# Representation and Belonging in Organic Chemistry

## Transcript

00:00:01:80 - 00:00:28:07
**Dr.Jessie Key:** Hello again, in this video we're going to discuss some aspects of representation and belonging in Organic Chemistry. Chemistry is the study of matter and the interactions of matter. This means that humans have been doing chemistry by learning about matter, by interacting with the world around them since time immemorial.

00:00:28:07 - 00:01:00:85
**Dr.Jessie Key:** Ancient philosophers, such as Empedocles and Aristotle, sought to classify matter using a system based on four elements, Fire, Earth, Water, and Air. Is believed that the term element was first used and defined by Aristotle here. Until the 1800's, many alchemists, medical practitioners, and philosophers held beliefs about matter based in mysticism or vitalism.

00:01:00:85 - 00:01:34:97
**Dr.Jessie Key:** Bottom left of the slide is a painting from 1771 entitled “The alchemist discovering phosphorus”. It is meant to show a surprising discovery when an alchemist accidentally discovers phosphorus instead of their desired outcome, turning a common metal into more valuable gold. Many alchemists focus their efforts on tasks which we would now consider the realm of fantasy, such as the ‘transmutation’ of inexpensive metals into more valuable metals or the creation of elixirs of immortality.

00:01:34:97 - 00:02:19:48
**Dr.Jessie Key:** Vitalism, a popular belief until the 1800's, proposed that materials from living organisms were created from or contained a thing called vital force, which is distinct from physical or chemical processes. Organic Chemistry as a scientific field, began in the 1800's with inquiries into the understanding of the molecules of living organisms. Arguably, the field of organic chemistry was recognized as starting when Friedrich Wohler was able to refute the claims of vitalism by synthesizing urea, a compound of bodily fluids using non-living material in 1828.

00:02:19:95 - 00:02:57:67
**Dr.Jessie Key:** We now classify Organic Chemistry as the chemistry of carbon compounds, of which there are over 195 million known. We find organic molecules in many areas of our

lives, biological molecules, including DNA, RNA, carbohydrates, protein, lipids they are all organic. Many medicines from aspirin to monoclonal antibodies, industrial materials, including plastics, clothing, foods, and fuels like gasoline, diesel and natural gas are organic molecules.

00:02:57:67 - 00:03:41:20
**Dr.Jessie Key:** The courses Organic Chemistry I and Organic Chemistry II focus on the fundamentals of the discipline, such as how we represent or draw molecules, how we communicate about molecules and how we analyze or characterize molecules and the reactivity of molecules. Because we're focused on these fundamentals, most of the scientists discussed in our Organic Chemistry courses and textbooks popularize this material in the 1850's to 1950's. The timeframe where the field of Organic Chemistry was in its infancy and developing at a rapid rate.

00:03:42:33 - 00:04:16:10
**Dr.Jessie Key:** To exemplify this point, I plotted the time frame for all scientists named directly or indirectly in the first ten chapters of McMurray Open Stacks Organic Chemistry tenth edition in the graph below. The greatest overlap is between the time period of 1850 to 1950 with very few beyond the year 1975. In this time period, the countries and universities devoting resources to develop the understanding of this new field were primarily in Europe and the United States.

00:04:16:10 - 00:04:44:50
**Dr.Jessie Key:** In this bar chart on the left side of the slide, you can see the top 12 countries in terms of number of scientists mentioned in the first ten chapters of the McMurry Organic Chemistry tenth edition textbook. The United States takes the top position with the remainder being primarily from European countries like France and England. The street map image on the right helps to visualize how limited the global representation truly is.

00:04:47:35 - 00:05:03:63
**Dr.Jessie Key:** Culture and practices in this time period in Europe and the United States were very different from today. Scientists at the time were almost exclusively male. In fact, all scientists mentioned in the first ten chapters of Organic Chemistry tenth edition were male.

00:05:03:87 - 00:05:28:31
**Dr.Jessie Key:** Today, Organic Chemistry is a much more diverse field with global research efforts. I have plotted the top 20 countries contributing to chemistry research articles in the year 2023 to illustrate this point. The top country in terms of chemistry research in that year was China, and there's representation of many countries from North America, Europe, Asia, and Oceania.

00:05:28:59 - 00:05:56:07
**Dr.Jessie Key:** Because modern Organic Chemistry is a global community, organic chemists are much more diverse than the scientists represented in our textbook. According to the

American Chemical Society, one of the largest associations of chemists in the world, it's 2022 membership identified as 67.4% male, 32.4% female, and 0.2% non binary or self described.

00:05:56:35 - 00:06:29:76
**Dr.Jessie Key:** In my time as a chemist, I've had the opportunity to perform research internationally and here in Canada with a diverse group of brilliant scientists. Our modern day organic chemistry heroes are often recognized for their contribution with awards like the Nobel Prize, which are like the science equivalent of the Oscars or Emmy Awards. These giants in the field come from many different countries and have diverse backgrounds, but all share a passion for chemistry, which has led them to great success in their respective areas.

00:06:29:76 - 00:07:03:72
**Dr.Jessie Key:** On this slide, I'll point out a few recent Nobel Prize winning chemists who have contributed greatly to the field of organic chemistry. On the left is Akira Suzuki, a chemist from Japan who won the 2010 Nobel Prize for the development of a class of organo-metallic coupling reaction, which is named after him. In the center, we have Carolyn Bertozzi, an American scientist who won the Nobel Prize for her contributions towards the area known as "bioorthogonal chemistry", These are chemical reactions for use within living biological systems.

00:07:03:72 - 00:07:32:21
**Dr.Jessie Key:** An interesting fact is that during her undergraduate years at Harvard, she played in a band called "Bored of Education" with Rage Against Machine guitarist Tom Morello. On the right is Sir Demis Hassabis, who won the Chemistry Nobel Prize in 2024 for research using AI and computational methods to help predict how proteins fold. At the time of recording this video, he's the chief executive officer and co founder of Google Deep Mind and advisor for the UK government.

00:07:32:21 - 00:07:41:69
**Dr.Jessie Key:** Organic Chemistry is a field which has changed greatly since its inception in the 1800's, and all are welcome within this discipline of science and this course.