

Bad Moon Rising: The Science of Werewolves (2009)¹

By Jennifer Ouellette²

Confession: I love werewolf mythology, and have done ever since I first saw the classic film *Was a Teenaged Werewolf* as a kid during a sleepover at a friend's house. My folks didn't like me watching horror films, mostly because I had a vivid imagination and inevitably suffered nightmares afterward.

This was no exception. I woke suddenly in the night, and realized there was the vague outline of a furry human being near the foot of my bed. Terrified, I lay as still as possible and tried to regulate my breathing, figuring if the werewolf thought I was still asleep, it wouldn't eat me. It was a good 10 minutes before my rational brain re-asserted itself and I realized it was a poster of David Cassidy³ my friend had hung on her wall. (I'm sure the therapists out there could have a field day with this one.)

The werewolf legend -- and shape-shifting in general -- is quite possibly as old as civilization itself. *How Stuff Works* points to "The Epic of Gilgamesh,"⁴ one of the oldest written works, as a possible "first mention" source for werewolves. Gilgamesh discovers that the goddess Ishtar -- who has amorous designs on his virtue -- turned one former lover (a shepherd) into a wolf. Gilgamesh wisely refuses her romantic overtures.

Ovid's "The Metamorphosis"⁵ tells the story of King Lycaon of Acadia, who is visited by the god Jupiter in disguise and dares to serve human flesh to the immortal.

Jupiter frowns on cannibalism, it turns out, so he turns Lycaon into a wolf. It's not a coincidence that his name comes from *lykos*, meaning "wolf" -- which is also a root word for *lycanthropy*, the delusion wherein someone believes he or she has been transformed into a wolf or other kind of animal.

The earliest film about werewolves is *The Wolfman*,⁶ in which those bitten by a werewolf transform into the same half-human, half-wolf hybrid.

Originally, the transformation took place in the autumn, commonly the season when monkshood or wolfsbane is in full bloom. People in the movie attach wolfsbane flowers to their



Jupiter turning King Lycaon into a wolf
(1589 engraving by Hendrik Goltzius)

¹ This was originally written for Jennifer Ouellette's science and culture blog, *Cocktail Party Physics* (<http://twistedphysics.typepad.com>) and adapted for the on-line edition of *Scientific American* (<https://blogs.scientificamerican.com/cocktail-party-physics/bad-moon-rising-the-science-of-werewolves/>).

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³ David Cassidy (born 1950): musician and actor-- most famous for starring as Keith Partridge on the 1970s musical-sitcom *The Partridge Family* (in the process becoming a teen idol)

⁴ written ca. 2100 BCE in ancient Mesopotamia

⁵ Ovid was a Roman poet, and he first published this collection of myths in verse form in 8 CE.

⁶ a 1941 movie starring Lon Chaney, Jr. as the Wolfman

clothing to ward off attacks, but in reality, the plant is very poisonous so it wasn't the smartest protective mechanism. Those who work with these plants typically wear gloves and give their hands a thorough washing after.

In the *Twilight* series, Jacob Black's unique condition runs in the family, and it turns out that there is a genetic disorder called hypertrichosis that gives rise to excessive hair growth, in the most extreme cases all over the body. It is sometimes called "werewolf syndrome," and may be the root of the werewolf legends.

In the mid 16th century, a man named Petrus Gonzales was brought to the court of King Henry II of France as a novelty: he had long soft hair all his body. Nonetheless, he married and fathered three children who inherited his condition.

His was not an isolated case. In the mid 19th century, a Mexican Indian woman named Julia Pastrana had hypertrichosis terminalis: her face and body were covered with straight black hair and she achieved some measure of fame as the "Bearded and Hairy Lady" on the freak show circuit. She could read and write in three different languages, but people still gawked at her as if she were just an animal.

The person responsible for exploiting her was none other than her husband, Theodor Lent, who had no compunction about selling her body to a Russian anatomist after her death to scrounge a few extra dollars out of his "investment." And when the anatomist returned the mummified body, Lent took his wife's remains on the road. Julia's mummy was lost for many years, but was rediscovered in 1990 at the Oslo Forensic Institute in Norway, where it still resides today.

Many of those who suffered from hypertrichosis found themselves on the freak show circuit, figuring it was better to make the best of a bad situation and get paid for their unfortunate appearance. Other famous examples are Stephen Bibrowski, a.k.a., Lionel the Lion-Faced Man, the so-called "wolf-boy" Jesus Aceves, Annie Jones the Bearded Lady, and Fedor Jeftichew, known to fans of P.T. Barnum's traveling circuses as JoJo the Dog-Faced Boy. It was certainly preferable to the fate of sufferers who had the misfortune to live in the 16th century: in 1573 an alleged werewolf named Gilles Garnier was burned at the stake.

Apart from obsessive shaving and depilatory techniques, there is no treatment or cure. Back in 1995, a team of researchers managed to identify a gene that in its mutant form may cause (or at least contribute to) congenital generalized hypertrichosis, the rarest form of the disease.

The rare modern cases largely are confined to one particular Mexican family, 32 of whom agreed to donate their blood for genetic screening to participate in the study. Nearly all exhibit excess body face and body hair, but the condition is more pronounced in the males, because hypertrichosis is an "X-linked trait."

Daughters only inherit one copy of the mutant X chromosome responsible for the disorder, but their other normal X chromosome counters the expression of the gene. This means they usually only have patchy spots of excess. The male members, alas, only inherit one X chromosome, with no second X chromosome to offer any protection. Ergo, the mutation is active in every cell of the body resulting in a more uniform coat of hair.



Julia Pastrana
(1834–1860)



Stephan Bibrowski
(a.k.a., Lionel the Lion-faced Man)
(1890-1932)

More interesting than the gene itself -- which has not been completely isolated, but has been localized on the bottom half of the X chromosome -- is the fact that it seems to belong to the class of atavistic mutations: the re-emergence of a genetic trait that lies dormant because the organism has evolved in such a way that it's no longer needed, and the gene is set aside.

But it doesn't disappear from the genome completely, and the working hypothesis is that occasionally such atavistic mutations can reawaken those genes. Why is the body such a pack rat when it comes to hoarding no-longer-used genes? Per the *New York Times* article about that research:

Biologists propose that the reason atavisms exist at all is nature's propensity for recycling old ideas. Rarely is a gene used for a single purpose in the growth and health of an organism. Instead, most genes are Renaissance artists, able to work in a range of styles and media depending on the needs of the species. A gene involved in hair growth may also play a role in the development of skin or bones. Thus, even a relatively naked ape like *Homo sapiens* cannot afford to lose the hair gene for fear of jeopardizing the rest of the body's architecture and packaging.

This is not a new idea in evolutionary theory. Charles Darwin himself suggested that the condition of

having more than the usual number of fingers or toes (polydactyly) was an ancient trait, now mostly dormant, that occasionally reappears due to some hereditary misstep. In the case of hypertrichosis, the scientists speculate that humans way back in their earliest days still possessed some semblance of a protective "fur coat." The research could also tell scientists more about how hair grows, in theory producing a treatment for baldness. (Whoever figures that one out stands to make a fortune.)

Given the rarity of hypertrichosis, it's unlikely this alone fueled the widespread versions of werewolf legends and other shape-shifting stories around the globe. The psychological disorder known as clinical lycanthropy [...] is a bit more common, and has been known for centuries.

The Greek physician Paulus Aegineta wrote about the syndrome in the 7th century, and the Biblical king Nebuchadnezzar is believed by some historians to have suffered from lycanthropy following a seven-year bout of depression. In 1589 a German named Peter Stubbe was executed in Cologne for cannibalism and multiple murders; he claimed he had a magical belt that enabled him to turn into a wolf.

In France a decade or so later, a man named Jean Grenier claimed he had a skin that allowed him to become a wolf, and said he was responsible for several murders and disappearances. The court ruled he was insane and confined him to a monastery for the remainder of his life, but his was a common delusion.

Some historians estimate that between 1520 and 1630, there were over 30,000 recorded cases in France of people who thought they were werewolves. Robert Burton mentions the syndrome in his 1621 treatise *The Anatomy of Melancholy*:

Lycanthropa, which Avicenna calls *cucubuth*, others *lupinam insaniam*, or wolf-madness, when men run howling about graves and fields in the night, and will not be persuaded but that they are wolves, or some beasts. Aetius and Paulus call it a kind of melancholy, but I should rather refer to it as madness, as most do.

The disorder, while rare, is still around today. Some 30 cases have been reported in the medical literature since 2004 alone although only a few involve wolf or dog transformations. Despite its name, those suffering from lycanthropy believe they are transformed into various different animals, such as a 34-year-old schizophrenic woman who thought she could turn into a frog and often exhibited frog-like behavior, or another schizophrenic woman who believed she was turning into a bee.

Those who study these sorts of psychiatric conditions believe lycanthropy is usually linked to other conditions such as schizophrenia, bipolar disorder, or clinical depression, but that doesn't explain why those episodes take the form of lycanthropy. There might be neurological factors at play.

For instance, certain parts of the brain are known to play a role in shaping body image, and at least one brain imaging study revealed that those suffering from clinical lycanthropy show an unusual level of activity in those parts of the brain. So the transformation process would feel extremely "real" to them. That still doesn't explain why they feel transformed into specific creatures; that may be due to cultural influences.

It certainly can make for some interesting family gatherings. One famous case involved a 49-year-old married woman who began experiencing delusions of being a wolf, culminating in disrobing at a family dinner and, well, basically behaving like a dog in heat. She had episodes of growling, scratching and gnawing at the furniture, and when she looked into the mirror, her body image was so distorted she saw the head of a wolf instead of her own face. Fortunately, nine weeks in an institution under medication for schizophrenia controlled her behavior sufficiently that she was discharged.

The case Scicurious highlights involved a woman dubbed "Ms. A" admitted to the hospital after refusing to take her meds. Her excuse:

She told her family and the doctors that she could not take the medication because they belonged to Ms. A, and Ms. A had died two weeks before. The patient told them that she had been transformed by the devil into a snake. She was observed sticking out her tongue in snake-like fashion, hiding under things, and attempting to bite (and threatening to kill) her doctors. Ms. A had a past history of several episodes of major depression. When she was prescribed antidepressants and antipsychotics, the symptoms resolved almost immediately and she was able to go home.

Okay, I love the mythology, the history, and it's fun to delve into the science behind such a quirky subject. But those with such rare conditions don't have an easy time of it, despite the fact that at least one 11-year-old revealed in being named hairiest girl last year. The physical effects are daunting enough. Like Sci, I suspect that experiencing the psychological condition would likely prove even more terrifying -- almost as terrifying as actually shapeshifting into a wolf.



Lon Chaney, Jr. in the 1941 movie *The Wolfman*