Introduction to Augmented Reality for Teaching and Learning

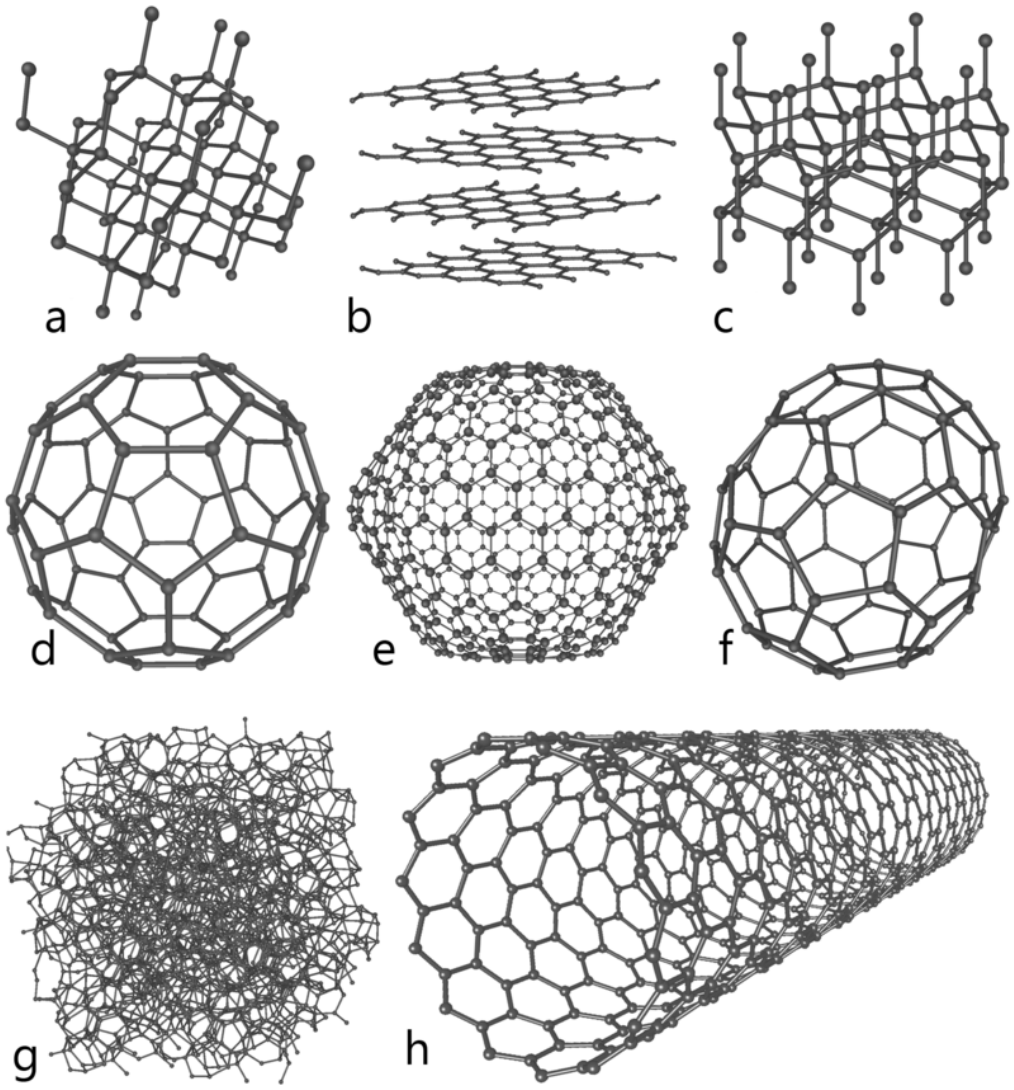
October 30, 2019.

The following activities are examples of how to use the AR technology in your teaching and learning. All of them require the installation of the free "Augment" App.

Augmented Reality Activity

Understanding Carbon Allotropes

Carbon is capable of forming many allotropes due to its valency. Well-known forms of carbon include diamond and graphite. In recent decades many more allotropes have been discovered and researched including ball shapes such as buckminsterfullerene and sheets such as graphene. Larger scale structures of carbon include nanotubes, nanobuds and nanoribbons.



Eight allotropes of carbon: a) diamond, b) graphite, c) lonsdaleite, d) C_{60} buckminsterfullerene, e) C_{540}, Fullerite f) C_{70}, g) amorphous carbon, and h) single-walled carbon nanotube.

Source and More info: https://en.wikipedia.org/wiki/Carbon_nanotube

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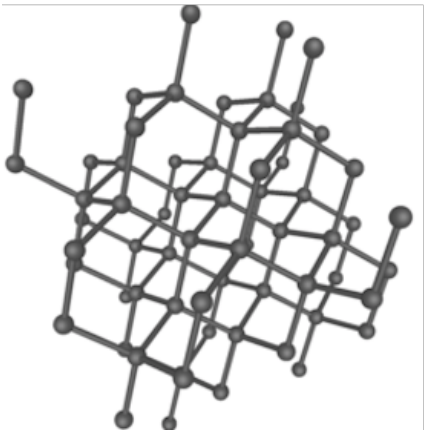
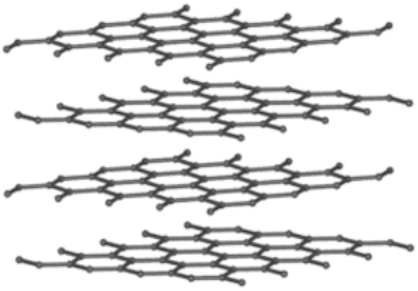
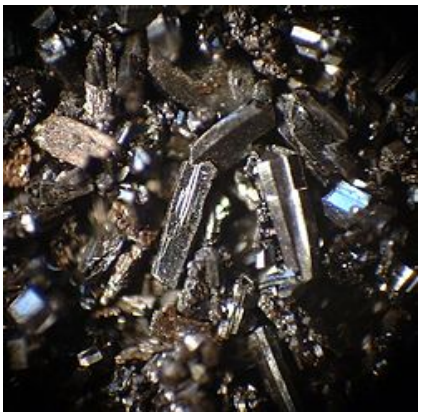
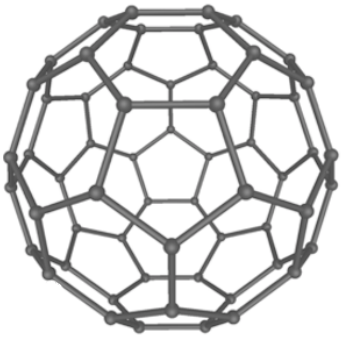
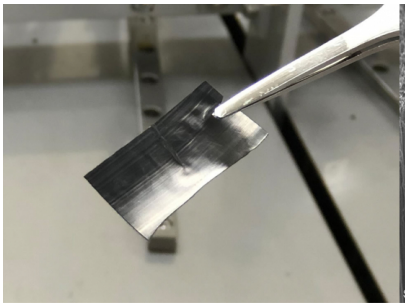
Scan the code with Augment and examine the allotrope in your hand!

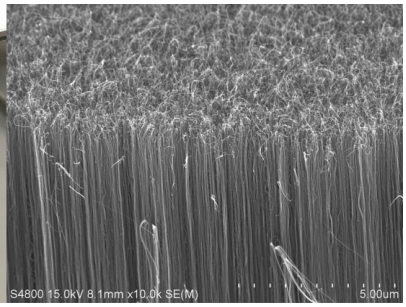


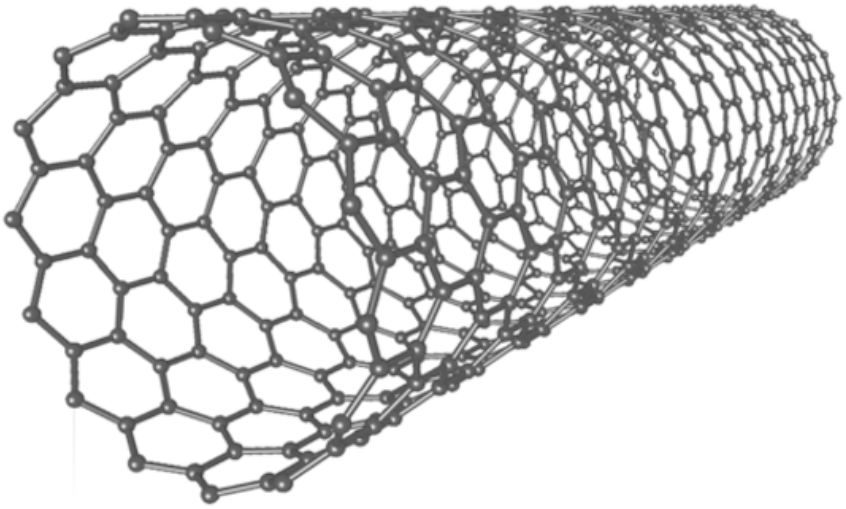












Augmented Reality Activity

Understanding Surfaces & Math

The Möbius strip or Möbius band, also spelled Mobius or Moebius, is a surface with only one side and only one boundary. The Möbius strip has the mathematical property of being unorientable. It can be realized as a ruled surface. Its discovery is attributed to the German mathematicians August Ferdinand Möbius and Johann Benedict Listing in 1858, through a structure similar to the Möbius strip can be seen in Roman mosaics dated circa 200–250 AD.

"If an ant were to crawl along the full length of the strip, it would return to its starting point having traversed both sides without ever crossing an edge"

- More info:

- Virtual in your hand → scan the code with Augment!

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- Build it yourself:

Augmented Reality Activity

Understanding Virus, symmetry, 3D Structure (see zika.pdf file)

Read the attached material, anytime you see the Augment logo:

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Scan the code or use the app to get and augmented visualization.

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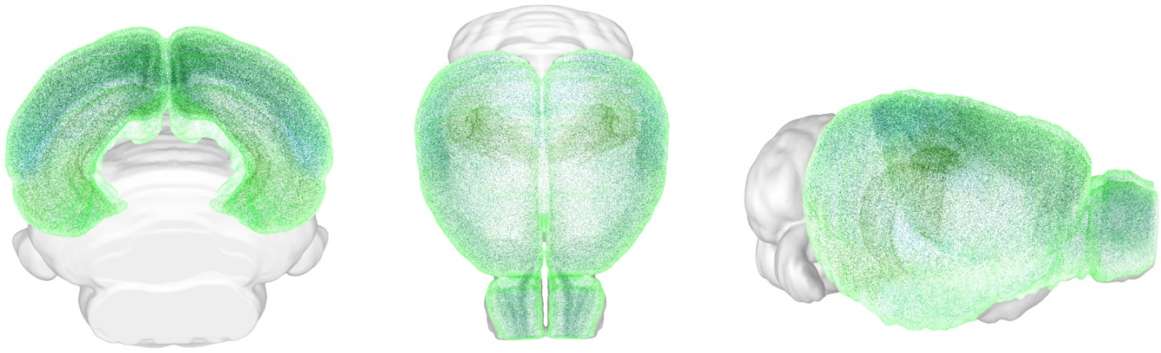
Mouse brain Cerebral Cortex:



Source: https://bbp.epfl.ch/nexus/cell-atlas/

The Blue Brain Cell Atlas is a comprehensive online resource that describes the number, types, and positions of cells in all areas of the mouse brain. The user can download cell numbers for statistical analysis, download cell positions and types for modeling and visualize

Front. Neuroinform., 28 November 2018 | https://doi.org/10.3389/fninf.2018.00084

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Drugs, Chemistry & Stereochemistry

- **Ibuprofen** is a medication in the nonsteroidal anti-inflammatory drug (NSAID) class that is used for treating pain, fever, and inflammation.

- **Ibuprofen** is a chemical compound which formula is $C_{13}H_{18}O_2$ and chemical name:

(RS)-2-(4-(2-Methylpropyl)phenyl)propanoic acid

Scan the QR code using the Augment App to load the ibuprofen molecule and identify the different chemical moieties.

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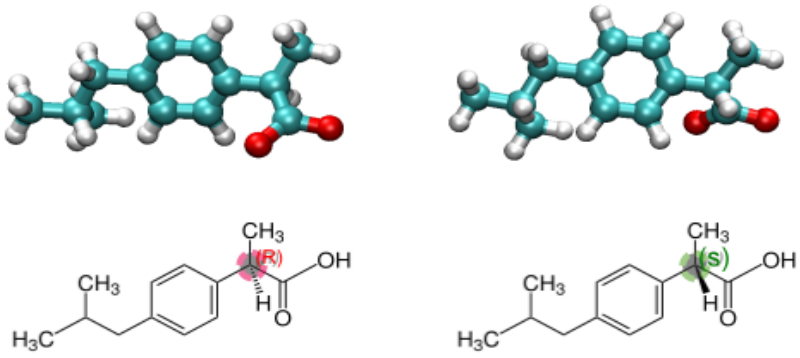
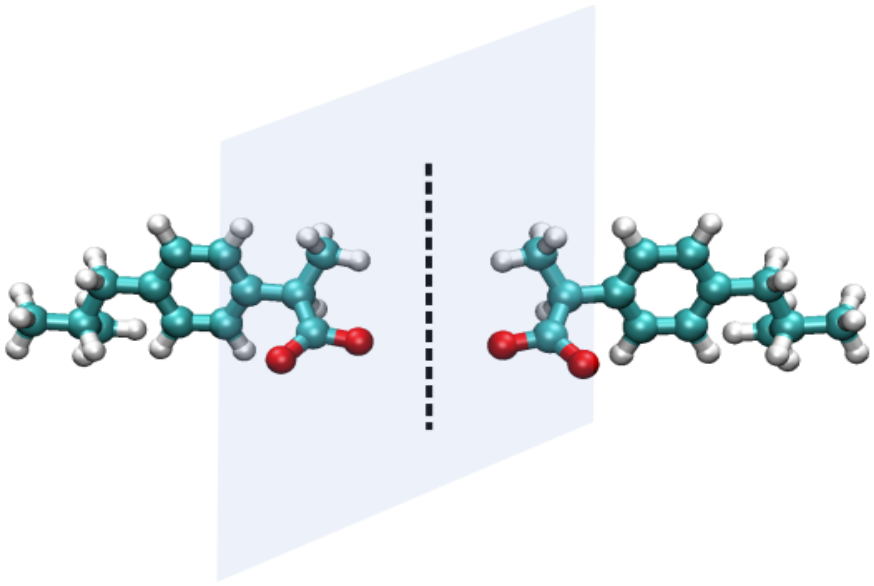
- **Ibuprofen** It is an optically active compound with both *S* and *R*-isomers, of which the *S* (dextrorotatory) isomer is the more biologically active. Ibuprofen is produced industrially as a racemate. The compound, does contain a stereocenter in the α-position of the propionate moiety. So two enantiomers of ibuprofen occur, with the potential for different biological effects and metabolism for each enantiomer.

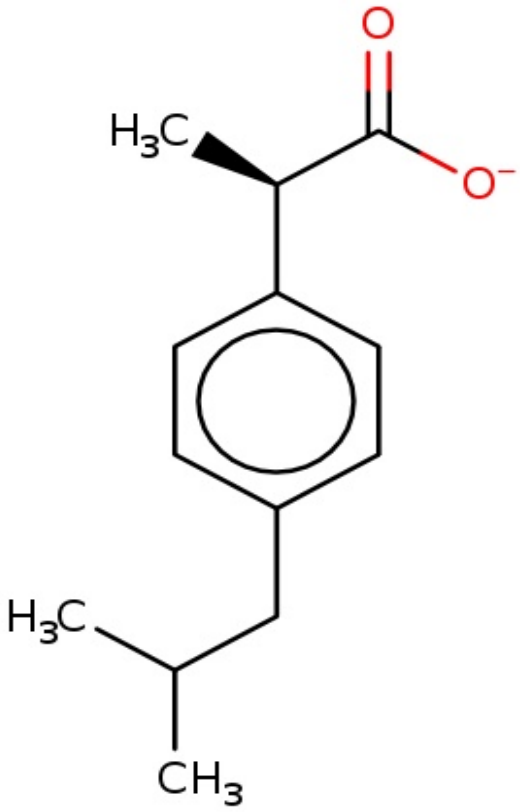
Using the Augment App identify which isomer do you have in your hand.



An isomerase (alpha-methylacyl-CoA racemase) converts (*R*)-ibuprofen to the active (*S*)-enantiomer.

http://www.rcsb.org/pdb/results/results.do?tabtoshow=Current&qrid=E155D4F3





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Virtual Molecules and Physical models

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Augmented Reality Activity
Virtual Molecules and Physical models

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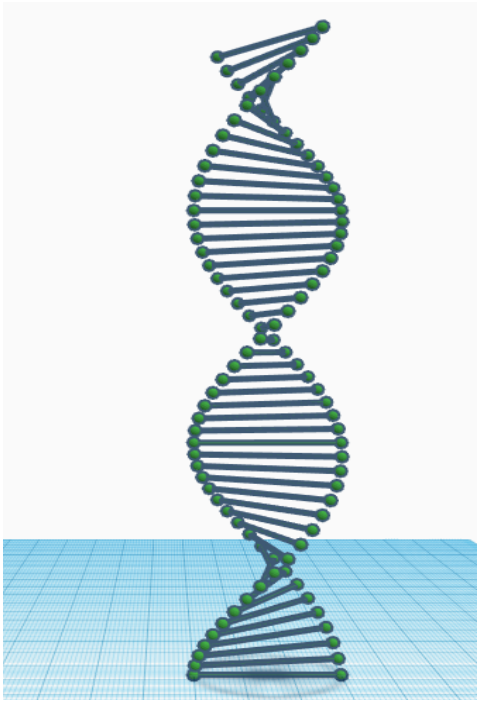
3D shapes & Art



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House Prototype

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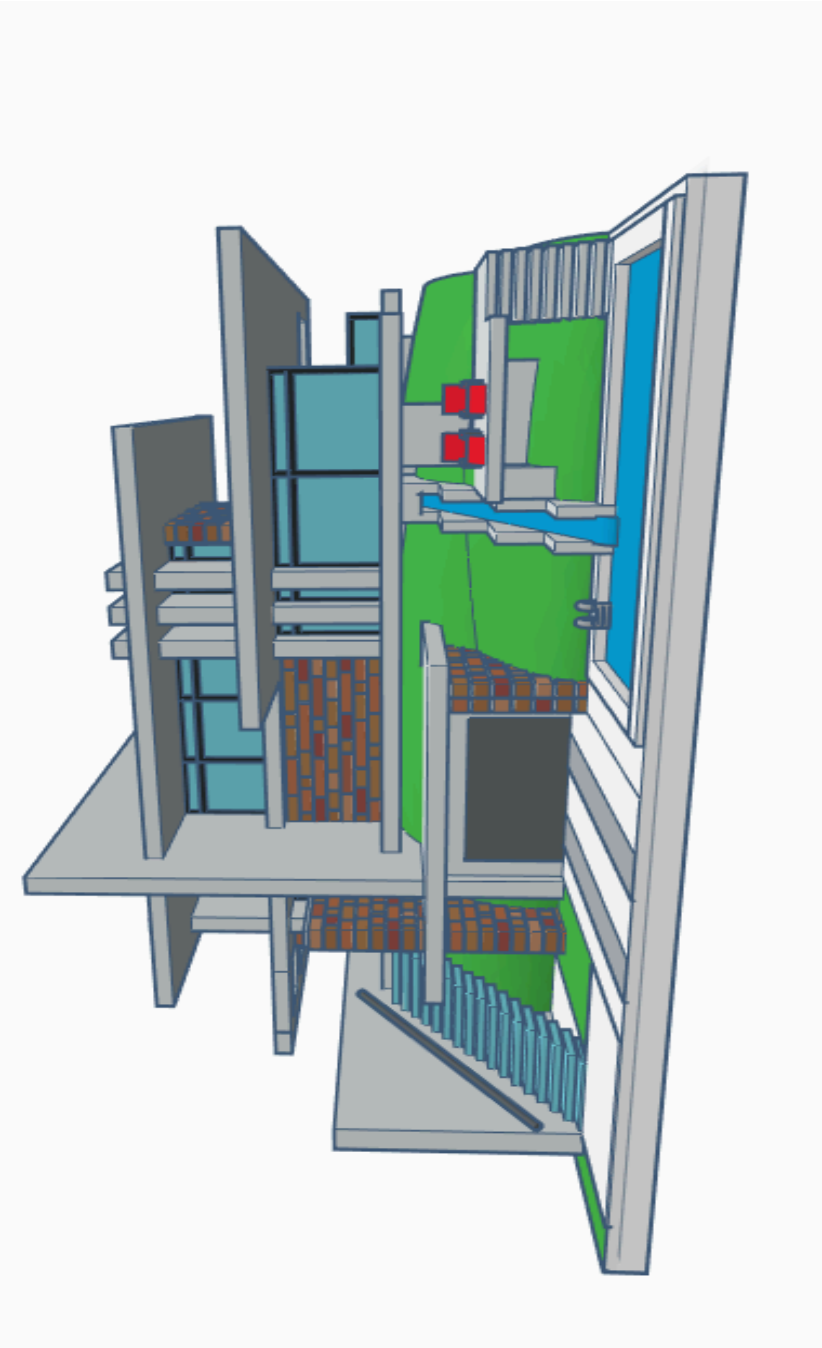

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3D Shapes

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Cube

Tetrahedron

Icosahedron

Augmented Reality Activity
History/Architecture/Art

Eim ya kyaung Temple

The Eim ya-kyaung temple is located East of Old Bagan, 300 meters west from the much larger Hitlominlo Temple. Of the thousands of monuments in Pagan, Eim ya kyaung nga-myet hna is one of only sixteen that have been identified with a pentagonal plan. The temple and associated monastery (Monument 1832) are located within a walled enclosure.

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Caracol - Chichén Itzá

One of Chichén Itzá's most well-known structures is the Caracol. The Caracol is one of the oldest standing observatories in the Americas, and highlights the great importance that astrological phenomena held for the Maya.

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Indigenous Storytelling

Download the ***Indigital App*** and scan the picture.

Augmented Reality Activity

Science-Water properties

Water, Water, Everywhere

Phase Diagrams of Ordinary Water Substance

L. Glasser

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Water is everywhere about us: within, upon, and around the Earth *(1, 2)*. It is essential to life and indeed, in space exploration, is regarded as the very signature for life. Its ubiquity is illustrated in the English language by the numerous words for water (much as the Inuit are reputed to have an extensive vocabulary for snow): bodies of water are described as oceans, seas, lakes, dams, reservoirs, aquifers, wells, ponds, puddles, and dewdrops; flowing water comes in rivers, streams, rivulets, billabongs, waterfalls, cascades, creeks, brooks, rain, drips, and drops; solid water appears as ice, icicles, icebergs, glaciers, hail, sleet, snow, and frost. Water enables the major processes of this planet's energy transfers: the Sun's energy powers the weather, cycling water between the oceans, vapor, and precipitation; engineers use water as the energy transfer medium in hydroelectric systems and steam generation; in chemistry, water is the (almost) universal solvent.

For such reasons, the properties of ordinary water substance (that is, water as solid ice, liquid, or vapor and gas) are much studied *(3–5)*: over 20,000 values in the literature have been collated in reporting the behavior of water *(5)*. The purpose of this article is the presentation of the full phase diagram of water, in the form of a graphical representation of the three-dimensional (3D) *pVT* diagram using authentic data—such a diagram does not seem to have been published before. This presentation follows our recent publication of the 3D *pVT* diagram of carbon dioxide, where details of the theory and interpretation of such a diagram may be found *(6)*.

A generalized and diagrammatic *pVT* diagram, with "exploded" views of *pV*, *pT*, and *VT* projections *(7)* is shown in Figure 1. This diagram may be useful for broad discussions. However, the authentic diagram (Figure 2) emphasizes different features of the diagram. A principal difference between the sketched (Figure 1) and authentic (Figure 2) phase diagrams is that the ranges in values of the *p* and *V* variables are so great that it is essential to use logarithmic scales to encompass the three phase regions: solid, liquid, and vapor or gas. Figure 3 is a *pT* projection of the fluid region of the water phase diagram *(4)*, while Figure 4 depicts the *pt* (where *t* is temperature in units of °C) relations among the solid phases

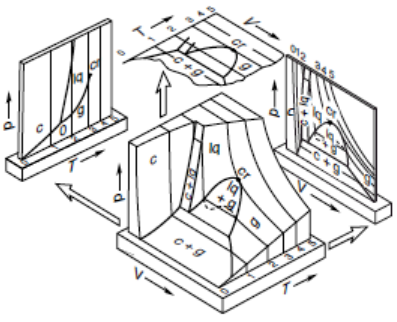


Figure 1. An illustrative orthographic (isometric) three-dimensional *pVT* diagram, with exploded views of the *pT*, *pV*, and *VT* projections (adapted from ref *7*, Figure 50, p 206).

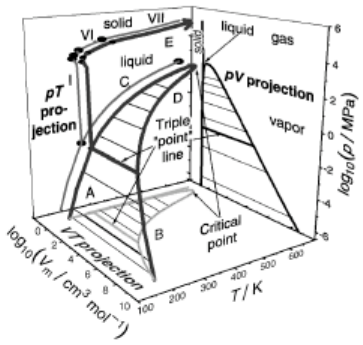


Figure 2. A perspective three-dimensional *pVT* diagram for water, with projections onto the *pT*, *pV*, and *VT* planes. To accommodate the full range of data, the logarithms of the pressure and molar volume axes are used. The horizontal lines (constant *pT*) are tie-lines connecting phases in mechanical and thermal equilibrium across the phase gaps. The dot at the end of the liquid–vapor line in the *pT* projection represents its termination at the critical point. (Note: The carbon dioxide diagram, in ref *6*, is also perspective, but is incorrectly described as "orthographic".) Volumes in the diagram (corresponding to areas in the projections) are labelled solid, liquid, vapor, and, above the critical point, gas. I, (III and V not labeled), VI, and VII refer to the respective solid phases that can equilibrate with liquid water.

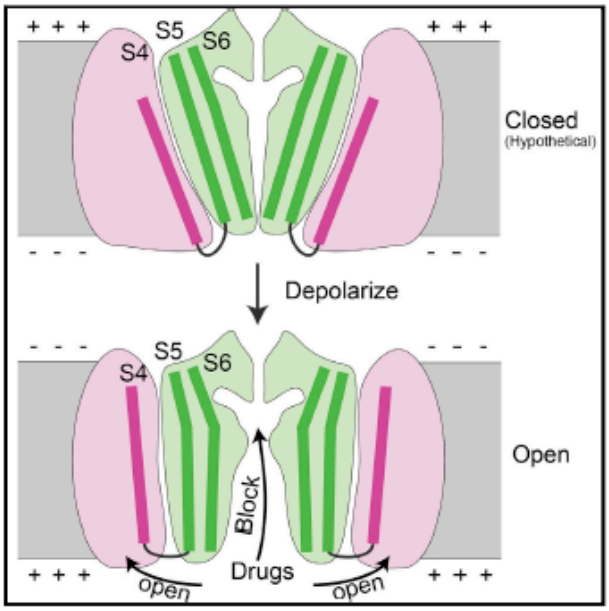
Augmented Reality Activity
Protein Structure

Article

Cell

Cryo-EM Structure of the Open Human *Ether-à-go-go*-Related K^+ Channel hERG

Graphical Abstract



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In Brief

Structural analysis of the hERG channel helps to understand known human channelopathy mutations and why the channel is extremely sensitive to a wide range of drugs.

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