

Our Biology Makes Us All Truly Equal "Race" is a persistent example of our imagination.

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Bookshelf of the Universe, in 30 Volumes.

Unlikely and exotic as it may seem, the best explanation for the facts of astronomy today is that the Universe began at a point, all at once, some 13.7 billion years ago. As space has expanded from that point to beyond the furthest galaxies today, it has never once been separated from the passage of time, with one exception. Time does not flow in our dreams as it does in nature; we may imagine timeless idealizations, perfectible futures and heroic pasts, all at once.

About 4 billion years ago—recent history, in terms of the Universe—something nearly unimaginable occurred here on Earth. In the salty seas, clusters of atoms hooked up into long strings, at random initially, and a very rare sequence of those strung-out clusters acquired the capacity to make a copy of itself, preserving the sequence of its subunits. One of those self-copying strings of chemical letters—DNA—has been copying itself ever since.

DNA is a chemical of great informational density, a text of enormous importance. As far as we know today, it is a new feature in the history of the Universe, having appeared on our planet and nowhere else. Of course, self-copying is a necessary piece of life's emergence on our planet, but it is not sufficient to tell the whole story. The second requirement for life is that the different strings of self-copying DNA carry meaning, and that one of these meanings is the capacity to assist the DNA in making more copies of itself. Thereafter, any version of DNA encoding a novel strategy for the survival of DNA would itself be preserved as the novel meaning of that new sequence of DNA. This second step—Darwin called it Natural Selection—is both necessary and sufficient to explain the history of life on Earth

from the first DNA-encoded organisms to ourselves and all the species of creatures and plants alive on Earth today.

Our form of life, emergent by the same process of natural selection that has produced the living novelties of this world, has been around for only a very short amount of time.

Think of each million years since the beginning of the Universe as being a page in a book. Today that bookshelf of the Universe would hold 30 volumes of 450 pages each. The first 21 volumes would have nothing in them about life. Fossil evidence and evidence from DNA sequences both recognize that the informational molecule DNA would have been born some time in Volume 21, because archaeobacteria, the first forms of life, appear in the seas in Volume 22.

Bacteria were the only shape life took through Volumes 23 and 24, though the ones emerging in Volume 24 would change the planet's atmosphere to one rich in oxygen, by bacterial photosynthesis. Big-celled forms of life like paramecia and diatoms would appear for the first time in Volume 25. Living things made of many big cells would appear in Volume 27. Animals would remain in the seas where life began until the first forms of animal life on land—the first tetrapods—march on shore at the end of Volume 29.

Dinosaurs would appear in the middle of Volume 30. They would for the most part be wiped out by an asteroid on page 385. Only the last 65 pages of the last volume would have anything to say of significance about mammals, like the cat. The last ancestor of both ourselves and our nearest living

relative, the chimp, would have lived and died only by page 440 of the most recent volume, 10 million years ago. From that ancestor many other ancestral hominoid species would follow, each coming and going in those last ten pages.

On the last tenth of the last page of that last volume humans would merit a note about our emergence in Africa. And then, somewhere toward the last sentence written so far, the editor would mention the emergence of language, texts, and the *mental* world of thoughts and imagination, like *Alice's Adventures in Wonderland*. The period at the end of that sentence would hold the time since science emerged in our mental worlds as a social activity with the capacity to understand all this.

In this last eye blink of universal timekeeping, we find ourselves entranced by two notions that share the same persistence in our minds and the same imaginary quality as Alice herself: that a person is no more than what that person has inherited in her DNA, and that a person's race is merely the clearest example of that generality.

The facts of science assure that our mental worlds are *not* encoded in our DNAs. Any brain can imagine, learn, teach, remember, or forget any idea, regardless of the ancestry of the person whose mind is emergent in that brain, and regardless of whether that idea reflects the facts of nature. Perhaps the most self-serving and punitive example of such a dreamt idea is the notion that "genes are destiny." They are not. The dream that they might be certainly prevents a person from celebrating the freedom to compose novel thoughts, which is in fact the birthright of every human brain and mind.

The differences in base-pair sequence—letters in the text—for the coding region of any gene studied come to about one in a thousand between any two unrelated people. The DNA sequences of the cells of two siblings are more alike, but not by much, as each copy of parents' genes has only a one-in-four chance of being the same for both children. Cumulatively over all 10,000 genes, even brothers' and sisters' DNA sequences are distinct to almost the same degree as strangers' sequences. With three billion letters in the DNA we inherit from each of our parents, that one-in-a-thousand difference adds up to many million sequence differences between any two people, except for identical twins.

What makes our genomes human—and all that makes us human in a biological sense—is that these [6.8 billion different genomes](#) are capable of coming together with each other through sperm and egg to make another generation of people. The sieve of natural selection assures us that no matter what the differences in our DNA sequences, all of us are here because our ancestors' DNAs contained the capacity to encode the structures for fertile reproduction in their bodies. Everything else encoded by our DNA that makes us different from one another is in service to the necessity of fertility to our survival, or it is a difference carried along by fertility because it does not get in the way.

No rational explanation of humanity, then, can possibly begin with the claim that one set of these exceedingly large number of genetic variants encoding fertile but different people encodes a full human, and another encodes an *apparent* human unworthy of full recognition and rights as "one of us." The biology is clear: There is no chance of some human genomes being special and others not. Our biology makes us all truly equal.



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