

# A Cat Gut Parasite And The Persevering Drive To Construct the Pyramids in Ancient Egypt.

This is a search for understanding, an attempt to discover the 'holy grail' of why ancient peoples went to almost superhuman lengths to achieve immortal grandeur. Whether the Great Wall of China, the giant stone figures of Easter Island and particularly the great pyramids of ancient Egypt, there is nothing that justifies the degree of diligent work involved to explain just why such colossal achievement's were perceived as worthwhile pursuits. Not discounting the engineering and mass labor required, nor the belief that such accomplishments would provide safety, tribute and glory to powerful kings and gods, and/or everlasting life in paradise---nothing, explains the great magnanimity of the societal efforts put forth. The first early pyramids were built from the beginning of The Old Kingdom, circa 2647 B.C. They provide a testament to the countries glorious past when their civilization was one of the richest and most powerful. - Egyptian pyramids were not built with forced slave labor but by the Egyptian peasants during the seasonal flood period of the Nile River; they were paid mostly in bread, beer and onions which comprised their daily normal diet. Approximately 2.25 million stones each weighing 2.5 tons had to be quarried, moved, and set into place to build Khufu's Great Pyramid at Giza. At minimum, it required 20, 000 men to labor for twenty seasons to finish. Surprisingly the real dynamic force driving the Ancient Egyptians efforts may be related to the humble cat and a lowly one-celled protozoa that needs felines to *sexually* reproduce. It was such an association that possibly provided the obsessive drive and instilled the discipline of determined purpose required to do the job by the Egyptians. Say what? Worship of the Sun God and the Pharaohs was not suitable motivation? Such lofty tributes were spurred onward by authentic spiritual belief and cult-like devotion, but the steadfastness to *persevere* in such grand projects of such large scope was buoyed by a broad-based cultural obsession that was not set in motion by fear, warfare, natural disaster, nor fanatical idolatry. It is theorized here, that such intense motivation is a derivative of neurotransmitter changes in the brain caused by a parasitic infection that afflicted most of the Egyptian community.

Pregnant women are to avoid scooping kitty litter because if she contracts *Toxoplasma gondii* [*T. gondii*] it can cause her to miscarry or damage her fetus's brain function and vision. It is a harmful parasite, like an amoeba, more complicated than bacteria and much larger than a virus. It has a large genome of 80 million base pairs. Originally, it was a feline parasite but it can infect several other hosts including humans, primates, rodents, bats, whales, chickens, and camels. Like other livestock including horses, camels acquire *T. gondii* through ingestion of excreted oocysts by cats—feral, domesticated, and wild. Antibodies against *T. gondii* in dromedary camels from North African camels show seroprevalences approaching two-thirds of the population. Camels are not native to the Egyptian Sinai and were introduced to that desert about two-thousand years ago. Camels were not present during the Pharaonic period of Egypt beginning in 3200 B.C., and horses existed in ancient Egypt only as far back as the thirteenth century B.C. Cat owners commonly contact it through their skin when handling soiled cat litter, and in the United States today roughly ten percent of Americans and one-third of all people worldwide are infected. When a mouse smells cat urine, it causes an instinctive fear response even in laboratory animals that have never seen a cat nor have its ancestors for several generations. A hard-

wired alarm signal is transmitted to the *amygdala* in the mammalian brain that processes a range of emotions from pleasure and contentment to anxiety, panic, and fear. This sends mice scurrying for cover in hopes of avoiding predation. In mice, the protozoan invader swims straight for the brain where it forms clusters of tiny cysts within the amygdala control center. The *T. gondii* produces a contrarian response in that the mice begins to crave the cat urine odor. Instead of fleeing, it pleasurably seeks it out. The scent of cat urine signals the *T. gondii* within the amygdala to pump out dopamine, a neurotransmitter that registers pleasure and overrides the alarm bells that are usually set off. In male rodents, cat urine causes the amygdala to throb and their testicles to swell as if it was a pheromone from a female in heat. The infected mice still fear other predators but move toward the danger caused by cats, the urine becomes a lure. Protozoans like *T. gondii* do not colonize genomes like some harmful viruses but they can steal a gene and even in creatures that are not normally feline prey such as humans they might at times manipulate brain chemistry that affects the hosts' behavior. Many human hoarders of pet cats---that exhibit a pronounced subset of obsessive-compulsive disorder [OCD] symptomology---oddly also crave the rather repulsive odor of cat urine or just don't notice it.

Like most animals, *T. gondii* craves sex but when inside most creatures including mice, humans, camels---they clone themselves making identical copies of themselves *asexually*. Sexual reproduction only occurs for them inside of the digestive guts of cats! By tricking mice into becoming ready prey, the protozoa end up where it wants to be for sex, inside the intestines of cats. *T. gondii* has not one but two genes for facilitating the production of dopamine which within an infected amygdala can cause a flood of this potent neurotransmitter which produces positive feelings. For mice, feeling so good and wanting more, walks them into a feline mouse trap.

Toxoplasmosis is a rampant zoonotic disease today in North Africa and studies estimate the seroprevalence of *T. gondii* in contemporary Egyptian cats is 97 percent. It is transmitted to humans from animals via the oral-fecal route and the consumption of infected meat and/or unpasteurized, contaminated milk; it also is passed through the placenta from the mother to fetus. The population of domestic and feral cats is high and the sandy soils in zones of the urban metropolises of North Africa are heavily contaminated with *T. gondii* oocytes. The record of historical reverence of domesticated cats in ancient Egypt is well-documented dating back to around 2000 BC when European felines ran wild. Cats in ancient Egypt gained an exalted status in royal circles while earning a place in the peasant communities who prized them for companionship and their hunting of grain-eating rodents and poisonous snakes. They were revered as a totemic, living incarnation of Egyptian deities, raised in large catteries at religious temples, sacrificed as offerings, modeled in bronzed statuettes, and mummified, often to be buried with their masters. They were depicted in tomb art, where cats were strongly suggestive of female sensuality and fertility. The historian Herodotus wrote that when an Egyptians house caught fire, the owners were most concerned about the fate of their cats and not their property or possessions. Perhaps apocryphal, is the device employed by the Persian conqueror King Cambyses in 525 BC at the battle of *Pelusium* in the eastern Nile delta. He cleverly put rows of cats and other animals that the Egyptians believed were manifestations of their gods in front of his advanced troops as a talismanic shield, knowing that the Egyptians would refrain from shooting arrows and catapulting missiles in fear of hurting the sacred symbols of their gods. The tentative, confused, and hamstrung Egyptian fighters were defeated. They took flight in a rout that devolved into a massacre after seeing their beloved animals being driven before them by their enemy, whose own shields were cynically adorned with the likeness of their Egyptian goddess *Bastet*. She was the deity with a feline head and

woman's body who protected the home and domesticity, shielding the household against malevolent spirits. She safeguarded women's secrets, fertility and childbirth as well as insulating them against illnesses that affected mothers and their children. She was the daughter goddess of the almighty Sun God *Ra* of whom the Egyptians devoutly worshipped because she could conjure up divine vengeance to right wrongs. It was a grave offense in Egypt to harm one of her cats and Herodotus reports that death was the punishment for killing one. The cats were in themselves were seen as inhabited vessels used by gods but not as being divine themselves.

Egyptian mummies contain evidence of toxoplasma-origin DNA in soft tissue biopsies from embalmed heads, using metagenomic Next-Generating Sequencing analysis for microbial artifacts. Genomic evidence of a pathogen---microbe, virus, or parasitic protozoan, in an Egyptian mummy strongly intimates its presence during its lifetime. Recent studies show stronger evidence of a positive relationship between toxoplasmosis infections and mental disorders such as OCD. It is not definitive yet whether endemic toxoplasmosis in a population gives rise to a greater propensity for obsessive-compulsive disorder in that group but that is likely and further study is advised. Also, clinical studies show the prevalence of toxoplasmosis is higher in refractory OCD patients than those who respond appropriately to medicine and behavioral therapy with both OCD groups exhibiting higher rates than normal control groups. The ancient Egyptians were a driven people whose devotion to cats is evidenced by historical artifacts to their honor and the number of breeds worldwide whose lineage is from the first efforts at cat selection in the catteries of ancient Egypt. Just possibly, the Herculean effort to construct the Great Pyramids and other treasured monuments to ensure acceptance into the eternal afterlife of their gods, was propelled forward by a common but lowly infection of the emotional center of the human brain. Microbes manipulate our emotions through genetic machinations and drive human evolution by forcing us to adapt--- but by also altering our DNA. It is one thing to find broken-down DNA incorporated in our human DNA but the completion of the Human Genome Project led biologists to three eye-popping realizations:

1. Only 2 % of the DNA in our genome functions to code for proteins that run the entire human body and its metabolic processes while perhaps ten times that much DNA regulates in our genome is involved with gene regulation; ramping up or tampering down gene activity.
2. About 8 % of our genome, 250 million base pairs are ancient viral genes inserted into our chromosomal genes long ago that have never been discarded. Most are disabled and do not function but a few viral genes do play current vital roles inside our bodies.
3. We have fewer genes than expected, only about 20,000, fewer than some varieties of onions; a finding that suggests that humanity may at one time come close to extinction. The exciting new field of *epigenetics* explores how the environment and our experiences affects the activity of our genes and reveals aspects of how the hardwiring of our DNA works akin to how software in computing affects the operational functioning of the computational hardware. Epigenetics uses extra-genetic signals and small chemical moieties that are attached to the DNA that affect how human cells access, read, and utilize the DNA. We accumulate more of these *de facto* mutations categorized as these epigenetic change as we age. Epigenetics studies how genes get turned on and off. It is a process involved in every aspect of life and such reversible and heritable changes affect the way we live as well as the potential acclimation and success of our future generations.

Human beings have a richer culture than other animals, and we live in fast-moving environments but we have biological flexibility because of imprinting on our genes through epigenetics. The true gods guiding human destiny may not be spiritual but epigenetically inspired, and such innate, potential change also includes the remnants of the almost invisible, minute agents of life that function as mobile genetic elements that comprise about half of our human genome. They linger, consume cellular resources, float around on their own and burrow into human chromosomes at random. Some do nothing useful; some regulate functioning genes but they are inside every cell we have and such bits of DNA no matter what the source of their origin—viral, bacterial, or protozoan—are now a permanent part of human beings. And they have in the past directed animal evolution including ours and will continue to do so in the future.

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