

## **Navigating the Future in a Sea of CRISPR Uncertainty: Contemplating Map Essentials**

**June 24, 2019**

### **How do we define humanity?**

#### ***Opening Words***

“My tribute to a relative.”

This morning we remember *Homo luzonensis*.

Welcome to the family.

Your bones and teeth, remains from two adults and one child were found resting in a cave on the island of Luzon, they hint at your place among us, the hominins.

Your DNA signature and relation to earlier hominins is still a mystery, but enough to ponder again how many of our relatives may have left Africa before we did.

50 to 67 thousand years ago we shared the planet with you, but only our evolutionary path led to today.

Still, we can remember you and try to learn more about you.

Forgotten no longer, welcome to the family.

By early 2014 Jennifer Doudna was becoming increasingly concerned about the new gene editing tool she had helped reveal to the world. Her concern especially centered around the likelihood that sooner, rather than later, the technology would be used on human embryos unleashing our ability to swiftly edit the human germline. The results of this tinkering, like it or not, would then be passed onto future generations. Natural selection over deep time could be upstaged by human technology. Assuming “descent with modification” writ large over deep time was

the author that defined “what it means to be human” are we prepared to steal the pen and write our own definition? The general consensus by many scientists, including Doudna, seems to be No:

“Until we have a better understanding of all the attendant safety and ethical issues, and until we have given a broader range of stakeholders the opportunity to join the discussion, scientists would do well to leave the germline alone. But, really, whether we’ll ever have the intellectual and moral capacity to guide our own genetic destiny is an open question-one that has been on my mind since I began to realize what CRISPR was capable of. *...We should think twice before crossing that line. And then we should think again.*” (p. 182)

So here we are thinking hard and thinking again. Doudna, along with a small group of other scientists including leaders from the national academies in the United States, the United Kingdom and China, eventually published a whitepaper in the Spring of 2015 that asked scientist to hold off making heritable changes to the human germline. However, they purposely chose not to use the word “ban” or “moratorium”. *I do not believe for one moment that the use of stronger language would have kept what we all know happened next from happening*, namely in November 2018 He Jiankui, a Chinese scientist, announced that he had used CRISPR to create genetically modified twin babies. Now we have that stronger language. In reaction to that announcement a commentary by scientists and ethicists from seven nations was published in the journal *Nature* in March 2019 that calls for a moratorium on gene editing experiments designed to alter heritable traits in human

babies, and for the creation of an international governing body. *Yet how easy it was for someone to take that first step across the line.* Now what? Hopefully regulations but...

Do you think we could ever agree on how we might use CRISPR to define our genetic destiny? Maybe one place to begin thinking about this is with a reflection on where we are now, that is, how do we define humanity? Is there something in the definition that we can agree should be unalterable and thereby provides a constraint on editing the human germline? And how do we think about that without considering where we have come from? *The question that captures all of this for me is- "What does it mean to be human?"*

For just about two years, from March 2015 to April 2017, I had the opportunity to ask 19 different communities around the country that question as part of the public programming for the Smithsonian's traveling exhibit "Exploring Human Origins- What Does It Mean to Be Human?" The curator of the permanent human origins hall at the Smithsonian's National Museum of Natural History, Rick Potts, created this portable exhibit to bring scientific discoveries about human origins outside the beltway, to individuals who might never visit DC. The Smithsonian's Human Origins Program worked in partnership with the American Library Association to make this happen. We chose 19 libraries to display the exhibit for one month during which time the Smithsonian team provided two public programs, one a science lecture and the other a community conversation, and two by invitation events, one for area clergy and one for science educators. I serve the Smithsonian's

Human Origins Program as a Co-Chair of the Broader Social Impacts Committee, and during the exhibit's tour I facilitated the community conversations.

The exhibit highlights that the development of traits we associate with being human, including walking upright, large brains, tool use, longer childhoods and the use of symbols, are traits that appeared over a time span of 6 million years. The exhibit is a science exhibit and it strives to introduce visitors to the evidence for evolution and how scientists know what they know about human origins. The challenge we faced with the community conversations was to create a space where people could respectfully share their thoughts about human origins while being encouraged, ever so gently, to consider what scientific discoveries about human origins might mean for how they think about their place in the world. Always we began this discussion by inviting people to share their answer to the question "What does it mean to be human?"

So how did people answer this question? If you would like to get a flavor of the answers for yourself, then I encourage you to visit the Smithsonian's Human Origins website where the answers that were left on sticky notes on a panel in the exhibit are displayed for each of the 19 libraries. The answers are far ranging and similar to those we heard in the community conversation. *Never once though, did I hear someone refer to the human genome to describe what it means to be human. I did, however, hear plenty of references to being created in God's image.*

It was kind of a trick question, wasn't it? Asking people to define what it means to be human in the context of illustrating milestones of human evolution spread over 6 million years, and where 3 million of those include a running total of now 10

different identified species in the Genus Homo. These 10 species are part of a larger group of hominins, -members of the human family tree who are more closely related to one another than they are to chimpanzees and bonobos. After presenting a hominin bush of shared traits, we beg an answer to a question that seems to be asking what it is that makes us unique. The thing we know for sure is that we are the only hominin example currently alive. *Does that translate into our genomes, which resulted from 6 million years of evolution, defining what it means to be human?*

Our audiences never mentioned this, they preferred to list identifiable characteristics that I think they believed separated us from all other life. Created in God's image fell into that category, *and maybe it's the cleverest answer of all, because with it we can claim a unique category while not necessarily settling on what we mean by "image."* Is it our capacity for reason and our free will, that is our ability to think and choose, that is unavailable to the rest of creation? Is it our capacity for complex and intricate relationships, especially with God that sets us apart from the rest of life? Or a calling to be God's representatives in the world? Theologians have proposed all of the above. What they are struggling with is trying to identify that aspect of humanity which is defining and therefore unalterable. Can we agree that such an aspect exists? Scientific discoveries, in terms of understanding nature and natural processes, as well as being able to use technology to manipulate them, both challenge easy answers and create a new urgency around sorting this out.

One of the challenges that science presents to our struggle with defining human uniqueness is the persistent nudge, by at least some anthropologists and primatologists, for us to recognize not only physical but also behavioral

characteristics we have in common with other animals, particularly mammals. Currently the work of individuals like Barbara King and Frans de Waal, for example, ask us to re-consider the capability of animals in terms of both emotion and cognitive abilities. Read the sticky notes people attached to the traveling exhibit panel where we asked them to share their answer to the question “What does it mean to be human?” *and you will find many references to emotions and intelligence.* Here is what Frans de Waal, a primatologist, would like us to understand about animals and emotions:

“Let me start off with a radical proposal: emotions are like organs. They are all needed, and we share them all with other mammals. ...shame, guilt, revenge, forgiveness, hope, and disgust, we can’t exclude their presence in other species. These emotions may be more developed in us, or they may be used under a wider range of circumstances, but they aren’t fundamentally new. That some human cultures emphasize some of them more than others hardly argues against a biological origin.” (*Mamas Last Hug*, p.165-166)

De Wall is careful to draw a distinction between emotions and feelings:

“Emotions are bodily expressed, hence observable, whereas feelings remain private.” As a scientist he is in the business of observing bodily expressed emotions in animals, particularly primates, but while he will not conclude that he can know with certainty what any primate feels, he would like us to recognize “how similarly the emotions manifest themselves in animal and human bodies.” We may never know precisely what an animal feels but to deny them feelings is nonsensical in his view. *To be kind, to be grateful, to love, to have emotions- these are all answers*

visitors gave to the exhibit's question "What does it mean to be human?" Frans De Wall wouldn't deny those attributes to humans but he wouldn't limit them to only humans. And all those animal emotions,... they reflect the complex and intricate relationships that mammals experience.

What about our ability to think and choose, reason and free will, unique to us? I'll bet you can guess what Frans De Wall would say about that...

"Today we are in the midst of a belated cognitive revolution with regard to our fellow species...The internet regularly features exiting scientific breakthroughs in evolutionary cognition –the study of human and animal intelligence from an evolutionary perspective-accompanied by striking videos of apes, corvids, dolphins, elephants, and so on demonstrating causal reasoning, theory of mind, planning, self awareness, and cultural transmission. This new research has increased the regard in which we hold animal intelligence so dramatically that we no longer need miracles to explain the human mind. Its basic features have been around for ages." (*Mamas Last Hug* p. 262).

The expression of emotion and intelligence in Homo sapiens is unique in terms of level of development or degree, but the overall argument being made by De Walls is that we are off track when we look for an extraordinary jump that took place in terms of human evolution, rather than the usual slow course of evolution. *Crossing over from human to other animal through natural selection, whether a step backwards, forwards or sideways, is all about fuzzy lines drawn in deep time. It is a trick question- "What does it mean to be human?"*

*Perhaps CRISPR has the potential to draw sharper lines in shorter time frames.*

But that is a defining feature of humanity today, isn't it?- our ability to alter our surroundings at an unprecedented rate, and now not just the environment, but the human genome that interacts with the environment. We have the potential to dramatically impact our species', and by default other species', future destiny. But it will always be about environments and genomes interacting -how can we control and predict that with any certainty?

I propose that Uncle Ben, Peter Parker's, aka Spiderman's, uncle and surrogate father sums up the dilemma nicely: *"Just because you can\_\_\_\_, I'll fill in the blank here with "alter the human genome, doesn't mean you should. With great power comes great responsibility."* Of course Uncle Ben is saying this to his nephew who has already been transformed into a human with spider abilities by the mysterious addition of spider genetic material to his genome via an unintended bite from a genetically modified spider. Stan Lee was thinking about all of this gene editing stuff long before I was. His advice to Spiderman is *also my hopeful answer to the question "What does it mean to be human now?" – it means balancing great power with great responsibility.* Whether or not that will turn out to be a good working definition of humanity remains to be seen.

### ***Closing Words***

Modified from Rolfe Gerhardt

We extinguish a flame, a mere wisp of matter in process, almost as insubstantial as the thought of it.

Yet our humanity has harnessed the power of such a flame to shape the world.

So may it be with the power of our thoughts, that responsibly, in love, they may shape a new world.

So let it be, amen.