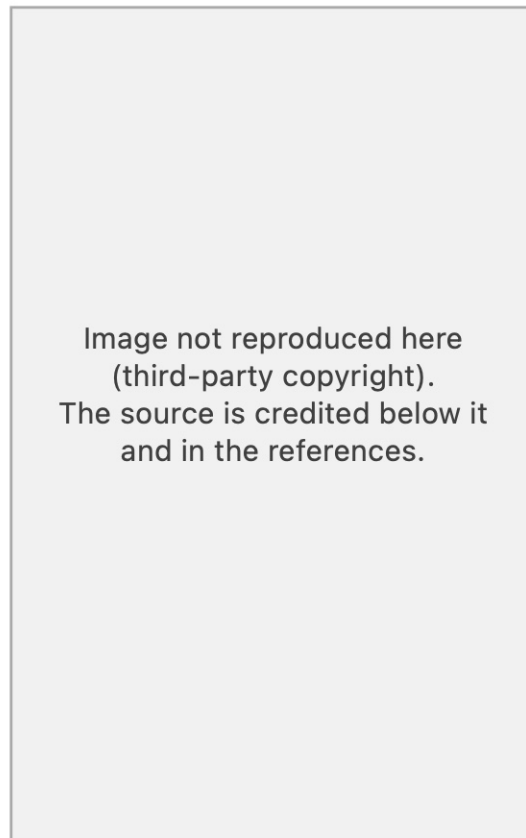


TOK Exhibition: To what extent is certainty attainable?

Object 1: DNA double helix diagram



(Mardaneh, 2007)

This diagram of the DNA double helix is a key concept in genetics and biochemistry, and a symbol of scientific knowledge. It shows two strands wound around each other, linked by base pairs. This iconic representation is one of the most significant scientific discoveries of the 20th century, receiving a Nobel Prize in physiology and medicine. Yet despite its appearance of certainty and symbolism of scientific knowledge, the double helix is really just a model, created through a process called X-ray crystallography, biochemical experiments, and molecular theory (Mardaneh, 2007).

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The significance of the object lies in the fact that it is often accepted as certain in education; however, it is important to understand that we accept it as certain only because of a long series of scientific assumptions. For example, some of the assumptions for this specific model are that the process of X-ray crystallography accurately reflects molecular geometry and that DNA follows standard chemical rules and laws (Pray, Leslie A., 2008). Only if those assumptions hold can we consider the model valid. Yet these necessary scientific principles often rest on even deeper assumptions. Therefore, this raises the question: to what extent is certainty attainable?

The diagram of DNA as a double helix structure illustrates how scientific knowledge builds certainty through accepted assumptions that we hold to be true. While we can not observe the structure of DNA with the naked eye, the consistency of the experiment and the scientific method justify the trust in the model. In this case, certainty is not absolute as questions arise around possibly endless environmental assumptions; however, from a scientific perspective, the model is provably constructed. The object shows that in science, certainty is attainable as long as we can accept that certain foundational assumptions are true; otherwise, scientific knowledge and models are unprovable and therefore uncertain. This implies that the certainty of scientific frameworks is built on conditional trust in methods and assumptions. Therefore, while models like the DNA double helix may feel certain, the certainty is always provisional - highlighting that scientific certainty is conditionally attainable but never absolute.

Object 2: Mercury Ointment Jar

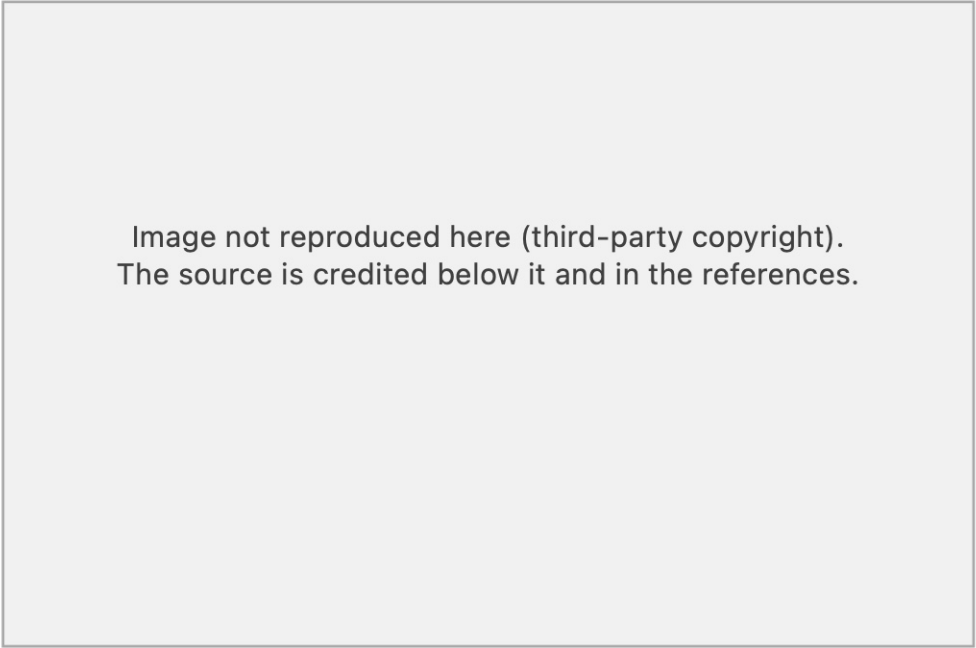


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Royal Pharmaceutical Society Museum. (n.d.)

This object is a ceramic jar that once held a mercury-based ointment used to treat syphilis. The ceramic jar dates back to a time when alchemical principles dominated scientific knowledge, beliefs that today we consider completely incorrect. The object serves as a powerful representation of how scientific certainty can shift dramatically over time. What was once treated as accepted medical knowledge, the belief that mercury-based treatments were effective for syphilis, is now understood to be harmful and chemically toxic (Wong et al., 2016).

The jar used to store mercury ointment challenges the belief of science being certain, illustrating how “scientific” beliefs can be later disproven. From the 15th century until the late 19th century, mercury treatments were considered medical facts. This object raises the question: if certainty in science failed before, how can we be sure it won’t again (Royal Pharmaceutical Society Museum, n.d.)?

However, it is important to note that this object doesn’t mean we must abandon the idea of scientific certainty altogether, as assumptions change. The ceramic jar shows that certainty is also based on the historical and scientific context of the time, and often only valid within a particular theoretical context. Mercury treatment made sense in 16th–18th-century medicine, but was later proven harmful by more advanced science.

This jar reminds us that scientific certainty is always temporary—attainable, but only under specific assumptions. As those assumptions change, what we call “certain” can quickly collapse. Therefore, this object yet again supports the idea that certainty is real and attainable

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in a scientific context. Still, a consequence of this is that beliefs we consider certain may be correct at one time but may collapse in the future, indicating that certainty is tied closely to time-bound knowledge frameworks, making it historically dependent and open to change.

Object 3: Boiling Water on a Stove Top



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Krystal (2021)

The object is a photograph of a pot of water boiling on a stovetop, with a digital thermometer reading 212°F (100°C). It represents a rudimentary demonstration of repeatable scientific observation, where, under the conditions of 1 atmosphere of pressure, water predictably begins boiling at 100 degrees Celsius. This specific scientific observation is not only a generally accepted scientific fact but also is a commonly used practical way for calibrating thermometers (New York City Health Department, n.d.).

In the context of the prompt: “To what extent is certainty attainable?” The object provides a reliable example that certainty in a scientific context can be completely attainable, and observations can be repeated under specific conditions. The scientific standard of the boiling point of water under standard conditions is not at all theoretical but practical and directly observable. When conditions are perfectly met- sea level, atmospheric pressure, and purity - the result is guaranteed - unlike more complex models based on shifting assumptions. The

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boiling point of water is a certainty that is entirely rooted in physical thermodynamic laws, which have never shown deviation when all key variables are accounted for.

It can be argued that this certainty is conditional; a slight change in air pressure, altitude, or purity can render this observation inaccurate. However, it does not mean that the phenomenon is not true; it simply highlights the fact that certainty in science can be fully achieved, but only when variables are tightly constrained and clearly defined, showing that certainty is attainable when conditions are tightly controlled.

The objects illustrate that certainty is entirely attainable, but only in the presence of clearly defined assumptions and contexts. While scientific frameworks offer high levels of confidence, history shows that they remain open to change. Therefore, certainty is conditional—attainable in specific frameworks, but always open to re-evaluation as knowledge evolves. This highlights that understanding the limits of certainty is just as important as recognizing its presence, encouraging a more refined view of knowledge that values certainty but also accepts its limitations.

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