

# Die Natur der Naturwissenschaften (The nature of science)

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Research: Improving teaching and learning

Science subjects in school often focus on facts and experiments. This gives rise to the myth that the natural sciences are purely objective and logical, with experimentation being the main focus. But this is not true, because the natural sciences are MUCH more.

My name is Petra Skiebe-Corrette. I am a habilitated neurobiologist and have been the head of the NatLab student lab at Freie Universität Berlin since 2004.

And my name is Dirk Krüger. I am a professor of didactics in biology. We teach student teachers how to successfully teach biology, and our research focuses on how we can improve the teaching and learning of biology.

## **Nature of Science - Research**

One of my research fields is the nature of science. With my research group, I investigate which concepts students and pupils have about the properties of the natural sciences.

We differentiate between 3 areas:

The first area includes the tools, processes and products of science.

In addition to experimentation, there are many equivalent methodological tools of equal value, such as modeling, comparing, and observing.

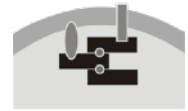
This raises questions about how scientific hypotheses can be formulated precisely and why describing data is different from interpreting a result. And it is important to be able to distinguish different knowledge products, such as models, laws, and theories.

This area also includes the perception of the many different fields of activity of scientists and the importance of evidence.

The second area deals with the limits of the natural sciences. Scientific knowledge is always provisional. Theories or laws, despite their current credibility, are never absolutely certain - they can change.

Since questions of an ethical, religious, or aesthetic nature cannot be resolved by scientific methods, they are not considered scientific questions. Tests and interviews show that few respondents are aware of this. In addition, it is important to remember that scientific progress always depends on the further development of technology.

The third area concerns the role of man in science, i.e. the working man and the interaction between science and society. People can solve scientific problems not only with logic,



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but also with their imagination and creative ideas. We distinguish between "observations" and "interpretations", because this makes it clear that the scientific interpretation was made from a specific point of view and thus also contains subjective elements.

One example of the interaction between natural science and society is science communication. Scientific research is financed by taxpayers, among others. Therefore, not only do the scientific results have to be communicated to the public, but also the approaches and working methods of the researchers.

The German Research Foundation not only supports research per se, but also always promotes its communication. For example, with Collaborative Research Center 958, which studies the interaction of various proteins at cell membranes, we have realized videos in which the researchers show themselves and their work.

We also work together with two student laboratories: the NatLab at Freie Universität Berlin and the Life Science Learning Laboratory at the Max Delbrück Center in Berlin-Buch. Here, a "window into research" is created, so to speak, because interested students meet researchers here.

By working in authentic scientific locations, interest in the natural sciences is fostered, hopefully providing for informed study and career guidance.

There are offerings for entire school classes or upper school courses, as well as programs for individual interested students. And students, student teachers, and teachers can network with scientists.

In one experiment we deal with the structural elucidation of the model protein "lysozyme". The basics of crystallization are explained as well as the modeling of the protein with the help of computer programs.

Elucidating the structure of proteins helps us understand their function in cells. And in the same way, an understanding of the nature of the natural sciences helps to be able to judge the significance of natural science.

Project website: [bcp.fu-berlin.de/nos](https://bcp.fu-berlin.de/nos)

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