Oscillator

Xenobiology

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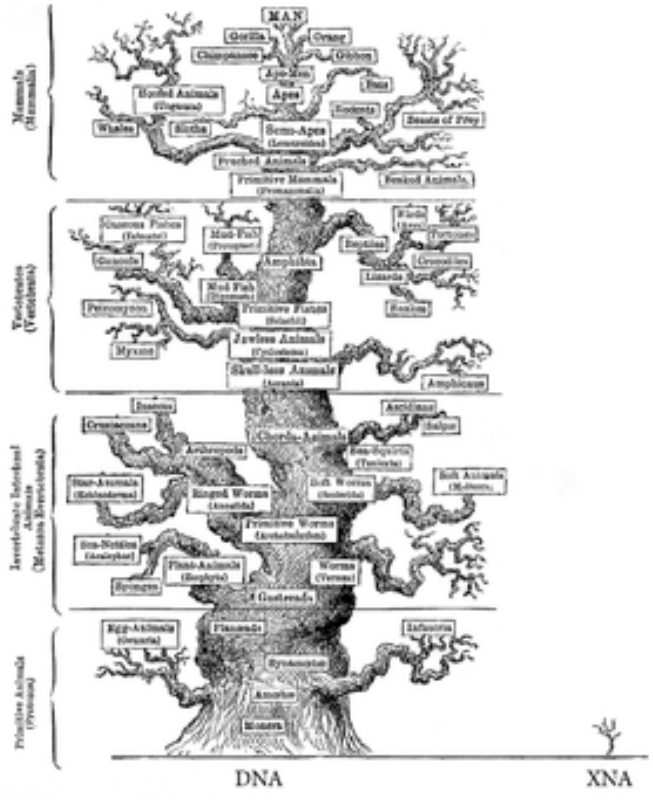
An interesting paper in BioEssays last month looks at the potential future of xenobiology, totally orthologous biological systems made out of synthetic nucleotide and amino acid bases, new cells that use XNA instead of DNA. The author, Markus Schmidt, argues that while the design of such systems current poses a difficult technological challenge to researchers in synthetic biology, that xenobiological systems will enable a "genetic firewall" between natural and designed organisms, creating a built-in measure of biosafety.



This is something I've argued for before, in reference to creating new genetic reading systems for cells, so that even if DNA was passed between organisms, a natural organism would read the synthetic gene as genetic gibberish. Schmidt takes the discussion much further, pointing out that even though there will be a genetic firewall, synthetic organisms will likely be able to still interact with natural organisms at a chemical and ecosystem level, passing chemicals back and forth in the environment. This kind of interaction is something that has to be thoroughly considered in the design of new biologies, and may turn out to be difficult to predict in practice.

New biologies will also likely have a huge impact on how we think about life. Schmidt ends his essay on an interesting and complicated note--how will designed xenobiology affect our worldview, our notion of life?

The history of science shows several changes to our worldviews, altering our folk-based narratives to more scientifically inspired (semi-)rational approaches. In this context, science has inflicted a series of disappointments and disillusions to our folk-based beliefs, such as: the earth is not the center of the Universe, men and apes share the same ancestors, or that emotions and thinking is correlated to a neurological substrate. The promoters of these ideas were often attacked by those trying to keep the intellectual status quo. Xenobiology could easily trigger the next paradigm change in the way we understand nature and life. Just as the Earth lost its place as the center of the universe, or men lost its unique status in the animal world, our natural world could lose its unique status as being synonymous with "life." But as with all other paradigm changes, concepts that better explain the world around us cannot be ignored for long.

If a new genetic paradigm built out of synthetic chemicals instead of naturally occurring DNA bases was designed, would it affect your sense of self? DNA's centrality to living systems on Earth is by no means a sign that DNA is the only genetic molecule that life can be based on, or that there even needs to be a genetic molecule at all. Manipulating and designing new kinds living systems will tell us a lot about what it means for something to be alive, but it shouldn't make life on Earth any less important or fascinating to us as people.