

DNA and You

*Blog Posts from the Golden Age of the Human
Genome Project*

DONALD N. YATES and TERESA A. YATES

Panther's Lodge Publishers

Longmont

ALSO BY DONALD N. YATES AND TERESA A. YATES

Cherokee DNA Studies: Real People Who Proved the Geneticists Wrong

Old World Roots of the Cherokee: How DNA, Ancient Alphabets and Religion Explain the Origins of America's Largest Indian Nation

Old Souls in a New World: The Secret History of the Cherokee Indians

Cherokee Clans: An Informal History

Red Man's Origin: The Legendary Story of His Rise and Fall, His Victories and Defeats and the Prophecy of His Future

PRAISE FOR *CHEROKEE DNA STUDIES*

The Yateses' DNA findings are revolutionary . . . the ages, diversity and uniqueness of certain lineages among the Cherokee strongly suggest significant pre-1492 genetic inputs from the Old World.

—Stephen C. Jett

Professor Emeritus of Geography, Textiles and Clothing, University of California, Davis; Editor, *Pre-Columbiana: A Journal of Long-Distance Contacts*, and author, *Atlantic Ocean Crossings*

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INTRODUCTION

The Human Genome Project, first sketched out in the 1980s, has been heralded as the “the most ambitious writing endeavor” in human history. A rough draft was announced to the world jointly by President Bill Clinton and British Prime Minister Tony Blair on June 26, 2000. A target of “85 percent completion” had been achieved, covering most of the 3 billion nucleotides in DNA. Phase II, the conquest of genetic disease, has occupied the best minds in medicine for over a decade now. All these exciting developments, and their importance for the field of genetic genealogy, were followed and reported on in the blog started by DNA Consultants in the early 2000’s, continuing down to the present.

Our oldest post dates from May 15, 2000 (“Six Generations of Cherokee Blood,” pp. 50-53). In the early days, entries often consisted of a bare notice. “A Future without Emperors,” for example, picked up on a news report by David Cyranoski in the journal *Nature* on February 22, 2006 and asked simply, “Will Japan have a queen?” (p. 94). Other posts minimally registered the appearance of a newsworthy scientific investigation with the proper citation and full abstract. Increasingly, a précis, summary or critical review might be provided, especially for product news and favorite interests, such as Native American testing, autosomal DNA methods and Jewish markers. Readers’ comments accrued, reflecting a wide range of interests, professional affiliations and diverse backgrounds. During the years between 2012 and 2015, I was joined by Teresa, my wife, in writing posts that were gaining greater and greater attention.

In addition to the two indispensable, leading journals *Science* (U.S.)

and *Nature* (U.K.), we have blogged about articles from the *American Journal of Human Genetics*, *Current Biology*, *European Journal of Human Genetics*, *Human Biology*, *Journal of Human Evolution*, *Molecular Biology and Evolution* and *PLoS (Public Library of Science)*. Occasionally, we have referenced lesser known journals such as *Genome Biology*, *International Journal of Legal Medicine*, *Journal of Forensic Science* and *Proceedings of the National Academy of Sciences*. Newspaper sources from which we found material include *The Guardian*, *The Huffington Post*, *The New York Times* and *The Wall Street Journal*.

Breaking news in the field of genetics is represented by a host of hot topics cropping up as they crossed over from technical publications and gained resonance in the popular press, some little more than brief notes and others full-blown reviews. Readers will be particularly interested in startling revelations about Neanderthals and Denisovans, the non-Asian roots of Native Americans, the introduction of personal genomics made possible by 23andMe ("Google Wants to Do What?" p. 296) and the skeleton of Shakespeare's villain and England's last York Dynasty monarch exhumed in a Leicester parking lot ("Richard III's New Winter of Discontent," pp. 87-90). One of the last items in our blog, still going strong on the DNA Consultants website, is an update from October 21, 2015 on the discovery of water on Mars (see "Alien DNA," originally dated October 4, 2012, pp. 6-7).

Mention is made in these pages of some of the most famous geneticists of our time. These include James Watson ("DNA Pioneer Rebuked For Racist Remarks," *BBC News*, October 20, 2007, p. 112), Swedish-Estonian biologist Svante Pääbo, whose team sequenced the Neanderthal and Denisovan genomes; Bryan Sykes, author of *The Seven Daughters of Eve* and founder of the commercial firm Oxford Ancestors; Danish geneticist Eske Willerslev, whose work has revolutionized the study of American Indian origins; Stephen Oppenheimer (*The Real Eve* and *The Origins of the British*); Mark Thomas of Cohen Modal Haplotype fame; Stanford's Luigi Luca Cavalli-Sforza; Columbia's David Goldstein; and Harvard's Richard Lewontin.

The classic study, "Population Structure and Genome-wide Patterns of Variation in Ireland and Britain" prompted a considered appraisal after it appeared in *European Journal of Human Genetics* in 2010. See

"Surprises in English and Irish DNA," pp. 170-172. Jon Entine's *Abraham's Children: Race, Identity, and the DNA of the Chosen People* gets major notice in the chapter "DNA and Religion." Who could fail to be fascinated by the chronicles of the royal family of Egypt whose mummies were investigated by Zahi Hawass' team in that same year?

Among the science journalists whose writing is followed are Nicholas Wade and Amy Harmon of the *New York Times*. There are also many lesser known bloggers and tweeters whose work in the trenches of genetic genealogy receives attention.

Exotic themes touched on are Roman soldiers in the DNA record of Britain, Egyptian and Greek DNA among the Cherokee, Basques in Idaho, ancient Sea Peoples detected in the DNA and rock art of the American Southwest, Chinese surname systems, Itza Mayas in north Georgia and India's caste system.

From our series "People behind the Numbers," come interviews and customer stories of special interest. Noteworthy are "Peter McCormick, Cultural Geographer" (pp. 174-175), "Elizabeth Hirschman, Modern Pioneer" (183-185), "Jim Bentley, DNA Frontiersman" (360-367) and "Phyllis Starnes: Designer Genes," (216-19). Starnes, who was an assistant investigator for DNA Consultants for many years, poignantly describes her Melungeon ancestry and long struggle with familial Mediterranean fever in the piece "Tapestries of Illness" (226-232).

Variety and diversity are signaled by the inclusion of unusual personal cases. In this category, we have Elvis Presley's "King-sized Sheets" with the adventures of canny Houston P.I., Bobbi Bacha, featured in the movie *Suburban Madness* (pp. 103-105), "A Red-Hot Tale from the Nation's Capital," by Monica R. Sanowar (130-133) and "Melungeon Revelation," by Kari Carpenter (212-215).

There are numerous excerpts and previews of books we have written over the years on history, culture and DNA. These include the "trilogy" I co-authored with Elizabeth Caldwell Hirschman, begun with *When Scotland Was Jewish* (2007), followed by *Jews and Muslims in British Colonial America* (2012) and concluded with *The Early Jews and Muslims of England and Wales* in 2014, as well as the solo study *Old World Roots of the Cherokee* (2012) and *Cherokee DNA Studies: Real People Who Proved the Geneticists Wrong* (2014). The last-named forms volume one in DNA Consultants Series on Consumer Genetics, in which

the present title is the volume two.

Blog posts relating to our publications range from "Customs and Beliefs of the Roma and Sinti" (pp.118-122) and "Shot across the Bow of the Good Ship Mayflower" (204-206) to "Signs of Crypto-Judaism" (322-326) and "Cherokees Spoke Greek and Came from East Mediterranean" (3-5).

Cutting-edge research, often from peripheral disciplines and out-of-the-way sources, is woven into the posts on history and archeology. Instances include contributions to pre-Columbian studies by Carl L. Johannessen, John L. Sorenson, Gunnar Thompson, Cyclone Covey, Barry Fell, Harold S. Gladwin, Gloria Farley and Stephen C. Jett. The last-named, a geographer, began his scholarly activity over 50 years ago with studies of Navajo place-names, Peruvian textiles and the diffusion of blow-gun technology in Pacific Rim archaic cultures. Jett has published over 130 articles and book chapters. At press time, his definitive *Atlantic Crossings* was still eagerly awaited by all who follow his work.

Historians often seem to pay more attention to beginnings than endings. When did the Middle Ages end? When did the last flat-earthier draw breath or last white supremacist in a position of academic authority go into retirement? In this regard, it is interesting to see that the obituaries of certain concepts are remarked upon in this collection equally with the birth of new thinking. Browse these pages for the passing of outmoded theories on American Indians, Homo sapiens, ancient giants, Australian Aborigines and numerous disease origins, including Alzheimer's, diabetes and cancer.

The human genome has turned into a library of information beyond our wildest imagining. "Genes are the teachers" (pp. 370-371), geneticists were the first patrons, but the Internet has opened access to all. May this anthology of news from the golden age of discoveries serve not only to inform people about how far we have come in this genetic landscape but also inspire us to be curious about our own DNA story and the scope, future and possibilities ahead.

D.N.Y.

1 DNA AND WEIRD SCIENCE

Self-Healing DNA Discoveries

Three astonishing experiments with DNA prove that it can heal itself according to the "feelings" of the individual as reported recently by Gregg Braden at the Global Healing Center in Houston, Texas.

March 2, 2005

Ruins of Possible Maya Settlement Uncovered in North Georgia

In what a December 22 report in *Raw Story* describes as possibly "the most important archeological discovery in recent times," the ruins of a stone city believed to be at least 1,100 years old have come to light in the mountains of North Georgia. Interest in the Kenimer Mound, a large, five-sided pyramid in the foothills of Georgia's tallest mountain, Brasstown Bald, near Blairsville in the Chattahoochee National Forest, goes back to a 1999 University of Georgia dig led by archeologist Mark Williams.

At least 154 stone masonry walls for agricultural terraces were exposed, plus evidence of a sophisticated irrigation system, prompting Richard Thornton to speculate that the site corresponds to Yupaha, a town explorer Hernando de Soto searched for unsuccessfully in 1540. Thornton relates the site to other Maya-like ruins in the Southeast and believes the people who built it were the Itza Maya, a word that carried

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over into the Cherokee language of the region. Traditional oral histories such as those recorded by Constantine Rafinesque have always traced the origins of the Natchez and other pre-Muskogean Native Americans in the Southeastern U.S. to Mexico. Rafinesque thus distinguishes between the Iztacans (or Aztec) and the Oguzhians (Algonquians).

The site is called Archaeological zone 9UN367 at Track Rock Gap and is a half mile (800 m) square and rises 700 feet (213 m) in elevation up a steep mountainside.

December 27, 2011

Genetics and Psychiatry

Mood disorders and schizophrenia have traditionally been approached as unrelated extremes on a continuum of psychiatric disorders. But now it seems the genes causing them, and the linkage disequilibrium associated with them, extend from one end of the spectrum to the other. In a report by Nick Craddock and Liz Forty in the *European Journal of Human Genetics* (2006) 14, pp. 660-668, the gene for bipolar disorder has been shown to be implemented in other disorders also, while manifestation depends more than previously believed on the interaction between one's environment and genetic susceptibility. The title: "Genetics of affective (mood) disorders." This entire issue is devoted to genetics and behavioral psychology/psychiatric medicine.

October 15, 2006

History Reburied Daily

The year 2011 has gone down as the year of faked scholarship, but what if sound (although undaring) research is the victim of scientific controversy? The prestigious journal *Human Immunology* first published the article "The Origin of Palestinians and Their Genetic Relatedness with Other Mediterranean Populations," then yanked it, instructing their subscribers to rip out the offending pages because they showed that Middle Eastern Jews and Palestinians are genetically almost identical.

As of today, we still found the article online along with the editor's retraction and protests, but you'd better hurry if you want to read it. The censors who guard the scientific fables about Jewish DNA may discover a way to rewrite World Wide Web history as well as world history. In the

meantime, you can read about the whole lamentable mess in *The Guardian* in a story by Robin McKie, "Journal Axes Gene Research on Jews and Palestinians."

January 7, 2012

Cherokees Spoke Greek and Came from East Mediterranean

Possum Creek Stone and Anomalous Cherokee DNA Point to Eastern Mediterranean Origins

Keynote Address for Ancient American History and Archeology Conference, Sandy, Utah, April 2, 2010

Donald N. Yates

In memoriam Gloria Farley

Summary. Three examples of North American rock art are discussed and placed in the context of ancient Greek and Hebrew civilization. The Red Bird Petroglyphs are compared with Greek and Hebrew coins and the Bat Creek Stone. The Possum Creek Stone discovered by Gloria Farley is identified as a Greek athlete's victory pedestal. The Thruston Stone is interpreted as a record of the blending of Greek, Cherokee, Native American, Egyptian and Hebrew civilization. Keetoowah Society traditions, as captured in "The Vision of Eloh'," are adduced to confirm a general outline of the origins of the Cherokee people in a Ptolemaic Greek trans-Pacific expedition joining pre-arriving Greeks, Jews and Phoenicians in the Ohio Valley around 100 C.E. Recent DNA investigations showing Egyptian, Jewish and Phoenician female lineages and the Y chromosome of Old Testament priests among the Cherokee are also touched upon.

A cave entrance overlooking the Redbird River, a tributary of the South Fork of the Kentucky River in Clay County, Kentucky, in the Daniel Boone National Forest, has inscriptions that according to Kenneth B. Tankersley of the University of Cincinnati display a nineteenth-century example of writing in the Cherokee syllabary. A local resident (Burchell) recognizes Greek writing in one inscription (called *Christian Monogram #2*), but his reading is unsatisfactory for a number of reasons.

Evaluation by experts in Greek and Semitic epigraphy identifies two distinct inscriptions, one in Greek and one in Hebrew. They appear to be contemporaneous with the Bat Creek Stone unearthed in the 1889 excavation of a tomb in East Tennessee by Cyrus Thomas of the Smithsonian Institution.

Another record of Greek-speaking people in ancient America is the Possum Creek Stone, discovered by Gloria Farley in Oklahoma in the 1970s. It is discussed by her in Volume 2 of *In Plain Sight* as proof that the man whom history knows as Sequoyah did not invent the Cherokee syllabary. The inscription can be read as Greek, HO-NI-KA-SA or 'o nikasa, i.e. "This is the one who takes the prize of victory," a common inscription for the pedestal upon which victors were crowned at athletic games. The use is Homeric, and the spelling Doric.

A third piece of evidence helps fill in the background of the arrival of Greeks and their intermarriage with Asiatic and other Indians in North America. In 1870, an engraved 19-by 15-inch limestone tablet was uncovered in a mound excavation on Rocky Creek near Castalian Springs in Sumner County, Tennessee (see *Ancient American*, vol. 12, no. 77). Dating to an earlier time than its Mississippian Period context, it commemorates a peace treaty between the Cherokee and Shawnee. The Cherokee chief wears a horse-hair crested helmet and carries the spear and shield of a Greek hoplite. His Shawnee adversary clasps hands in a wedding ceremony with a Cherokee woman who bears wampum belts as a pledge of peace, has her hair in a maidenly bun, wears a Middle Eastern-style plaid kilt, and displays a large star of David. In the Red Record or Walam Olum, we learn that before crossing the Mississippi, somewhere along the south bank of the Missouri, the Algonquians or Lenni Lenape (Delaware Indians), who are later allied with the Cherokee, encounter a foreign tribe they call the Stonys. Cherokee legends about Stone-coat demonstrate that the original Cherokee had metal armor and weapons. DNA studies confirm a mixture of "anomalous" East Mediterranean mitochondrial lineages such as Egyptian T, Greek U and Phoenician X with "standard" American Indian haplogroups A, B, C and D in the Cherokee and certain other Eastern Woodlands Indians.

To sum up, the Red Bird Petroglyph is a Greek inscription from the 2nd to 3rd century C.E., not a crude Cherokee scratching of around 1800

as announced recently by the Archeological Institute of America and *The New York Times*. It occurs above what is, in all likelihood, an inscription in Maccabean-era Hebrew. The Sequoyan syllabary for which these Greek and Hebrew inscriptions were mistaken originated in the Greek world of the Bronze Age along with other syllabaries like Linear A, Linear B and Cypro-Minoan. The Cherokee language, which today is Iroquoian, is the result of a relexification process in the distant past. It contains many relics of words of Greek origin, especially in the area of government, military terminology, mythology, athletics and ritual. Cherokee music also reflects Greek origins. The Cherokee Indians are, quite literally, the Greeks of Native America.

Greek Words and Customs in Cherokee

Greek	Meaning	Cherokee	Meaning
alomenoi	wanderers (in a hopeless sense)	eloh [*] ; elohi	migrants, wanderers; earth
dakos	noxious, devouring beast, whale	dakwa	mythic great fish
dasis	hairy, shaggy like a beast	dachi	hairy water monster
tynchana	things that befall	tikano	history
ethelokeoi [*]	volunteer settlers	eshelokee	Cherokee; original people
gemnadas	noble	kanat(i)	doctor, hunter
huios Dios	Son of Zeus (title of Herakles)	Su-too Jee	mythic strong man
illo, illas [*]	wrap, twist; rope	kilohi	twisted hair clan (cf. Hawaiian <i>hilo</i>)
kakotechneo	base arts, perjury, fraud	kaktunta	taboo regulation
kanon	straight-edge used by athletes	kanuga	scraper used by ballplayers
karanos	a chief	Koranu ^{**}	war chief title
kateis [*]	assembly	cahtiyis	assembly house
kerux	herald	skariroaken ^{**}	speaker, herald
mona [*]	stopping place, way-station	mona	land where the Elohi tarried
neika [*]	contest	anetcha	ballplay
Ogyges	titán of Greek mythology	Ootschaye	rival of Sutoo Jee (Herakles)
ouktenna	one not killed	Uktena	name of a dragon or serpent
oulountata	declared healthy	oolungtsata	divining crystal for health
skia	ghost, shade	atchina	ghost; cedar
stix	abominable	Stichi	name of dangerous serpent
tanawa [*]	astronomical instrument	Tchlanua	Great Hawk
(hoi en) telci	those in authority	tilihi	brave, warrior
theatas [*]	spectator in a play	tetchata	Playful Cherokee fairy
theatron	theater, assembly	tetchanun	ceremonial enclosure
Thrax	Thracian	tchaskiri ^{**}	sorcerer, Stoneclad
typho	raise a smoke, make sacrifice	Tathtowe, Tistoe	ceremonial title; firecracker (smoke) bringer (Santa Claus)

^{*}Doric Greek ^{**}Lower Cherokee

June 17, 2010

Alien DNA

A few months ago, someone called us and asked me if we had alien DNA. I thought to myself, "Does she think we have an alien from Roswell in the basement?" All I said though was, "No, but it sounds like a bestseller, and I hope we get it first!" The whole office got a huge laugh over that, thinking of all the different certificates we could create for it. It was a splendid joke. Seriously, I don't work for "Warehouse 13." We are a scientific and serious business. But when I thought about it, I realized the joke was on us. She was on to something.

Although it does not look like bacteria can grow in arsenic (*New Scientist*, No. 2849), as scientists have been unable to replicate Felisa Wolfe Simon's findings at NASA Astrobiology Institute in California culturing bacteria in arsenic soup, this does not mean it is the end of our search for alien DNA. Or for DNA that acts in an alien manner. In fact, it is just the beginning.

First, there was a study in *Nature* indicating that some people have ancient DNA from Neanderthals and Denisovans. Though both are related to humans, they are considered another species, so it is alien in that sense. This shook science. Many of us may have some ancient, alien DNA. If that is so, pinpointing where that is on our genetic code might be a next step.

And scientists are now looking for life in Martian soil with the robot rover Curiosity. They are concerned over what they are calling "black, spidery things" that show up every spring wondering if this is life. And if they are dangerous. Nasa says they have been seen during the Martian spring for some time. Some scientists think that these "black, spidery things" could possibly be microbial Martian strains. Strains of life. And strains of DNA. Now, bacteria have a much simpler form of DNA than do humans, a single strand, but the evidence of life would be a monumental step. We are living in the future. And it reads more like a novel by Isaac Asimov.

How could there be life on Mars? Curiosity has already confirmed that there were once waist-deep Martian rivers. In fact, some scientists now believe there may be underground rivers on Mars. Water could mean life. Of course, what kind of life we do not know.

For one thing, we do know that our own underground oceans are

teeming with life, and with “a biodiversity greater than the rainforest,” according to David Gallo, a pioneer in ocean exploration. And much of it that is unexplored seems alien enough. Bacteria thriving from toxic, sulfur dioxide. Worms thriving in boiling and freezing water at the same time. He compares it to something like putting one hand in a boiling pot of liquid and the other in freezing water at the same time. Fire and ice. How is life possible in such extreme conditions? We still have questions, but Gallo purports that underground volcanic activity “creates and supports” bacterial life. In fact, some scientists think these underground volcanoes might have been where life started. And Mars has volcanoes.

And though I am not ready, just yet, to create alien ancestry certificates, I think the potential for discovery is enormous. Katherine Dudley Hohn in her article, “Nasa Curiosity Rover on the Verge of Potentially Historic Discovery: Water on Mars,” says that we are about to find water on Mars. Where there is water, there is life. And where there is life, there is DNA. In this case, alien DNA.

Will we find microbial life and alien DNA on Mars? Will we one day be able to determine on your genetic code other alien DNA—if one of your grandmothers was a Denisovan or a Neanderthal? We are living in exciting times. I am just worried about one thing: the Mars rover bringing some of those “black, spidery things” back to Earth.

October 4, 2012

Update 10/21/15: NASA has discovered water on Mars! What more will they find?

The Werewolf Gene

Did you believe in werewolves as a child? There is a bit of truth to the myth. After school, one of the favorite things my brother and I loved to do was to watch grade B horror movies about monsters like *The Mummy* and *Count Dracula*. We would settle down with popcorn on our orange '50s style sofa and have a blast watching movies like *The Curse of the Werewolf*, *The Wolfman*, and *I Was a Teenage Werewolf*. I thought it was just fun.

Or perhaps you have read of Julia Pastrana, the “bearded lady” who toured Europe and North America in the 1850s or “Fedor Jepticheff,” who toured with P.T. Barnum as “Jo-Jo the Dog-Faced Man,” and who

became the inspiration for Disney's "Beast." Jo-Jo played along, barking on cue for P.T. Barnum, although he was very intelligent and made quite a good living from his "genetic misfortune," according to Ricki Lewis, a science writer who has a Ph.D. in genetics, in his *PLOS* article, "The Curious Genetics of Werewolves." What these people had has been historically known as the "werewolf syndrome." They actually look like a werewolf.

I think I would have been much more horrified and saddened if I realized there really was a rare, genetically inherited condition called the "werewolf syndrome," and how this "likely contributed to the ancient "werewolf" folklore. And how—from ignorance—these people have been labeled monsters. The IMDB database describes the 1941 movie, *The Wolfman*, starring Lon Chaney Jr., like this: "A practical man returns to his homeland, is attacked by a creature of folklore, and infected with a horrific disease his disciplined mind tells him can not possibly exist." But a horrific disease such as this does exist. Just not exactly as they describe it.

The "werewolf" disease known as hypertrichosis or Ambras syndrome is a very rare genetic condition. According to the Live Science article, "Werewolf Gene May Explain Hair Disorder," there are "fewer than 100 cases documented worldwide." Lewis says there are only 50 cases known.

The name for the disease comes from the case of a "Petrus Gonzales," who "at age 12 in 1556" was "brought as a slave ... to the court of France." The French royalty called him "man of the woods" because of his "strikingly hairy face," thinking he "represented a race of hairy people from the Canary Islands" (Lewis). He and his hairy family—three of his children had the trait—sat for family portraits. One of these was displayed at Ambras Castle, which "led to their notoriety" and the name.

The degree of hairiness differs. A man "Shwe-Maong" in Burma had Ambras syndrome, and an observer noted in 1826: "... the whole face, with the exception of the red portion of the lips, were (sic) covered with fine hair. The hairs were 4 to 8 inches long, straight and silky." He had one daughter, Maphoon, who was completely covered "in a pelt of long, silky grey hair" (Lewis).

Lewis says that those with Ambras syndrome are not evolutionary throwbacks:

Charles Darwin mentioned Maphoon in *The Descent of Man and Selection in Relation to Sex* (1859), but it was his readers who brought up that the striking hairiness was atavistic, a turning-on of an ancestral trait silenced through evolutionary time. But the quality of the hair isn't like that of an orangutan or gorilla. It's silky, and covers places, especially on the face, where our ape cousins don't have hair. People with Ambras syndrome aren't evolutionary throwbacks.

Then how do we explain it? It is a genetic mutation handed down in families. In 1995, scientists traced the approximate location of the mutation to a section of the X (female) chromosome ("werewolf gene").

What kind of mutation? Extra DNA. A "man in China with the disease helped researchers break the case." Xue Zhang, a professor of medical genetics at the Peking Union Medical College, tested the man and his family and found an extra chunk of genes on the X chromosome.

But just recently the 1000 Genomes Consortium announced that even healthy people have mutations ("Deleterious and Disease-Allele Prevalence in Healthy Individuals"). I was just getting used to being a living, breathing mutant myself, after reading this article, so how are we different from people with Ambras syndrome? According to Lewis, "apparently redundancies built into our genomes protect us" and we can "have a mutation (a disease-causing genotype) yet not be sick."

So with any DNA test, you have to be careful to not over-interpret results. Lewis says, "They are not a crystal ball." If you have a mutation for diabetes, it doesn't mean you will necessarily get diabetes. There are other factors. It is not the same, but in a similar fashion you can catch a virus and not come down with it. Just because you carry genetic markers from your parents for diabetes does not dictate you will necessarily get diabetes. It may mean you might want to watch your sugar intake though.

If there are environmental triggers, one wonders what the triggers might be for the "werewolf syndrome"? We don't know as we don't even have a cure (Lewis). And no—I did not mean the full moon.

November 29, 2012

Bigfoot DNA

What if Bigfoot—also called Yeti and Sasquatch—was an elusive relative? Has folklore and myth ever met science? Most of us assume that myth—or what is perceived as myth—never collides with the world of reality. Myth is supposed to belong to the realm of the mind, according to most scientists. However, there are a few rare exceptions when a creature has been incorrectly categorized as mythic when it belongs to the world of reality.

Some creatures once relegated to the world of myth or thought to be a hoax have since been redeemed and discovered by science. According to Brian K. Hall in his *Bio Science* article, "The Paradoxical Platypus," when European naturalists first saw sketches of the platypus in the 18th century, they were first thought to be a hoax. George Shaw, an English botanist and zoologist, who was one of the first to describe the animal, went as far as to put scissors to its duck-like bill to see how it was attached, according to "Platypus Facts on File" by the Australian Platypus Conservancy.

And this is but one. According to Australian zoologist, Tim Flannery, as well as other scientists, Boudai and Alexandra Szalay, in their *Mammalia* article, "A New Tree Kangaroo," they found a creature that was only supposed to belong to the world of myth. The elusive, tree kangaroo, the bondegezou, or dingiso, was called the "men of the forest" by the Moni tribespeople. It was not discovered until 2009 according to Flannery.

But no one has found a Yeti. In a PRWeb release in November 2012, it was announced that a team of experts "in genetics, forensics, imaging, and pathology," led by Dr. Melba Ketchum found Bigfoot DNA. According to the article, Ketchum, a participant in another published study mapping the equine genome and a veterinarian with 27 years of research in genetics and forensics, along with her team of experts, sequenced "20 whole mitochondrial genomes" and used "next-generation sequencing "from purported Sasquatch samples" to determine that "the species (Sasquatch) is a human hybrid ... that arose approximately 15,000 years ago as a human hybrid cross of modern Homo Sapiens with an unknown primate species." Ketchum says the "data indicate that the

North American Sasquatch is a hybrid species, the result of males of an unknown hominin (all members of the genus *Homo* including modern humans, Neanderthals, Denisovans, and others) species crossing with female *Homo Sapiens*."

But modern humans have never interbred with other species, have they? Actually, though this is still in debate, many scientists now believe that modern humans did once interbreed with Neanderthals and Denisovans. According to Matt Kaplan, in the *Nature* article last year, "Human Ancestors Interbred With Related Species," early humans having hot and heavy dates with other hominins "occurred in Africa some 35,000 years ago." Then could the origin of this species—if it is a species—be from this? Genetic testing has ruled out either Neanderthals or Denisovan DNA as "contributors to Sasquatch mtDNA (mitochondrial DNA, or mother's line) or nuDNA (nuclear DNA, found on loci throughout all your cells)." She says that the male line is more "distantly removed than other recently discovered hominins like the Denisovan individual."

To what then does Ketchum compare the purported, Sasquatch DNA? She says she cannot compare it to anything: "Sasquatch nuclear DNA is incredibly novel," and "while it has human nuclear DNA within its genome, there are also distinctly non-human, non-archaic hominim, and non-ape sequences. We describe it as a mosaic of human and non-human sequences." Guy Edwards, in his perhaps-too-quickly-named piece, "Dr. Bryan Sykes Has Not Even Begun Testing Yet," (he has) even quotes Dr. Bryan Sykes, author of the book *The Seven Daughters of Eve* as "agree(ing) with Dr. Melba Ketchum's study that there is indeed a new hominid in North America (though he) disagrees with Ketchum regarding the origin of this new hominid." However, he does not disclose his own verdict.

What other conclusions could there be other than the one Ketchum gives, the one Sykes hints at? Benjamin Radford, in the Live Science article, "Bigfoot is Part Human, DNA Study Claims," concludes that either her theory is correct and half-human beings have been hiding in the hills, or the samples were somehow contaminated: "Whatever the sample originally was—Bigfoot, bear, human, or something else—it's possible that the people who collected and handled the specimens accidentally introduced their DNA into the sample, which can easily

occur with something as innocent as a spit, sneeze or cough.” (This is an interesting point. What do we know about the quality of the lab/s? Were ISO certified, the highest quality labs and the standard of the industry used?) Radford also argues that “unknown” does not mean “Bigfoot.” However, John Thomas Didymus, in his Digital Journal article, “Scientist Melba Ketchum claims Bigfoot DNA Human-Cryptid Hybrid,” quotes Ketchum as saying in *The Register*, “Four other university laboratories have tested the samples prior to this study and they all found human DNA, so they all made the assumption that the samples were contaminated. That’s why we took a forensic approach, going to two different laboratories and testing two different ways and we were very careful to avoid contamination.”

But what evidence is there? So far, we have none, and scientists remain skeptical. According to Guy Edwards in his blog article, “Dr. Jeff Meldrum Responds to Melba Ketchum’s TV Interview,” Dr. Jeff Meldrum, “the highest profile scientist and academic when it comes to Bigfoot research, and an Associate Professor of Anatomy and Anthropology at Idaho State University” remains skeptical. Edwards quotes Meldrum as saying, “My criticisms stem from the lack of available substantiation of her interpretation of the mtDNA results, and the difficulty I have envisioning a scenario that accounts from what is proposed—a hybridization event 15,000 years ago in Eastern Europe that resulted in a population dispersed across North America.” Meldrum adds, “Many people don’t understand the purpose of a null (working) hypothesis.” He does believe in Bigfoot but claims, “Whatever is out there is likely a relict ape, or a relict early hominin (e.g. *Paranthropus*).” Meldrum wishes Ketchum the best: “Please don’t get me wrong, I truly hope she has the brass ring. I want very much for her study to be legitimate and significant.”

Of course, the vast majority of scientists and others do not believe in any version of Bigfoot. *Wired* blogger and science writer Brian Switek writes about an interview of Meldrum on a 2011 NPR interview: “Doug Fabrizio interviewed Idaho State anthropologist and Sasquatch devotee Jeff Meldrum. The stated point of the interview was to see how Meldrum applied scientific reasoning to the search for a creature that, at best, exists on the fringe of scientific investigation.” He goes on to say that that did not occur and he felt the interviewer was overly swayed by

emotional appeal rather than reason when evidence was lacking. This is not just the concurring opinion of the vast majority of scientists ... they ignore the topic since it is viewed as "fringe science."

It does not help that none of this has yet been published in a peer-reviewed journal. Moreover, according to another blog article by Edwards, "Dr. Ketchum's BigFoot DNA Study, Peer-Rejected," her application for publication in a scientific journal (not named) has just been rejected. However, should that alone be a determining factor? It is hard enough to get published, but a peer-reviewed article is very difficult, and sometimes the work has to be polished and reviewed and re-sent. Edwards quotes Katrina Keiner, a *Science* magazine editor, as saying, "We have to reject more than 90% of the papers submitted to us."

So, is that the end of hearing about Bigfoot DNA? No. According to the article, "Where Is the Ketchum Bigfoot DNA Study," posted on Doubtful News, "Igor Burtsev, a Russian Bigfoot/Yeti researcher who originally leaked the results of his study on his Facebook page," said that Dr. Ketchum had given him the papers to be published in a Russian journal, and they are currently under review. The author of the article concludes that either Burtsev is a "loose cannon" or Russia will embrace Bigfoot (though he hardly sounds serious). According to the initial PRWeb article Ketchum says she is available to interview or to answer further questions and provides contact information for those interested. And Edwards, in the article, "Dr. Ketchum's BigFoot DNA Study, Peer-Rejected," states that Sykes, who leads another Bigfoot Study, will try "multiple formats" instead of "hinging the research on a peer-reviewed paper." Hints are dropped of a later book and possibly a BBC show.

And so we are left to wonder. Is Sasquatch just a mythical creature? Or sometime in the near future will we learn of another hominid to add to our already very complicated family tree?

December 20, 2012

Hobbits Aren't Just in Hollywood

Hobbits, or something like them, it turns out, were once real. We cannot get enough of hobbits' mythic journeys and adventures in the movies, but who would have thought there really were hobbits? Who would have thought there once was someone like a Bilbo Baggins? Well, someone

his size, and he and his companions once walked the Earth some 17,000 years ago according to a recent ZME Science article, "High Resolution Genome Sequence of Ancient Ancestor Released Online."

Going on their own quest, in 2004 a team of anthropologists led by Mike Morwood, a professor of anthropology at the University of New England in Australia, discovered a miniature hominin in Flores, Indonesia, which they nicknamed the "Hobbit." Announcing they had discovered a new species of humans in the Ling Bua Cave, they shook science and the world. According to Morwood and Penny Van Oosterzee, in their book, *A New Human: The Startling Discovery and Strange Story of the 'Hobbits' of Flores, Indonesia*, these were beings that were "no more than three feet tall with brains a little larger than a can of cola."

However, is this a new species of humans? Scientists have battled back and forth about this. Megan Gannon, in her recent Huffington Post Science article, "Hobbit Face: Homo Floresiensis," says, "Scientists have debated whether the specimen actually represents an extinct species in the human family tree, perhaps a diminutive offshoot of *Homo erectus*."

Guy Gugliotta in his 2008 *Smithsonian* article, "Were 'Hobbits' Human?" says some thought they were a distinct species while others thought they were diseased humans. However, Gannon says a 2007 study has since disproved this supposition, as an examination of the "Hobbit's brain" was "inconsistent" with a diseased brain.

Many writers have now decided the "hobbits" were a kind of human after all. Gugliotta quotes Rick Potts, director of the Smithsonian's Human Origins Program, "who once doubted that the Hobbits were a separate species," as saying he has since changed his mind: "Flores was this wing in the building of human evolution that we didn't know about. There is no reason that 800,000 years of experimentation could not evolve a small but advanced brain."

Hominin brain expert Dr. Dean Falk analyzed the hobbit-like brains and determined that just because their brains were small did not mean they were not capable of thinking. He identified neural patterns that indicated cognitive and reasoning ability despite their smaller size (*Smithsonian*, "'Hobbits' on Flores, Indonesia").

What else do we know? We cannot sequence their DNA according to the article "High Resolution Genome" because "the hot, humid climate

of the Indonesian island of Flores, where their remains were found, impairs the preservation of DNA.”

Gannon quotes Dr. Falk as saying, “It’s not just that their brains are small; they’re differently shaped. It’s its own species.” Anthropologist, Susan Hayes, who uploaded 3D imaging scans, says about a female specimen, “She’s not what you’d call pretty, but she’s definitely distinctive” (“Hobbit Face”). The 3D picture is startling with deep set, haunting, and thoughtful eyes. It does look like at least an early ancestor of a hobbit. They were short and heavy—only about a “yard tall” but “squat,” she says.

Morwood, in his book, *A New Human*, says this was a “tool-making, fire-making, cooperatively hunting person.” Erin Wayman, in the *Smithsonian* article, “Were the Hobbits’ Ancestors Sailors?” postulates that in order to get to Flores, perhaps they were seafarers. If that is the case, perhaps they truly were adventurers like Bilbo.

Hopefully, we will be able to get better preserved “hobbit” bones, so we can do some DNA testing and determine the exact connection to our family tree as well as the connection with other hominins like Neanderthals and the Denisovans. Until then, we want to find out more about this species of miniature humans that walked the Earth with dwarf elephants, giant rodents and Komodo dragons.

“There is nothing quite like looking, if you want to find something. You certainly usually find something, if you look, but it is not always quite the something you were after.”—J.R.R. Tolkien, *The Hobbit*

December 23, 2012

Sykes' Sighting

Bigfoot might not be a hoax after all. We have been doing our best to make sense of our world since we lived in caves and first looked up at the stars. It is in our DNA to do so. We have not always been right because we did not have enough information. As a result, we thought the world was flat for a long time, and we created stories about the thunder gods and how the stars affected our everyday lives. And sometimes we have thought something was a hoax, like the platypus, when it actually belonged in the realm of scientific reality.

Though we are not accustomed to using Bigfoot in the same sentence

with science, Bryan Sykes, famous Oxford geneticist, has made insightful deductions about Yeti or Bigfoot and its Russian cousin, Zana, from DNA testing and other evidence. Sykes has determined with this evidence that what some of these people did see could be something that actually belongs in the realm of science. They just did not see a monster called Bigfoot.

What did they see? For one thing, Sykes does not think we are discussing one creature. He conducted extensive genetic testing on hairs and tissue samples from the jaw of a purported Yeti mummy and other specimens and declared that the Himalayan "Abominable Snowman" was some type of ancient, Arctic bear though it could be an unknown type of bear or bear hybrid (Ker Than, *National Geographic*, "Is the Abominable Snowman a Bear?").

However, the Russian Bigfoot evidence is even more exciting than a possibly unknown type of bear. Sykes has made a bold theory in this case. He believes that "Zana," who was captured in the Russian forest in the 19th century, might have been a slave that was a "remnant of an earlier human migration" and a representation of a "hitherto unknown human tribe." DNA testing results show that her maternal line is Sub-Saharan African and human; however, Sykes says this is not the end of the story. This does not explain some of the primitive features of the skull of her son, Khwit, according to Sykes. Despite this, she is not a Neanderthal as some thought she might be. DNA testing results show she has as much Neanderthal as the rest of Europeans and Asians which is only 2 percent to 4 percent (shown when the Neanderthal genome was sequenced in 2010 and no doubt from early inbreeding). It is quite a DNA mystery, and we cannot wait for the end result and the published paper on this ("Was Russian 'Bigfoot' Actually an African Slave?").

October 22, 2013

Genetic Genealogy Like Astrology?

Dust off the crystal ball. Scientists consider DNA ancestry services "genetic astrology," according to a recent BBC article by Pallab Ghosh. In "Some DNA Ancestry Services Akin to 'Genetic Astrology'," Ghosh quotes Professor David Balding as maintaining that "such histories are either so general as to be personally meaningless or they are just

speculation from thin evidence." One article, "Don't Believe the Guy Who Claims He's Descended from Vikings," quotes evolutionary geneticist Mark Thomas, as saying, "these tests have so little rigor that they are better thought of as genetic astrology."

But not all DNA ancestry tests or companies are created equal, so you may have to find where the astrologers and crystal balls are hidden.

First, not all DNA ancestry companies have an ISO-certified lab—the highest benchmark in the genomics industry. Why not? It is not required in direct-to-the-consumer DNA testing. With noncertified labs, there is a stronger possibility of contamination or lost or swapped samples. I know a person to whom this happened. He jokes that he thought he was someone else for two years!

And there are weaknesses with the most common DNA tests for ancestry—haplotype tests. The mitochondrial genome is small compared with the nuclear genome, according to the article "Mitochondrial Genome Analysis," which means there cannot be as much variation. Live Science writer Stephanie Pappas quotes Maria Avila, a computational biologist at the Center for GeoGenetics at the British Natural History Museum, as saying, "People could share mitochondrial DNA even if they don't share a family tree." And the article, "Doubts Remain," quotes Thomas, who concurs with this, saying, "People can have matching mitochondrial DNA by chance and not be related."

Male line haplotype testing has different limitations. "The Male Y-linked tests have very rapid mutation rates and are very fragile, so you can get a lot of errors with that type of testing," according to Dr. Donald N. Yates of DNA Consultants.

And it seems less stable than we previously thought. Bryan Sykes, professor of genetics at Oxford University and author of *The Seven Daughters of Eve*, makes a strong argument that the Y chromosome is weakening and in trouble in his book, *Adam's Curse*. He says it is "doomed" because of its instability and rapid genetic mutation and is headed toward extinction. (That is a scary thought—*Planet of the Females*.) Before the 1990s paternity testing was based on Y chromosome comparisons and limited to fathers and sons. Sometimes, an uncle would be mistaken as the father. Today, it relies on autosomal DNA comparisons that can be applied to females and is 99.99 percent accurate.

Moreover, there is no standard usage for the term "autosomal." Why does this matter? A conventional autosomal DNA test provides you with a 16 STR profile and is based on forensic and academic studies.

Autosomal DNA testing as it is traditionally understood is based on different science, connecting you to populations, not people, and gives you a comprehensive map of your ancestry.

This type of testing is more stable and has more scientific validity. It uses the same science used by the courts, government and law enforcement. And its validity has been confirmed over and over, using the magic of math and laws of large numbers.

Two research teams independently reached the same groundbreaking results that the DNA mutation rate is slower than previously thought: James X Sun et al., in the article, "A Direct Characterization of Human Mutation Based on Microsatellites," in *Nature Genetics* 44/10 (October 2012):1161-65, and A. Kong et al., in the article, "Rate of de novo Mutations and the Importance of Father's Age to Disease Risk," *Nature* 488 (2012):471-75.

What does this mean? The alleles on your DNA have been relatively unchanged for the past 20,000 years. These are markers that everyone has, the reason why anyone can take an autosomal ancestry test. That's about twice the length of what we call world history, hence a perfect time depth for valid inferences about population patterns and ancestry of individuals. Of course, anything can be over-interpreted. DNA testing is not magic—at least traditional autosomal DNA testing based on forensics isn't. If you want magic, look for someone with a crystal ball.

March 18, 2013

Science Fiction and Fictional Science

The future is here. According to Emma Huang in the article, "Personal Genomics: Where Science Fiction Meets Reality," the Human Genome Project started in 1990, and we are not far off from an individual medical diagnosis based on your personal genetic code with a unique prediction for disease "predict[ing] exactly which treatments will work best for you." This is where science meets science fiction. She says the "similarities with newborn testing in the movie, 'Gattaca,' are clear" though we are not yet where we can "tell you anything about your child's

risk for heart disease." But we are ever so close.

In a recent *Smithsonian* article, "Ten Inventions Inspired by Science Fiction," Mark Strauss says the inventor of the modern helicopter, Igor Sikorsky, was inspired by Jules Verne and used to quote him, saying, "Anything that one man can imagine, another man can make real." Art then becomes reality. Goethe, the German poet and philosopher, once said, "Few people have the imagination for reality."

But some do. Scientists and inventors have frequently been so inspired by fiction that they create something new to bend our idea of reality and what is possible. Personal genomics is one such discovery that "has the potential to change medicine and society as a whole" (Huang).

There are others. Robotics is another invention that could potentially transform our society. Could it eventually alter how we think about what it means to be human? An ancient idea, the idea of robots stems from Greek myths. The stirring, golden image of C3PO of "Star Wars" trekking across the desert or chatting in the eclectic, intergalactic bar is reminiscent of the bronze man, Talos, and the talking, golden handmaidens fashioned by Hephaistos, the Greek god of fire, in Greek mythology (Encyclopedia Mythica).

A recent *Smithsonian* article notes that Japan has of late created talking and very human-looking androids and even babies ("In Long History of Creepy Robot Babies, This One Really Takes the Cake"). They remind one of the robotic androids in the *I Robot* book series by science fiction writer Issac Asimov.

Other innovations that have shaped our society were written about long before they were invented. Martin Cooper, the director of research and development at Motorola credited the "Star Trek" communicator as his inspiration for the design of the first mobile-phone device in the early 1970s.

Indeed, H.G. Wells depicted a video Ipad (moving picture player) and a DVD/VCR (entertainment player) in his 1899 novel *When the Sleeper Wakes* and a wireless wrist intercom (like a cellphone later used in "Star Trek") in his 1936 novel *Things to Come*. And according to a National Geographic Daily News article, "8 Jules Verne Inventions That Came True," we now have several things he wrote about: Electric submarines, rocketships, and television newscasts are but a few.

The “father of the modern submarine, American inventor Simon Lake,” was “captivated” after reading Jules Verne’s novel *Twenty Thousand Leagues under the Sea* in 1870 and built the first submarine—the Argonaut in 1898. Robert Goddard, “the American scientist who built the first fuel-rocket in 1926 became fascinated with spaceflight after reading *War of the Worlds*.”

What future inventions may come from fiction? Harry Potter’s cloak may soon no longer be the stuff of fantasy. According to Carri Sieczkowski in a recent article of hers in Huffington Post Science, physicists at Duke University successfully “cloaked an object perfectly” with a “microwave cloak.” And Robert Lamb and Patrick Kiger, in a How Stuff Works article, “10 Future Inventions Everyone’s Been Waiting For,” claim we are on the brink of realizing cars that drive themselves. “Google scientists and engineers” are actually working on creating “autonomous vehicles that utilize intelligence software and Google maps to navigate. These have been depicted in several science-fiction movies, like *I Robot*.

But getting a personal answer to your child’s genomic history in under 50 hours? That could be vital. Especially when you have an ill child and “time is of the essence.” And that is just what Matthew Herper in a recent article in *Forbes*, “DNA Sequencing: Is Science Fiction Becoming Medical Fact?,” says may soon be realized.

Getting a flying car or a robotic maid like the one on “The Jetsons” is not happening that quickly though Lamb and Kiger do say you can go buy Roomba, a robotic maid that vacuums, although she doesn’t have the capability or the personality of Rosey. And you will have to wait a while to acquire that invisibility cloak.

But the car that drives itself might be on the roads soon; however, it will be too pricey for most.

According to Herper, DNA sequencing could become a standard first choice for infants in neonatal intensive-care units and routine use in the clinic. He quotes Han Brunner of the Radboud University Nijmegen Medical Center as saying, “This is a paradigm shift to genome-first medicine” for those patients where conventional strategies do not work. We are truly living in the future.

I just hope Rosey doesn’t take the automatic smart car for a test drive.

August 22, 2012

Customizing Our Offspring

Has *Gattaca* almost arrived? Remember the scene in the film when the parents are in a fertility clinic ordering their perfect bundle of joy by going over a shopping list of possible genetic traits they do or do not want their baby to inherit? We are nowhere near that capability of using genetic testing in this capacity, but some scientists are concerned about us opening that door from several fronts. Should we be concerned or not?

Actually, no one has proposed trying to use DNA testing to do this. All that has been proposed is using genetic testing to cure disease and help parents understand diseases that would be passed down to their children. That sounds like a positive benefit for society, so why all the hype? The argument sounds like this: We don't know where this science will lead, but it sounds as if it will lead to designer babies. That is actually a slippery slope argument as there is no reason to believe that one event must inevitably follow another. If X has occurred, then Y must happen. This type of argument is especially illogical if, as in this case, there are many other steps that must lead to Y.

According to Rob Stein's recent NPR article, "Proposed Treatments to Fix Genetic Diseases Raises Ethical Issues," some are concerned about the science of introducing the healthy mitochondrial DNA of a second mother into an egg of a woman who lacks healthy mitochondrial DNA. This has just been developed in order to prevent the passing of genetically inherited diseases; however, some are concerned this could lead to using DNA science to create designer babies. Stein quotes Mark Sauer of the Columbia University Medical Center, as saying his team of scientists and another are both hoping to "cure disease and to help women deliver healthy normal children."

And others are concerned about DNA testing companies going down this path though none has said it is. According to Alexandra Sifferlin in the *Time* article, "Company Patents First Designer Baby Maker, Now What?" one DNA testing company has just been granted a patent that could allow prospective parents to look at the genetic traits their future child could have with "drop-down menus." That is a huge breakthrough, and we have no idea where that science will eventually lead. However, the company denies it is in the business of making designer babies and says this is solely for the knowledge of genetic traits parents might pass

down to their child. So why are some people concerned?

Since Galileo there has been a fear of science about how it could change society. DNA testing is a marvelous tool. We have discovered diseases, tracked criminals and opened doors for people to discover their past. And we are just beginning. We are at the beginning of an exciting era with genomics. Science is not the problem, nor is DNA testing. But like money, it is what you do with it that matters. There are, perhaps, some things we should not do. Like recreate *Gattaca*. But no one has suggested that, so maybe we need to take a deep breath and calm down. At least for now.

October 14, 2013

DNA and the Future

We live in a world that once only science fiction authors tread. But is this "Brave New World" of genetic testing so alarming after all? Many things have seemed frightening before the technology was fully understood or developed. Many thought air flight impossible before the Wright brothers. And we could not see how much computers and the Internet would change our world.

Of course, we can only imagine how much the genomics field will change our world. But we do hold the keys. And as Mark Henderson points out in his article, "Human Genome Sequencing," "this advent of personal and medical genomics" calls for "broad(er) personal engagement" beyond the world of science. It also calls for a more positive imagination than the "Frankensteinish" ones envisioned in films like *The 6th Day* with Arnold Schwarzenegger.

DNA testing is no longer science fiction. It is part of our world. And we need to understand the science properly. And decide not just what we can do, but what we should do.

For instance, Britain is now set to create babies soon from the DNA of three people by using the healthy mitochondrial DNA of a second mother ("UK Takes Step Toward 'Three-Parent' Babies"). Some say this will help prevent disease.

But others are concerned about the ethical and social challenges for this and a range of issues within the field of genetics. Some are just ideas—like cloning and designer babies. But the ideas of today may be

science tomorrow. There are questions the scientific community has to resolve. But will science alone be enough?

DNA testing is now entrenched in the argument of rights versus security or freedom of expression. Most know that genetic testing can also be used to identify someone accurately. Think CSI. Forensics and the FBI. However, now cops can swab anyone they arrest—before they are charged ("Supreme Court Says Police Can Take DNA Swabs"). What do they do with the samples? Some feel this is an infringement of our constitutional rights.

Some think the busts of faces an artist created from DNA found in gum and hair found in public is questionable (Megan Gambino, "Creepy or Cool?" *Smithsonian*). Actually, scientists have declared specific depictions like this impossible despite the advances made in genetic testing. However, you could get a glimpse of facial possibilities. But where is this headed?

What we have to solve is not just what we do with DNA. It is how we understand how DNA is used. Henderson says the perception that genetic testing is a "simple and deterministic science" is wrong—it is complex. Other factors have to be considered. Otherwise, isn't this a belief in a kind of scientific pre-determinism? Having a gene for cancer does not automatically mean you get cancer any more than carrying a virus means you get sick.

Such genetic testing could and probably will go way beyond these fields. Perhaps it could be used for identity scanners at airports, hospitals and government offices. Perhaps everyone will be required in the future to carry their DNA with them to be scanned for identification much as we carry around a driver's license today. It could even be used for online dating services. Identity theft of one's DNA could be a serious future crime.

However it is used, it is up to us to envision a brighter future with DNA testing—not just a braver one.

June 28, 2013

Three-Parent Babies

As DNA sequencing gets cheaper, it seems that we live in a world that once only science fiction authors tread like *Gattaca* and *Brave New World*. Both depict a frightening future with genetics testing playing a

key role. But will it be such a frightening world after all when DNA testing is the norm?

Many things have seemed frightening before the technology was developed or when it was new. Air flight seemed impossible before the Wright brothers. Not a few were afraid to fly. And we could not envision how much computers and the Internet would change our world. We are just at the beginning of the Genomics Age and genetics testing. We can only conjecture what it will look like. But we hold the keys to creating a positive era both in our imagination and in the communication of the possibilities we wish to bring into fruition. As Mark Henderson points out in his article, "Human Genome Sequencing," this advent of personal and medical genomics" calls for "broad(er) personal engagement" beyond the world of science.

So, we have to begin talking more about how genetics and genetic testing affect our world and how we want it to affect our world. What is the basis for such unfounded fears? Henderson says one problem lies in thinking genetic testing is a "simple and deterministic science" when it is complex. Other factors have to be considered. Otherwise, isn't this a belief in scientific pre-determinism? Having a gene for obesity or cancer does not mean you have to be obese, or you are destined to get that type of cancer. Other factors have to be considered. This type of thinking is depicted in *Gattaca*, but the lead character, considered genetically deficient with a bad heart, out swims and outpaces his genetically enhanced brother and reaches his dreams. He is chosen for a prestigious space-flight mission despite all odds. Genetic testing that indicates certain health conditions is not usually, for most health conditions, a life sentence. Many have missed that final point of the movie. But genetics testing is a useful tool we can use to make better lifestyle choices. It is knowledge.

But that doesn't mean the path does not have some difficult spots and all fears are unfounded. As Henderson notes, there are other "social and ethical challenges" to DNA testing that we have to resolve. And there will likely be more. The Supreme Court just decided police can do a DNA swab test of anyone arrested—not charged. Some see this as protecting us as citizens in a world fraught with terrorism and others see this as an infringement of our constitutional rights ("Supreme Court Says

Police Can Take DNA Swabs"). It is up to us as a society to uphold this law or overturn it.

There will be more issues to solve as well. Should we allow the creation of babies from three parents? Britain is set to do this by also using the healthy mitochondrial DNA of a second mother when the biological mother's mitochondrial DNA is diseased ("UK Takes Step Toward Three-Parent Babies"). Some people see this as a great medical advance while others think it unethical.

And what of an artist who has been busy painting portraits of people from salvaged DNA from stranger's hair and cigarette butts found in public places? Is this an invasion of privacy? Or avant-garde? Matthew Herper, in his article, "Artist Creates Portraits From People's DNA," quotes the artist, a doctoral student, Heather Dewey-Hagbo, as saying these were only "speculative interpretations" and her key idea was to point to the future possibilities of DNA testing.

The possibilities of genetic testing in the future are only limited by our imagination. We just have to stay engaged.

June 30, 2013

The Retrovirus That Came from Outer Space

In the future, a doctor might pull some of her patients aside to inform them that she has determined with genetic testing that they have a rare Neanderthal virus. She needs more DNA tests run just to be sure. It sounds like a bad mix of a movie somewhere in between *The Flintstones* and *Contagion*. How could this be a likely scenario? Scientists have just proven that DNA testing results of some people in modern times show that they still carry Neanderthal retroviruses in their DNA, and there is some question whether or not this could be linked to diseases (Colin Barras, "Neanderthal Virus DNA Spotted Hiding in Modern Humans").

It is almost as if Neanderthals are getting some revenge for us having wiped them out. How could modern humans have signs of Stone Age viruses? First of all, it seems that many of us share a small percentage of our DNA with Neanderthals and Denisovans. This was discovered through advanced genetic testing of the genomes of both (Barras).

How did we get DNA and viruses from Neanderthals? It seems rather

DONALD N. YATES and TERESA A. YATES

likely that some of our ancient ancestors may have had some swinging hot dates with Neanderthals. That is not the picture most desire of their original ancestors though, and the debates over this have been just as heated ("Hot for Hominids," *Smithsonian*).

These hidden ancient retroviruses found in some modern DNA could be a clue for cancers and other diseases. It is found in people with cancer and has been shown as a link to disease for mice, but it could be another five years to make a definitive link with more genetic testing to see how widespread the virus is in the human population and whether or not there are definitive links to it causing diseases in humans (Barras).

We need to do more genetic research and more genetic testing for more definitive answers. Perhaps we can then use this information to help wipe out cancer and other diseases like HIV. Before a super Neanderthal virus has real revenge and wipes us out. That is, hopefully, a joke.

November 20, 2013

The Persistence of (Genetic) Memory

How many times have you looked at a painting by Salvador Dali and seen something you did not see before? Our DNA contains a wealth of information, and we have learned to access that information for many purposes. DNA testing for ancestry as well as genetic testing for forensics and medical purposes. But scientists have just discovered that our DNA contains more genetic instructions than we even previously knew. It has memory. How is that possible?

It seems that a second DNA code was playing hide-and-seek behind another one. Per Liljas, in *The Times* article, "Second Code Uncovered Inside the DNA," quotes the genetic research team leader, Dr. John Stamatoyannopoulos, as saying, "Now we know that this basic assumption about reading the human genome missed half the picture." That is like catching half a plane. How can you take off? Imagine what we have yet to discover if this is true.

But how did they discover this second code? It was part of a genomics project called "Encyclopedia of DNA Elements Project" or ENCODE which was funded by the National Human Genome Research

Project (Heather Tooley, Examiner, "Second DNA Code"). It writes out a new language much as John Lennon would compose and play a new tune with the same piano. We just weren't listening.

And what is it telling us? DNA writes in code like an undercover spy in *Mission Impossible*. This new DNA language to decipher is a code about gene regulation that is written over the first code about making proteins (UW Health Science and UW Medicine, "Scientists Discover Double Meaning in Genetic Code").

How will this impact genetic testing and genetic research? A new language means new information. Scientists can use this extra information to take someone's DNA testing results from a genetic test and better diagnose and treat for disease. ("Scientists Discover"). And scientists may be better able to understand the role of epigenetic, or lifestyle, factors and be able to reverse triggers that cause disease and even aging. The complete picture of our DNA is coming into focus. What will we see?

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