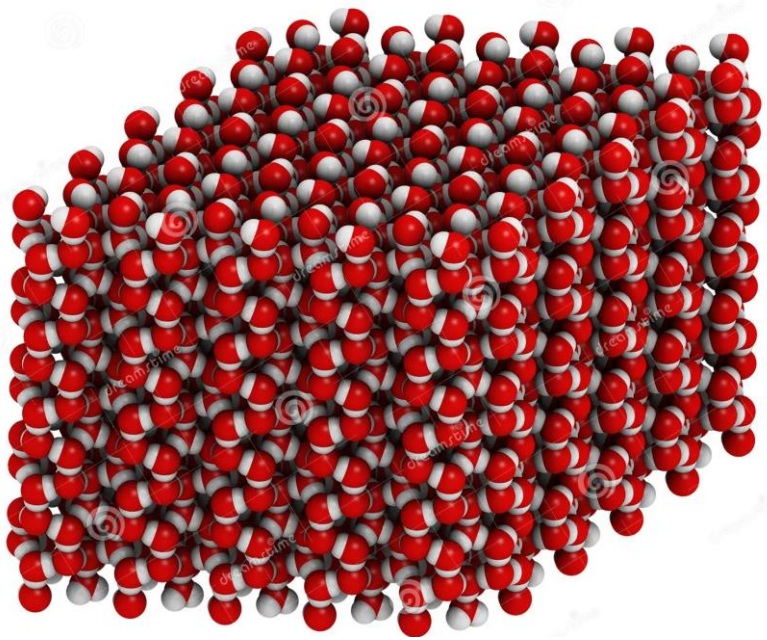
Strengths:

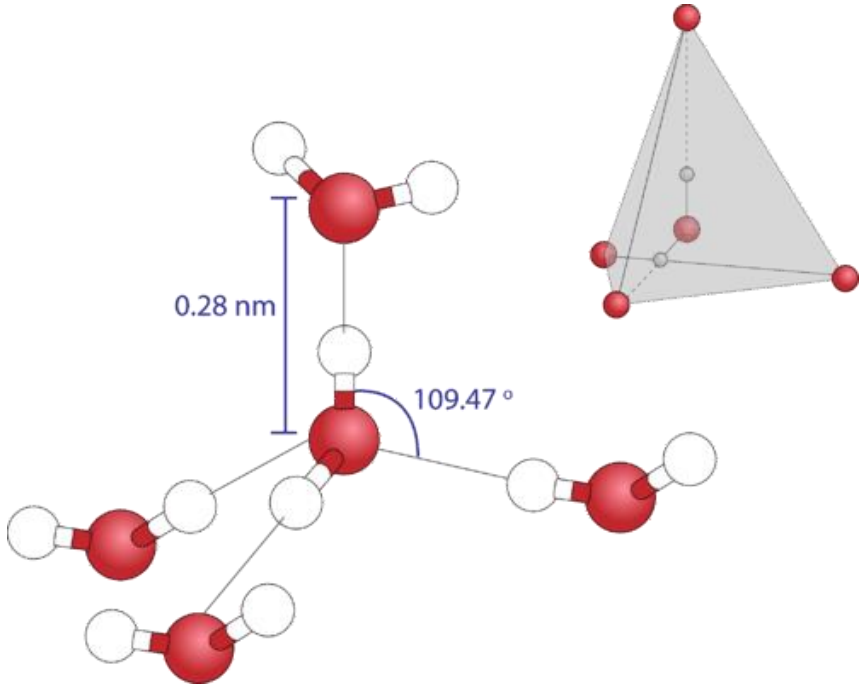
- focus attention
- tangible and tactile
- self exploration

Limitations:

- Static color schemes
- challenge to animate
- production limitations

Interactive Digital Media (IDM) has inherent strengths and limitations





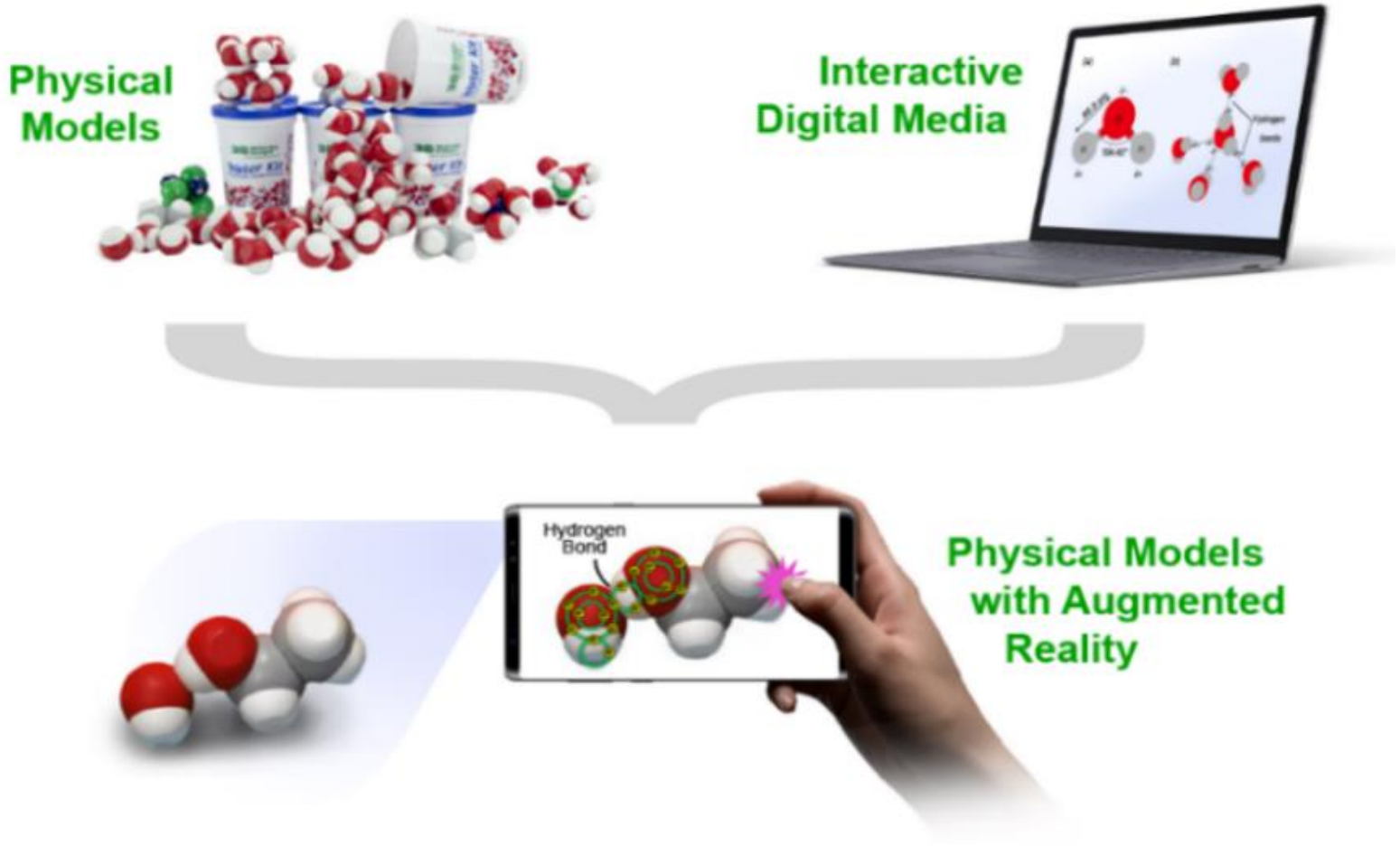
Strengths:

- easy to increase quantity or scale
- easy to animate or change
- easy to annotate

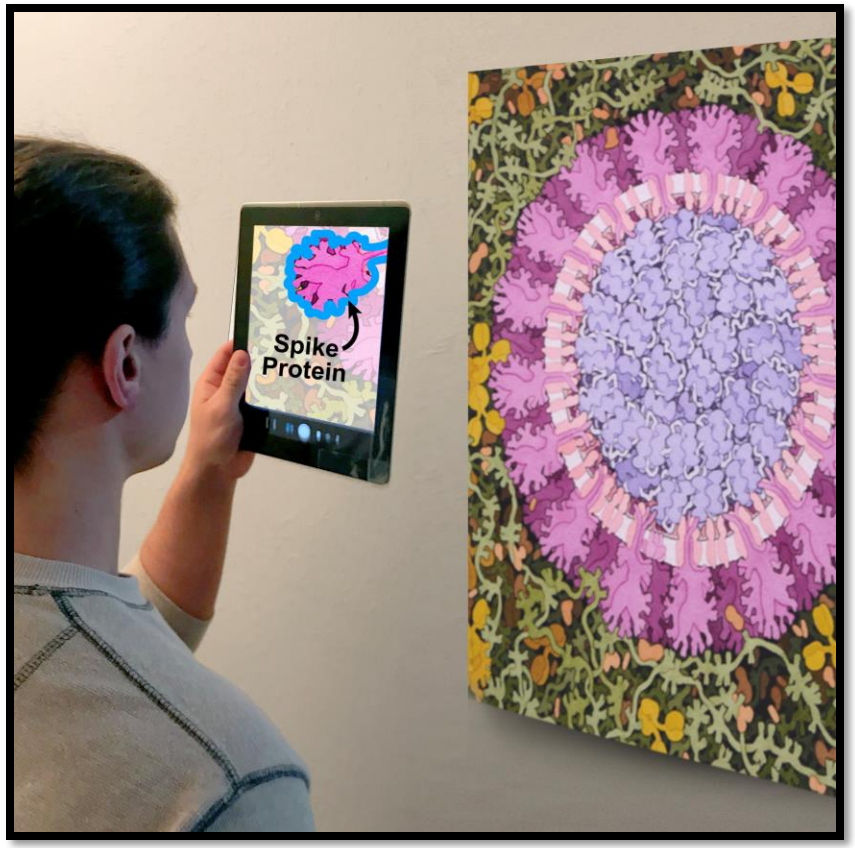
Limitations:

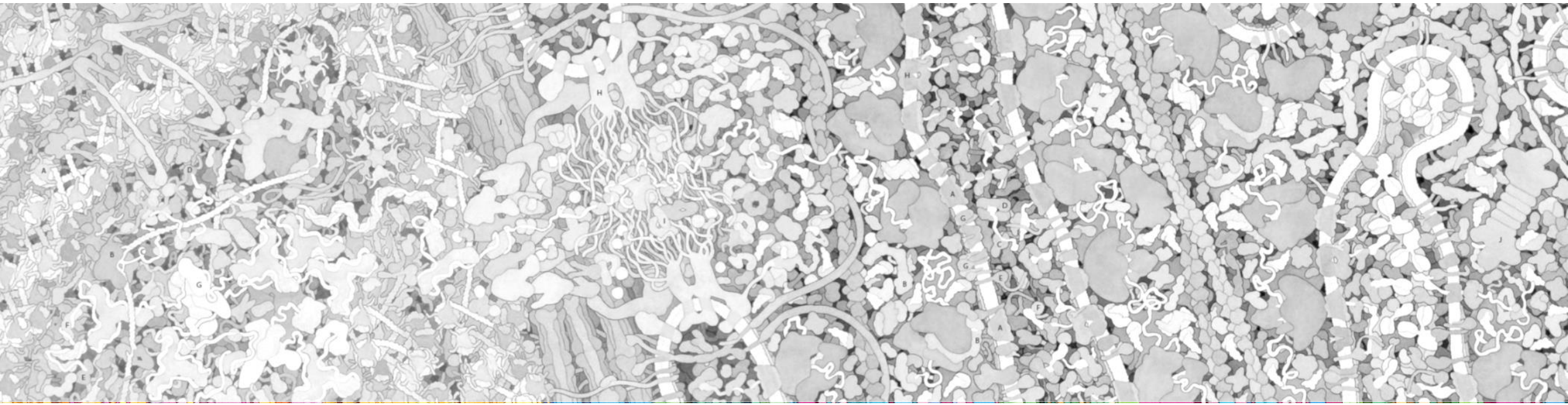
- Disconnected from the physical models
- not always tangible or easy to manipulate

Augmented Reality (AR) can combine the best of both mediums



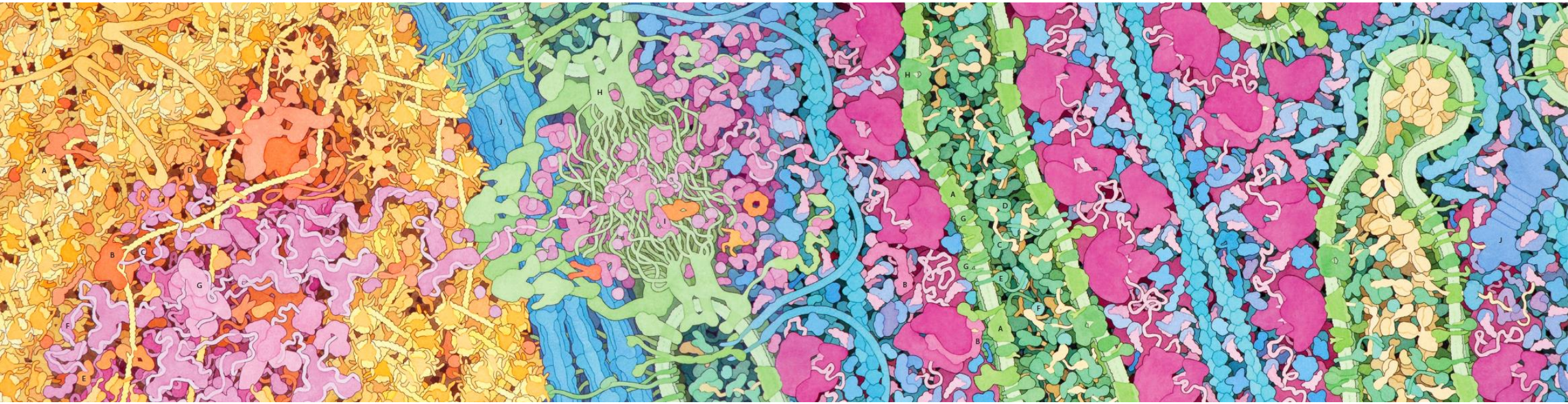
Web-based AR





Try it out!

https://www.centerforbiomolecularmodeling.org/markMyweb/tempNsta/



Try it out!

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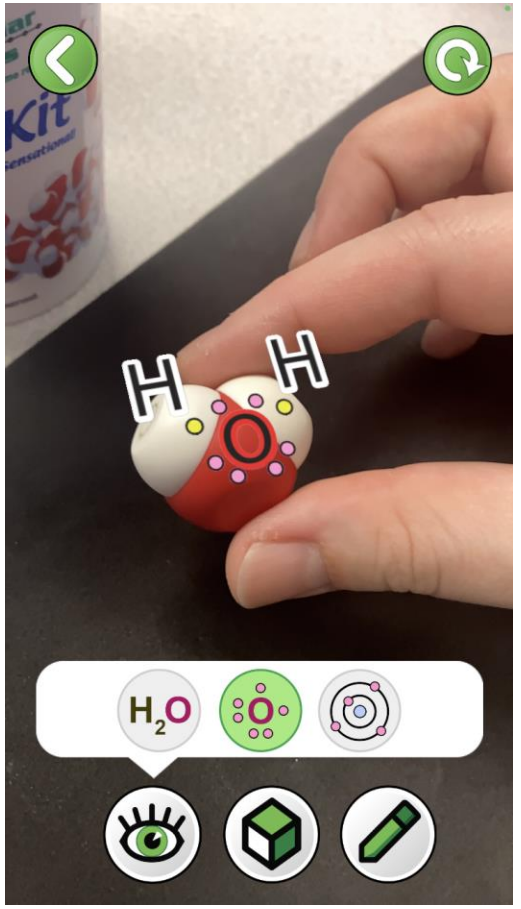
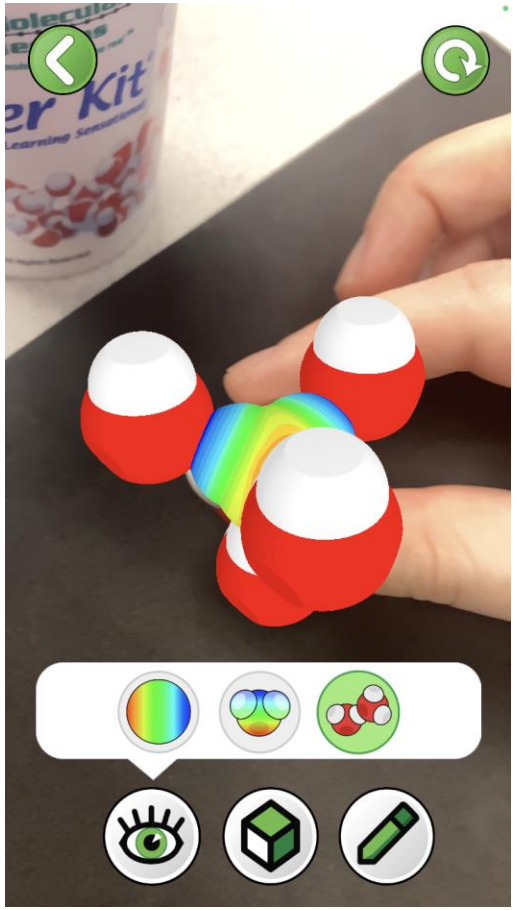
K+ CHANNEL
Mighty Model
3d molecular designs
Na+ CHANNEL
Mighty Model
3d molecular designs
AQUAPORIN
Mighty Model
3d molecular designs


3d
molecular
designs

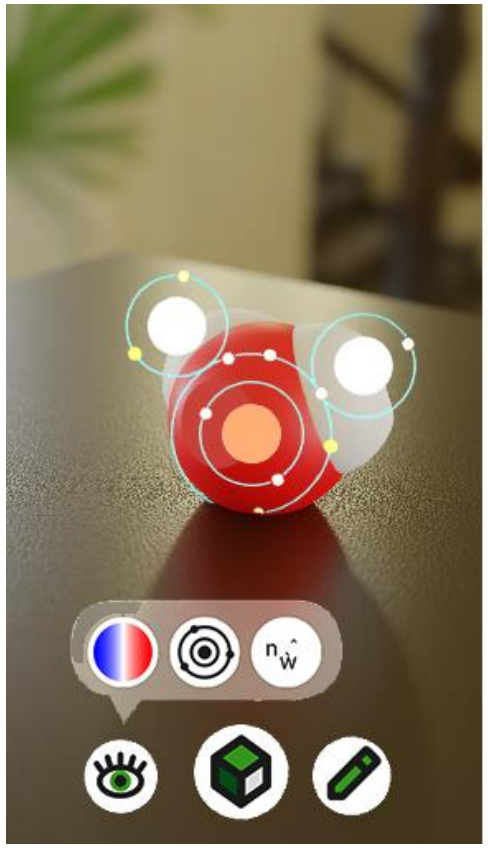
App-based AR

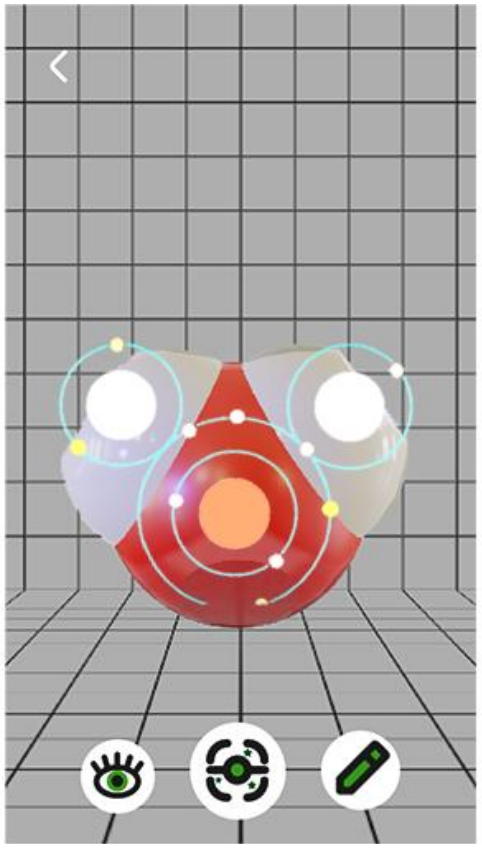

cbm.msoe.edu/markMyweb/
During infection the spike proteins bind to ACE2 proteins on the host cell membrane, allowing the viral genome to enter the host cell. This RNA genome can then direct the synthesis of new virus particles that further spread teh infection. When ready, click "NEXT" to move on.
AR VIEW
3D VIEW
NEXT


H
O
H
H_2O



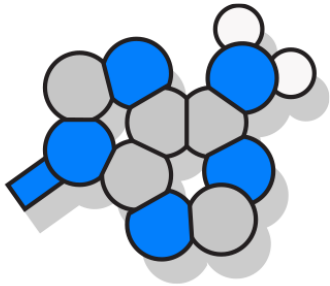
App-based AR



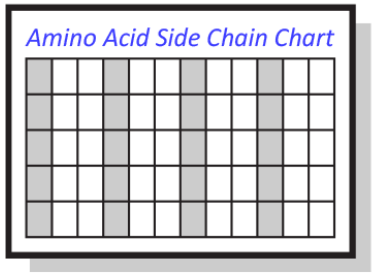


Demo "Training Activity"

Water Molecule

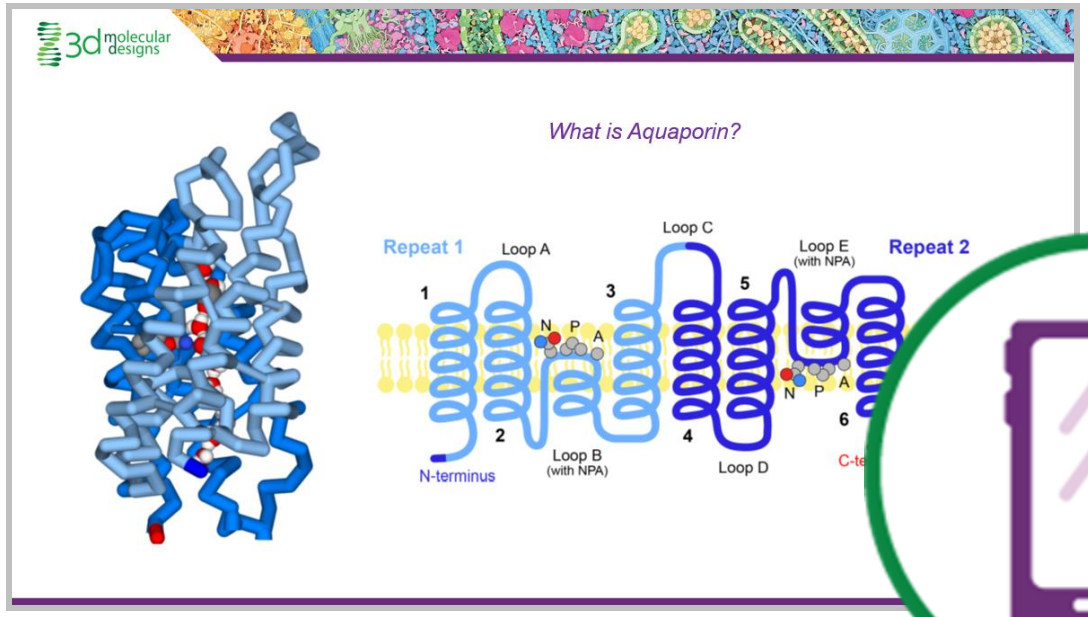


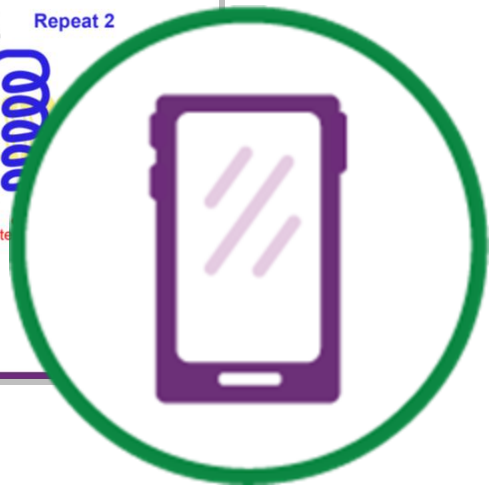
Adenine (A)

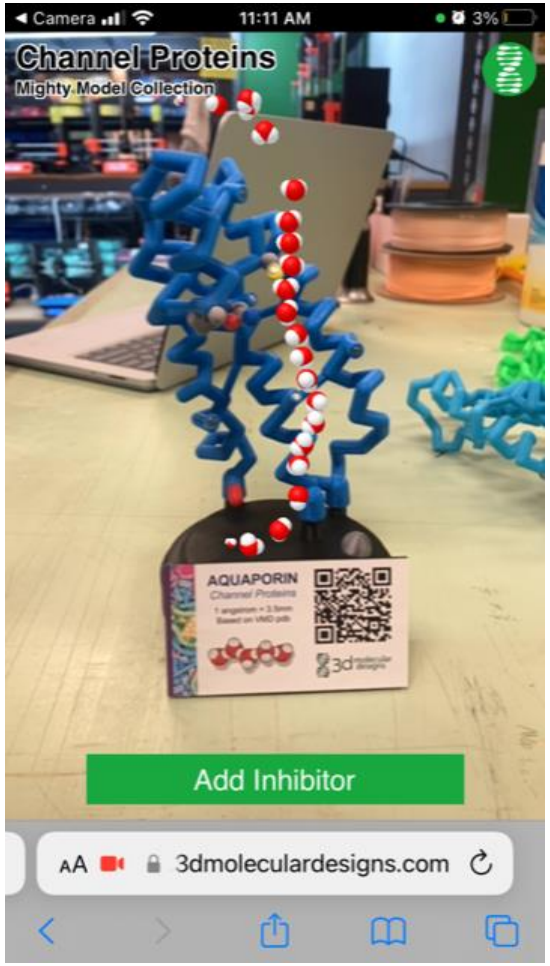


Amino Acid Sidechain Chart

Foam Nucleotides (AGTC)


What is Aquaporin?
Repeat 1
Loop A
Loop C
Loop E
(with NPA)
Repeat 2
1
2
3
4
5
6
N P A
N P A
Loop B
(with NPA)
Loop D
N-terminus

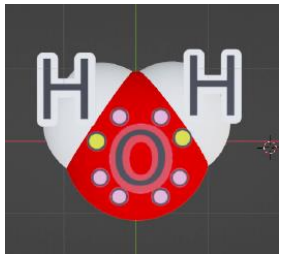


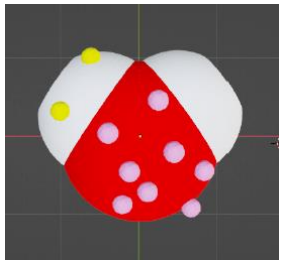

Camera
11:11 AM
3%
Channel Proteins
Mighty Model Collection
AQUAPORIN
Add Inhibitor
AA
3dmoleculardesigns.com

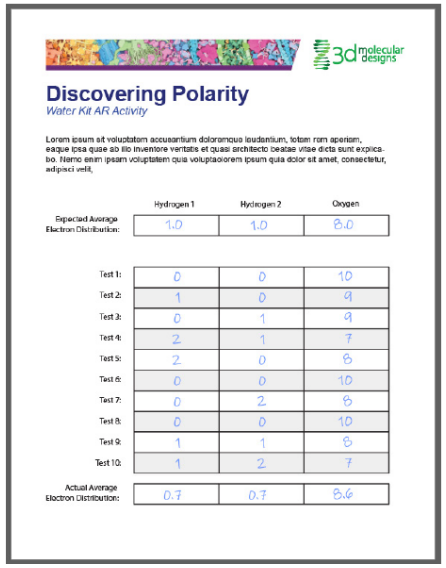
Slide Deck

Activity 1: Discovering Polarity

- *Covalent bonding*
- *Water Molecule Polarity*
- *Hydrogen bonding*







Discovering Polarity

Water Kit AR Activity

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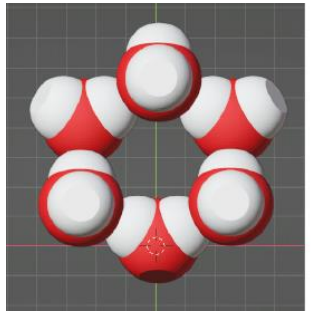
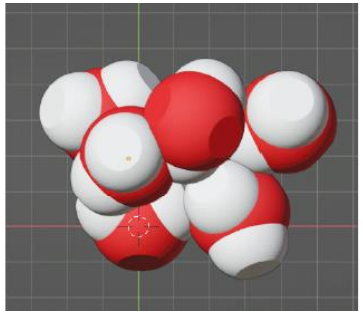
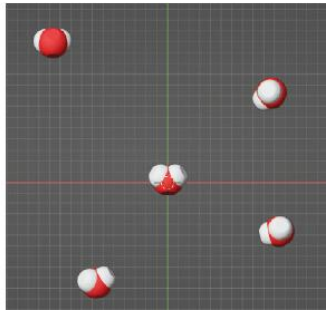
	Hydrogen 1	Hydrogen 2	Oxygen
Expected Average Electron Distribution:	1.0	1.0	8.0
Test 1:	0	0	10
Test 2:	1	0	9
Test 3:	0	1	9
Test 4:	2	1	7
Test 5:	2	0	8
Test 6:	0	0	10
Test 7:	0	2	8
Test 8:	0	0	10
Test 9:	1	1	8
Test 10:	1	2	7
Actual Average Electron Distribution:	0.7	0.7	8.6

Activity 2: States of Matter

- *States of Matter*
- *Impact of temperature*
- *Density*

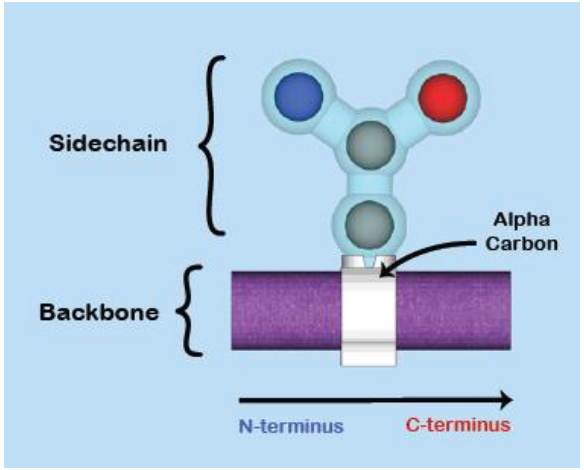


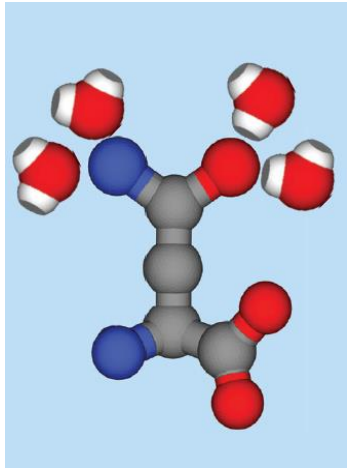




Activity 3: Sorting Sidechains

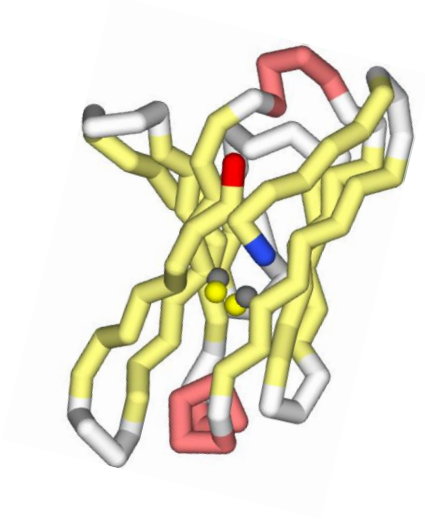
- *Amino Acid Structure*
- *Amino Acid Chemical Properties*
- *Principles that Drive Protein Folding*

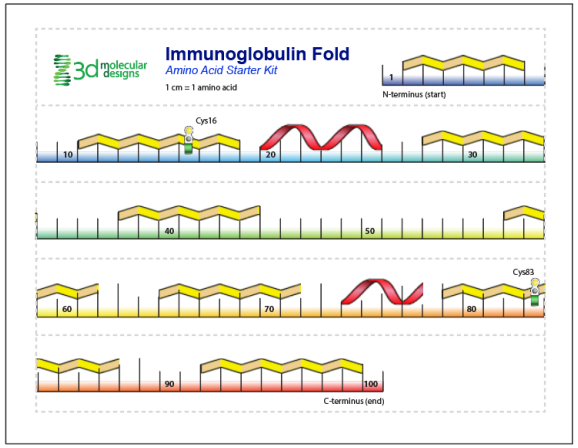




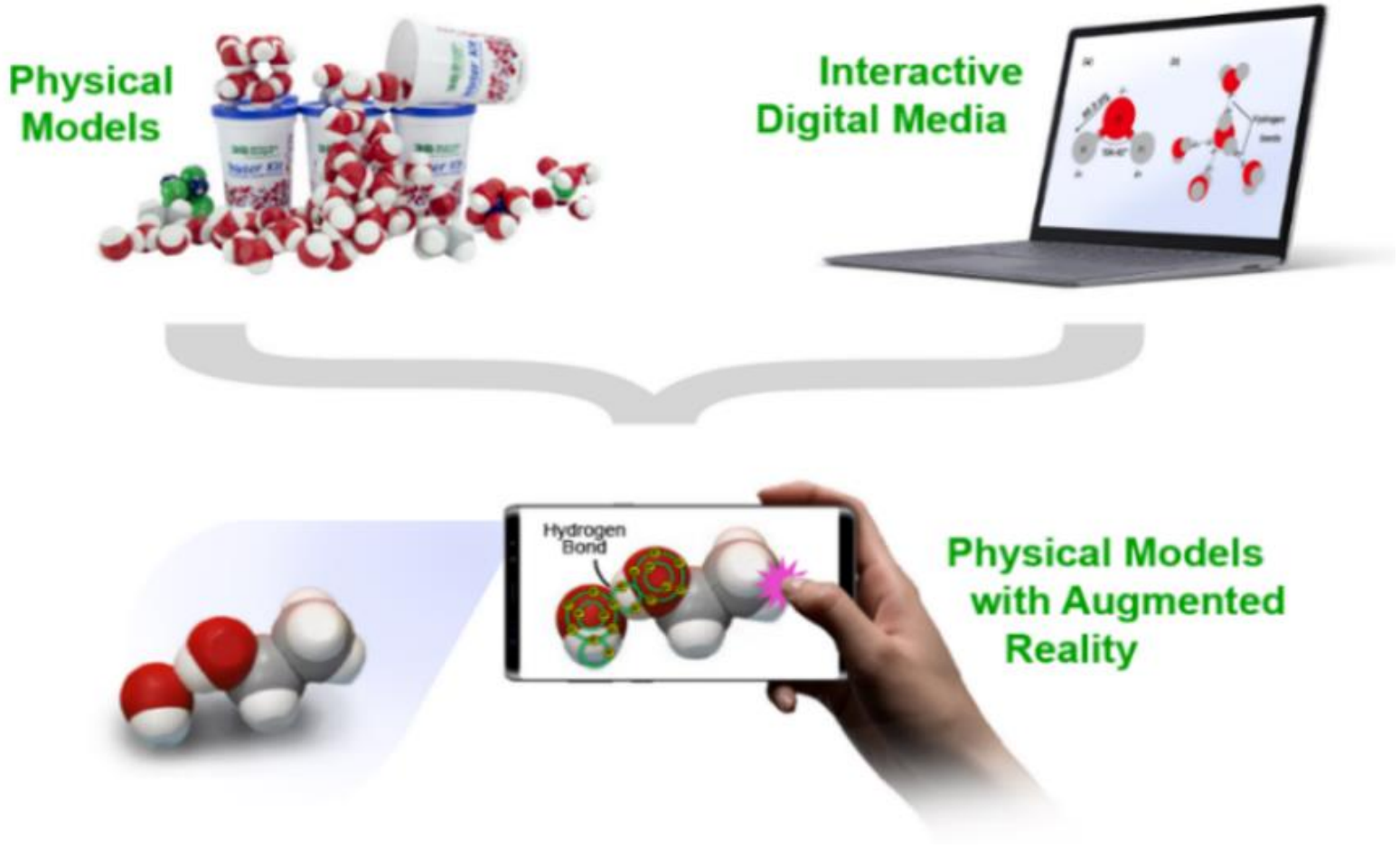
Activity 4: Folding Real Proteins

- *Protein Structure/Function*
- *Principles that Drive Protein Folding*
- *Secondary Structures*

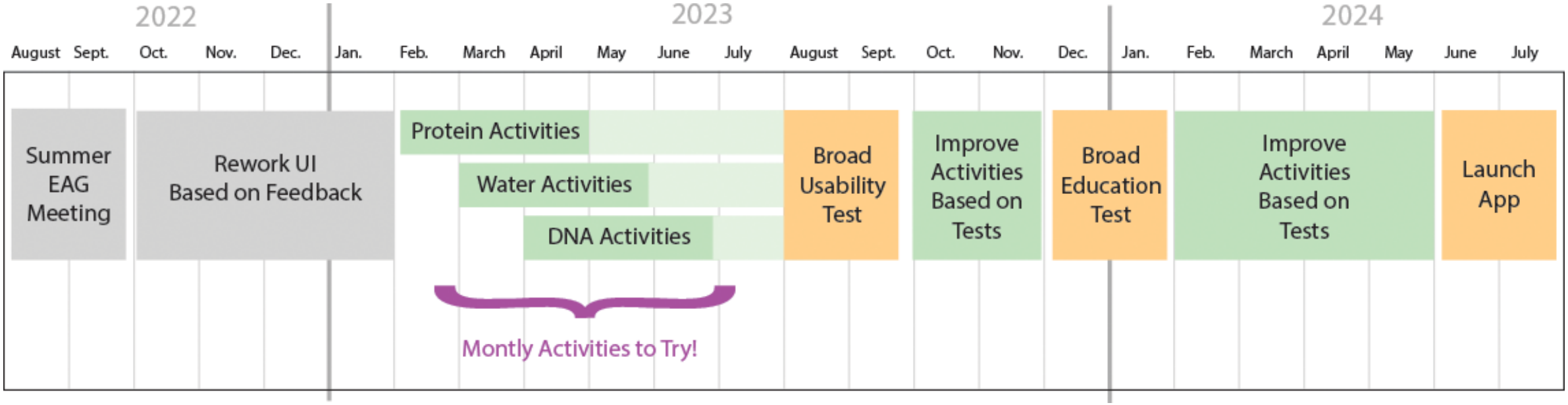




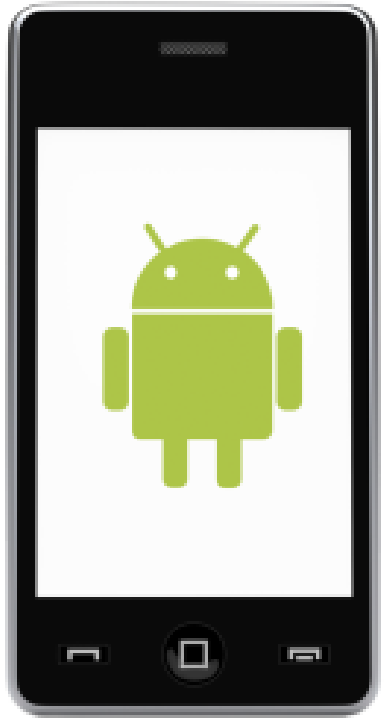
Do not replace the models. . . enhance them!



Where is this work going? What is next?

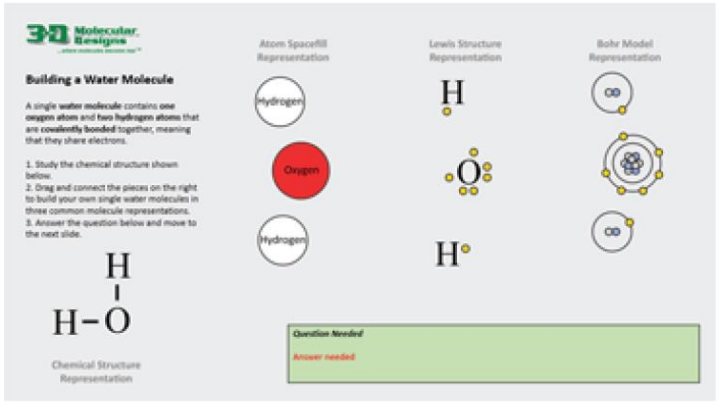


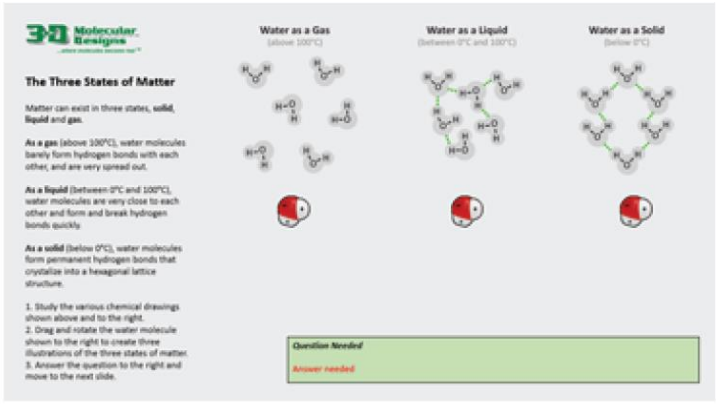
Making this work in the classroom

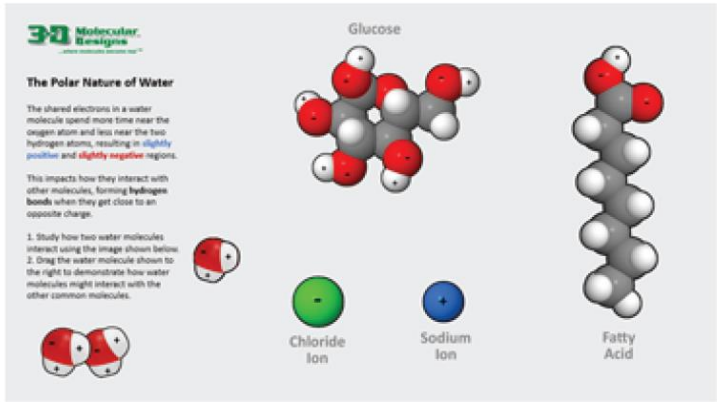


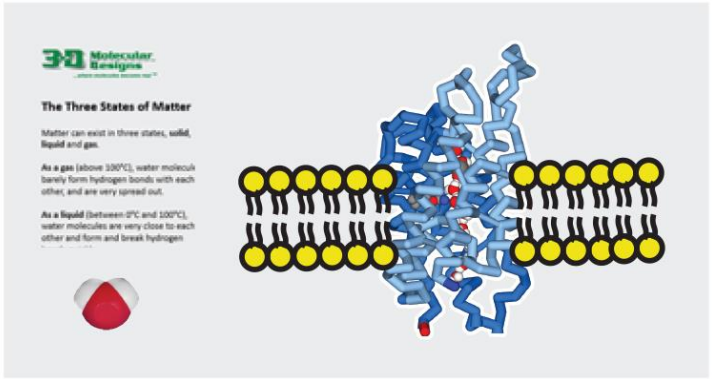
Accessories sold separately.

Beyond AR: Articulate Storyline

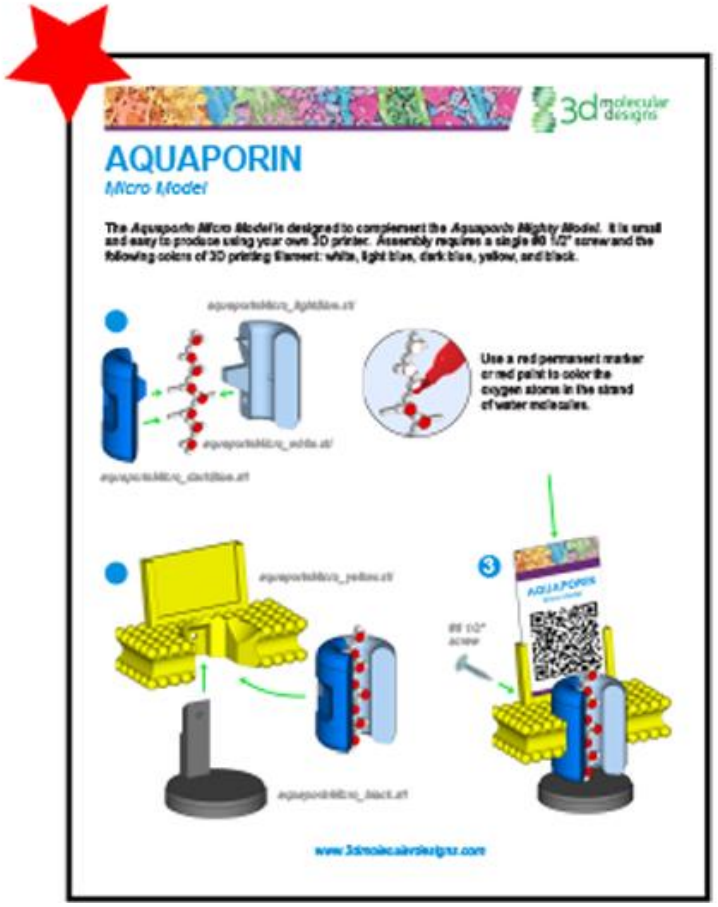




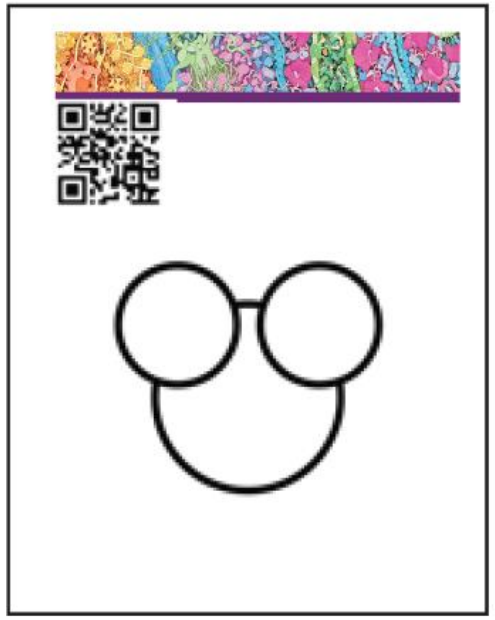


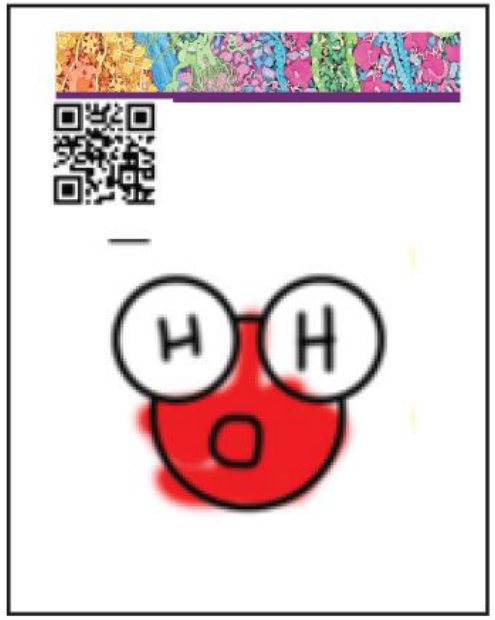


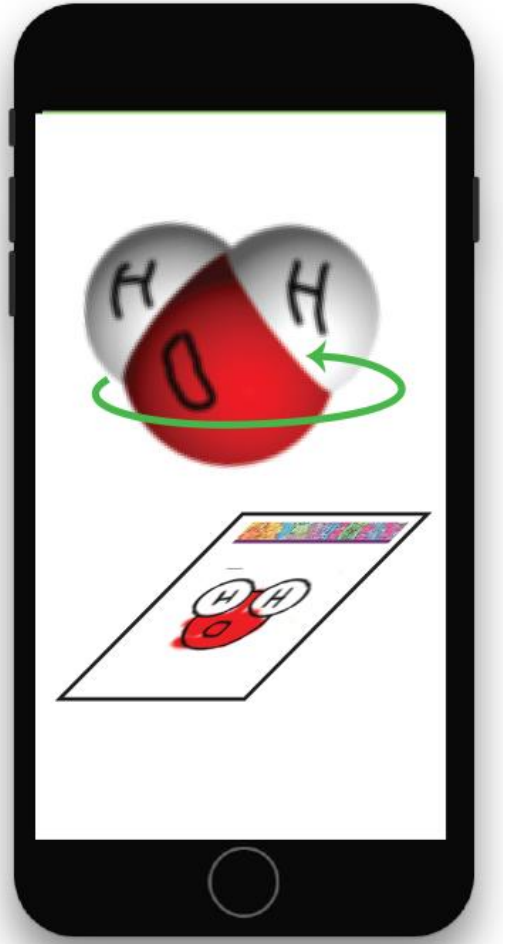
Beyond AR: 3D Print Files



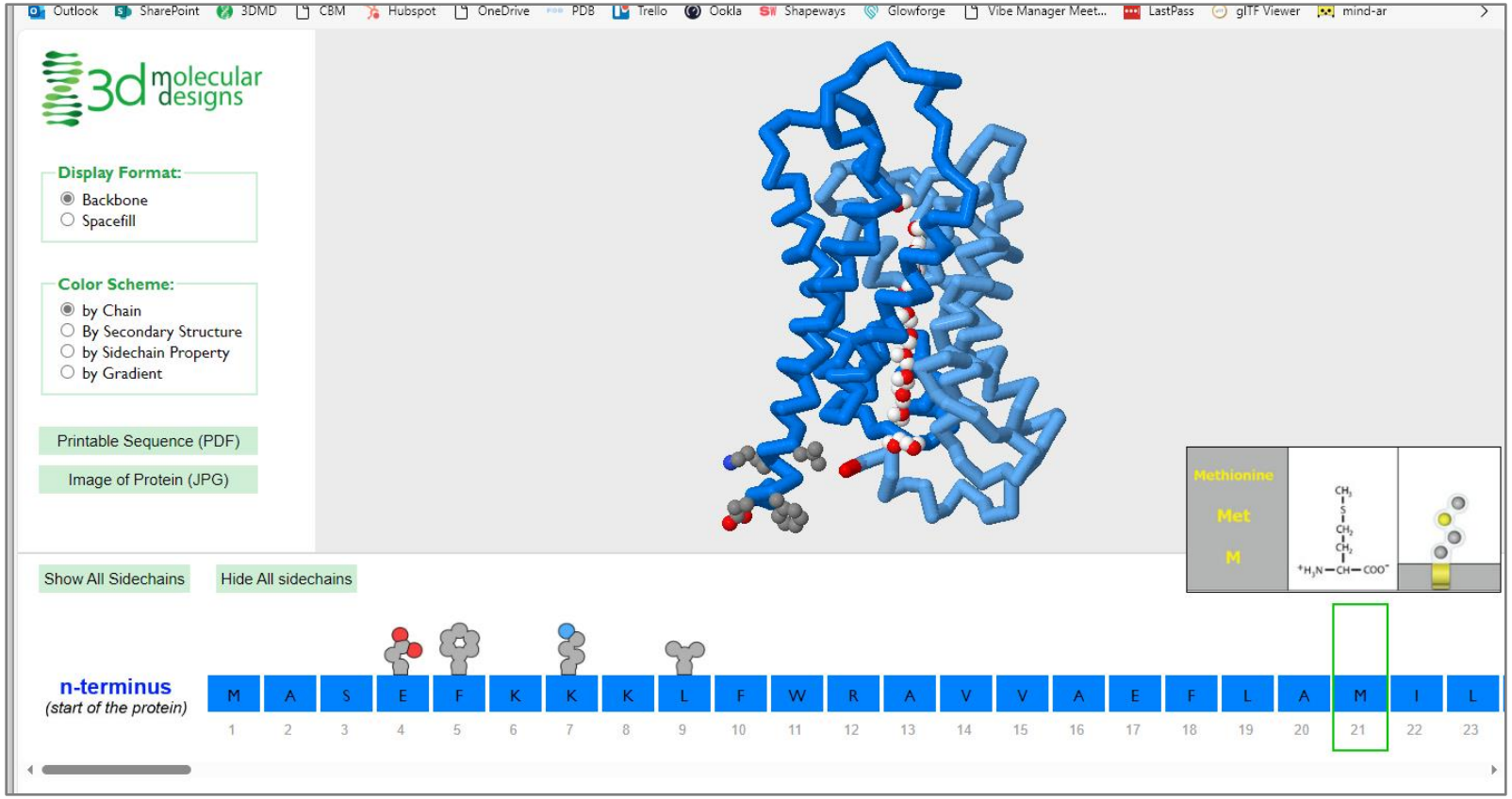
Beyond AR: Coloring Pages







Beyond AR: Protein Exploretorium



https://www.centerforbiomolecularmodeling.org/markMyweb/aquaporinMightyModel/

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