

Chemistry progresses.

Individual scientists struggle to acquire knowledge, and in their struggle they are driven by many complex motivations. (1) Because researchers are human, they are subject not only to inaccuracy, but sometimes prejudice. (2) Remarkably, the error and prejudice of individual chemists does not matter to the progress of chemistry. (3) Chemistry as a science, the collective activity of the half-million people in the world who are chemists, advances despite mistakes by individual chemists. (4) The science has self-correcting features in abundance: the most important one is that the more interesting the observation or theory, the more likely it is to be checked by someone else. (5) This is often for entirely the "wrong" reasons - driven by plain disbelief arising from the conviction that the initial observation must be wrong. (6) It doesn't matter why an individual chemist repeats a critical synthesis, or tries an alternative theory. (7)

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There is other stuff going on to make us what we are, including random factors.

Today's evolutionary scientists are less keen to try to learn about a gene-defined "human nature." (1) In fact, the whole "human nature" idea is looking more and more bogus. (2) Awkward family gatherings may be difficult to endure, but they provide ideal opportunities to observe that people who are raised together and share a lot of the same genes don't necessarily behave in the same way. (3) Neither genes nor environment do a good job of predicting how our children will turn out. (4) Neither factor (alone or in combination) can explain why a challenge that makes one child resilient can scar another child for life. (5) We may have to accept, like our ancestors did, that some stuff just happens — call it luck or "fate." (6) Not all the influences in our lives can be pinned down and explained. (7) Humans haven't evolved a mind programmed to respond in certain ways. (8) We evolved a mind that could evolve, and it has made us what we are today — a very different animal. (9)

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This is why, for example, the extinction of the dinosaurs lies directly on the Cretaceous-Tertiary boundary: The boundary was set to mark their loss.

Fossils were the best and easiest way to correlate between rocks that did not touch each other directly. (1) Some species of fossil life can be found in many locations around the world, and so form important markers in the geologic record. (2) Relative time was broken into sections divided by changes in the rock record, for example, times when many species apparently went extinct, since their fossils were no longer found in younger rocks. (3) The largest sections of geologic history were further divided into small sections, and so on, from eras, to periods, to epochs. (4) For centuries a debate raged in the scientific community over how much time was represented by these geologic divisions. (5) With the development of radioactive dating methods, those relative time markers could be converted to absolute time; for example, that the oldest known rock on Earth is 3.96 billion years old, and the Cretaceous-Tertiary boundary lies at about 66.5 million years ago. (6)

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Any definitions of "eating" and "moving" that are broad enough to encompass such a range of meanings would be useless.

Many biologists are impatient with the question "What is life?" (1) They point to past attempts to distinguish the living from the non-living (traditionally, organisms are said to eat, breathe, excrete, grow, move, respond to stimuli and reproduce) and tell us, quite rightly, that all such attempts have proved inadequate. (2) The reason why they have proved inadequate is simple. (3) Eating involves wildly different processes in, say, oak trees and weasels. (4) Weasels "move" in ways that oaks do not, and so on. (5) They would apply to many non-living things as well as living ones; and however broad we made our definitions, there would probably still be living things to which they would not apply. (6) The quest for a clear distinction between living and non-living has always been pointless, say the cynics, so it is a waste of time to consider the question further. (7)