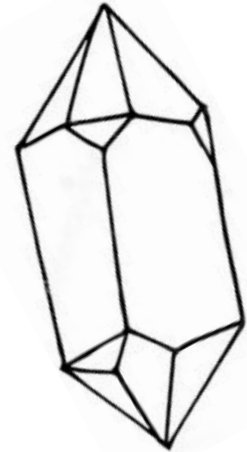
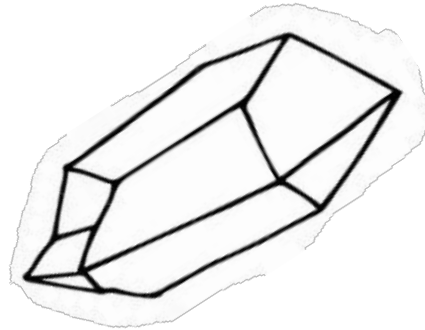
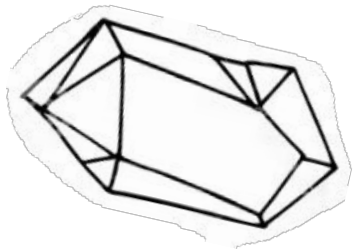


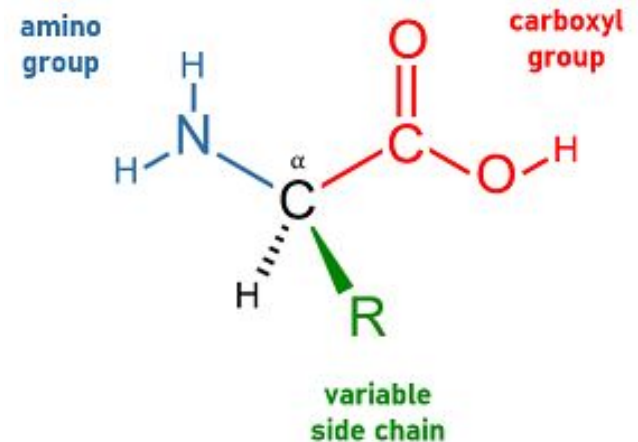
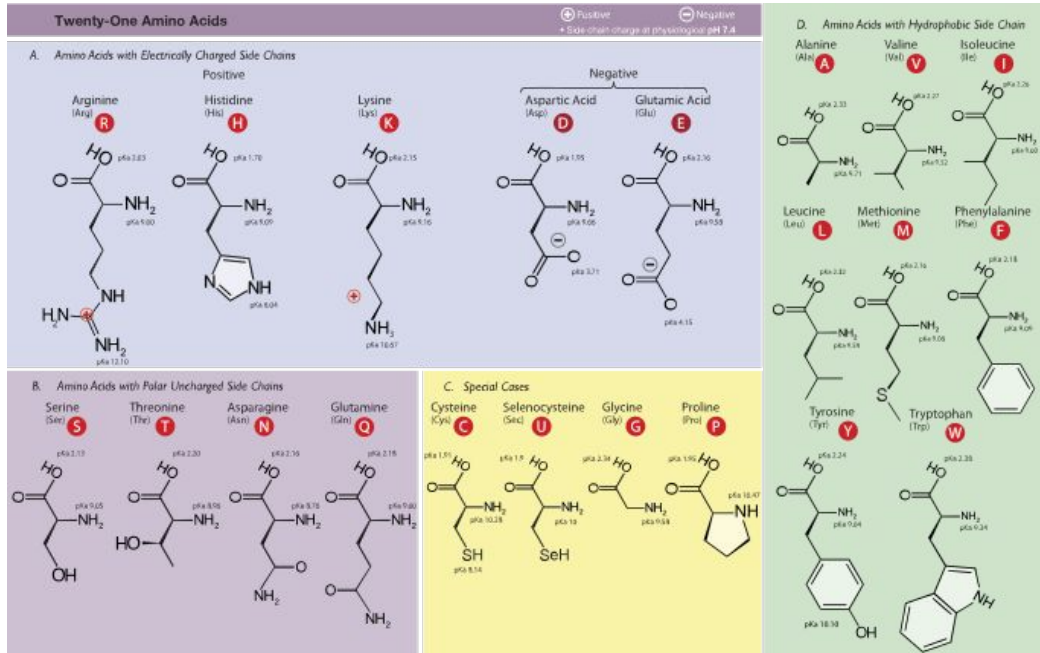
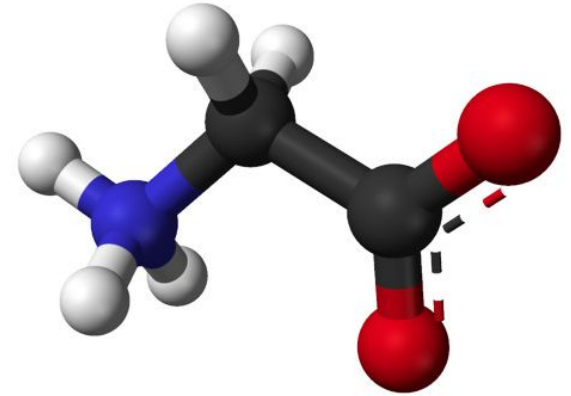
Potential use of amino acid crystals as actuators



Prepared by
Bezhenar Sviatoslav
and Oles Fedirko

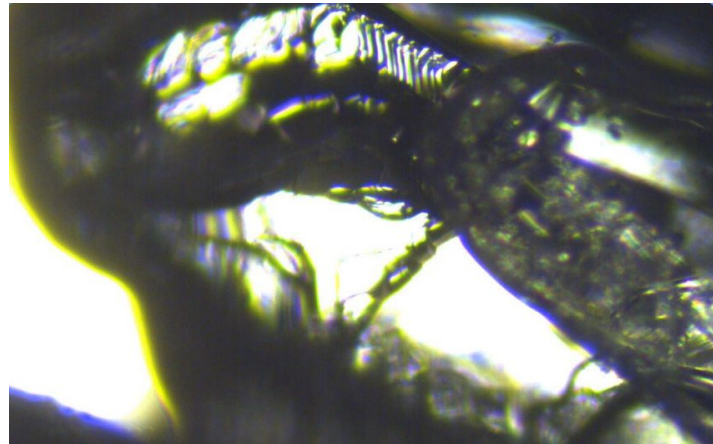
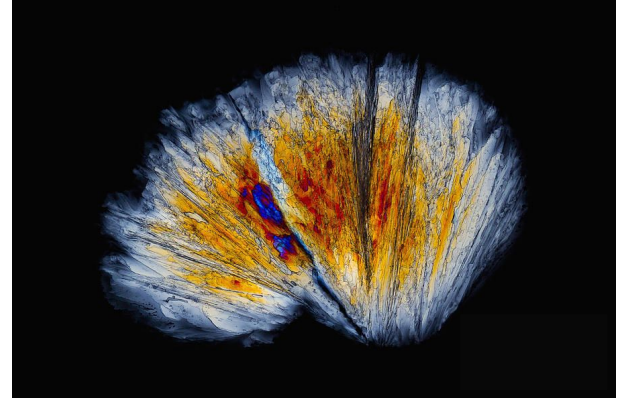
What are amino acids?

As you know, amino acids are the main structural elements of peptides and proteins. Proteins are the building material for all living things.



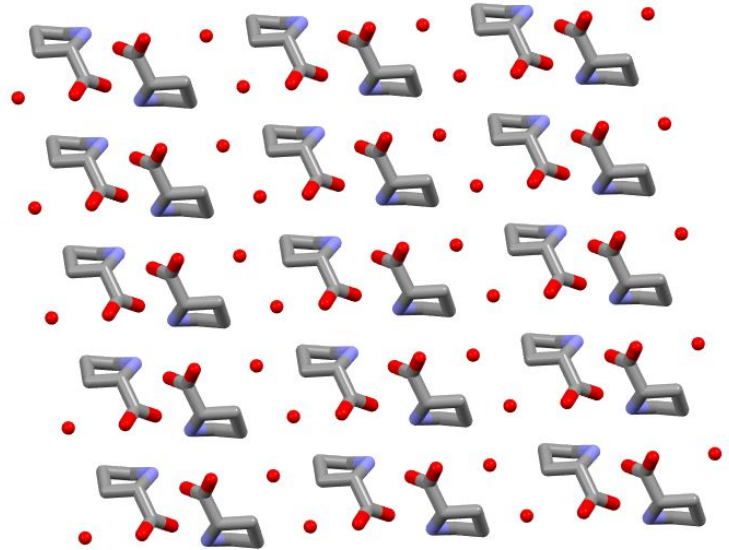
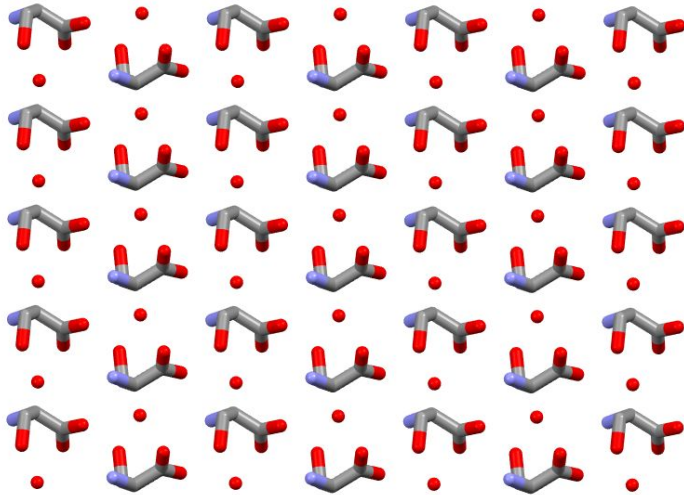
What else can amino acids do?

Amino acids can be made into their crystal hydrates, which have very interesting properties.



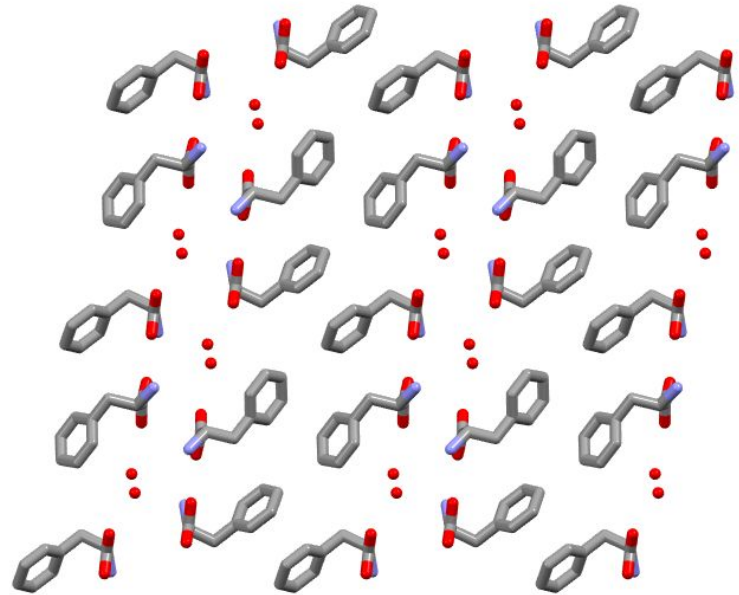
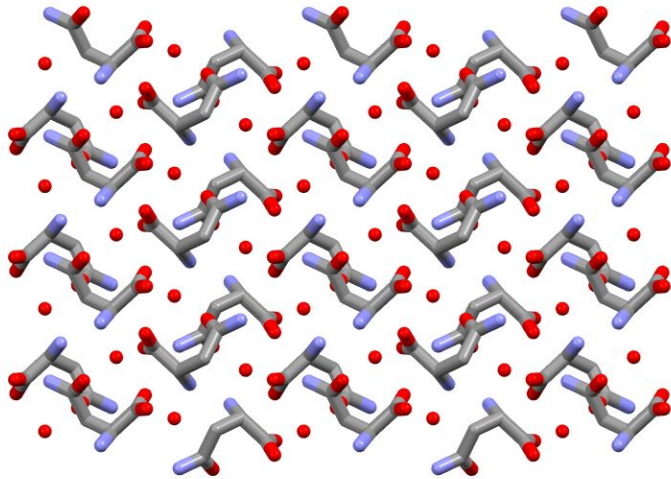
What properties are we talking about?

In our opinion, the most useful ability of amino acid crystals is the evaporation of water from the inside. Free water molecules are connected to amino acid molecules only by weak hydrogen bonds, so they easily detach.



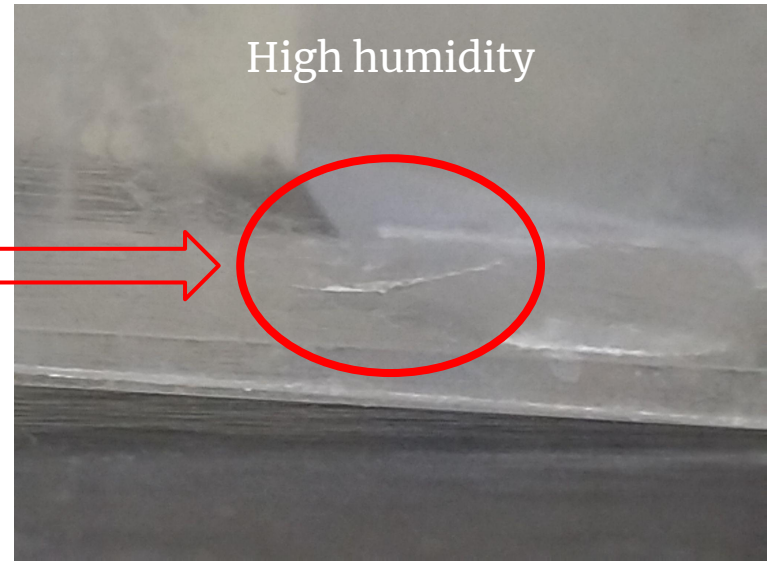
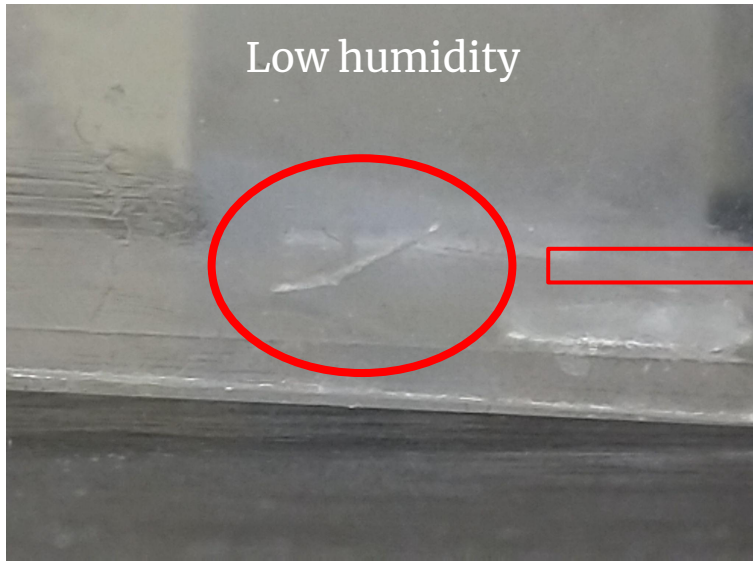
Why is this so important?

After detachment of water molecules, the crystals change their shape and decrease in volume.



What can we use this ability for?

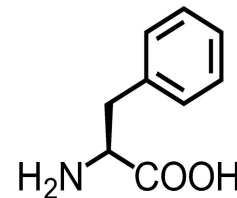
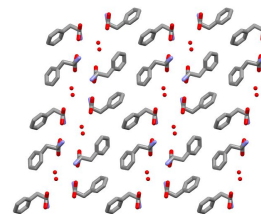
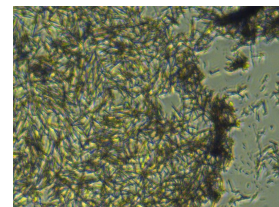
Using this property, we can make films that bend by themselves at different humidity levels.



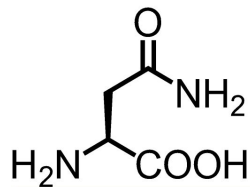
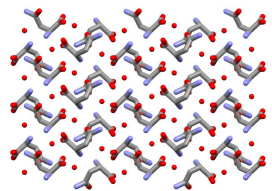
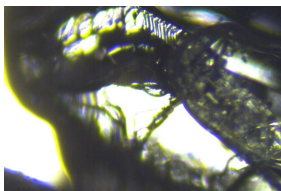
What did we do?

First, we made crystals from the amino acids we had access to. Then we dissolved them in water, mixed this solution with a glue solution and spread it on thin sheets of Mylar.

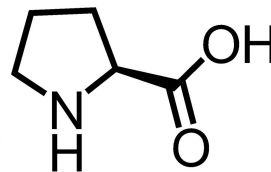
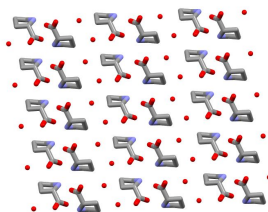
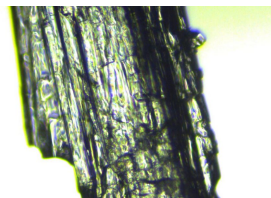
Phenylalanine hydrate



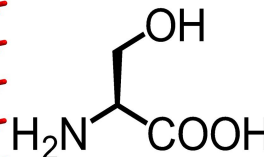
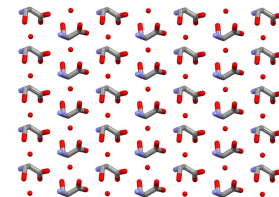
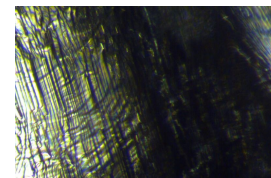
Asparagine hydrate



Proline hydrate



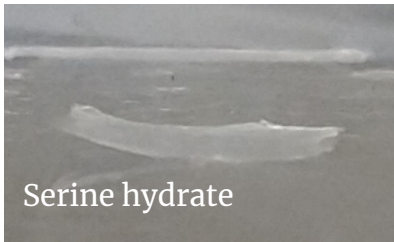
Serine hydrate



How do those films work?

When we reduce the humidity of the air, the water molecules evaporate from the crystals, the crystals shrink in volume, and, because mylar does not change its volume depending on the humidity, the sheets bend.

Low humidity



High humidity



Low humidity



High humidity



Low humidity



High humidity



Low humidity



High humidity



How can we use them?

We can use sheets of amino acid and mylar as actuators for motors. We can also use them to produce electricity, as their ability is one of the most efficient ways to convert chemical bond energy into mechanical energy.



Examples of use

We can somehow attach many of these films to electrical generators and place them over the ocean (or any other large bodies of water). Because the air masses are constantly moving, the humidity is constantly changing and the films are bending and unfolding, generating electricity.



Potential future research

This is a fairly new discovery, so scientists are constantly finding new ways to use this phenomenon, as well as development methods, the scale of its potential use, the resources that will be needed.



Thank you for your attention!