

# METAMORPHOSIS OF THE HUMAN ANIMAL: HOX ZODIAC

Victoria Vesna, Siddharth Ramakrishnan, 2010

## ABSTRACT

The *Homeobox (hox) genes* essentially define body regions in all animals including humans – responsible for determining two arms, two legs, one nose and so on. This gene is shared by all living beings – from the snail to the elephant to humans – and it can now be manipulated into transforming certain parts of the body into others. We have observed such transformations, such as that of an amputated antenna into a limb, as far back as 1901, termed neomorphosis<sup>i</sup>, and it has only recently re-emerged as an area of scientific study. Spontaneous transformations and induced regenerations are fascinating research topics that are fast becoming a reality; some scientists are postulating that it may be possible that the hox gene could be central to limb regeneration in the future<sup>ii</sup>.

This paper will present the *Hox Zodiac* project, which attempts to introduce this subject and push the ideas further into speculation of mutation (i.e. humans and animals) into creatures that may resemble the mythical beings we know as fiction. The starting point of this wheel of life is the Chinese zodiac, consisting of twelve animals that are associated with humans. In the process of development, it became interesting to note that half of the animals on the wheel are those used in the lab – rat, pig, monkey, dog, sheep and rabbit. The ox, tiger, horse, snake, and rooster are considered mythical and the dragon could easily fall into the category of a genetically modified creature that is to re-emerge in the future. Since medical and scientific testing on humans is strictly forbidden, scientists have virtually shifted to animals for all such studies. Thus, everything that is used on our bodies and minds is directly related to the animal kingdom. The pig heart and rat mind are symbols for the paradox of science that uses animals in ways that is at once disconnected while subconsciously connecting us more than ever by using research results in medical and food products we consume.

Although the controversy of using animals in labs is widely known and often violently opposed, the artist in the lab questions how this research impacts our collective consciousness, especially with the growing trend of brain-computer interfaces and particularly synthetic telepathy. This relationship of the human to the metaphorical meaning of the animal kingdom brought to mind Jung's research on metaphors, symbolism and archetypes, which became central to the *Hox Zodiac*. This paper focuses on the first animal in the Hox Zodiac, the (transgenic) rat.

<http://artsci.ucla.edu/hox>

Production collaborators: Pinar Yoldas, Miu Ling Lam, Romie Littrell

**Limb regeneration.** Panagiotis A. Tsonis, Cambridge University press, 1996, pg.

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Taking it in its deepest sense, the shadow is the invisible saurian tail that man still drags behind him. Carefully amputated, it becomes the healing serpent of the mysteries. Only monkeys parade with it. (Jung, *The Integration of the Personality*. 1939)

The *Homeobox (hox) genes* essentially define body regions in all animals including humans – responsible for determining two arms, two legs, one nose and so on. This gene is shared by all living beings – from the snail to the elephant to humans – and they can now be manipulated into deliberate transformations of existing body parts into others. Hox genes are expressed along the anterior-posterior (A/P) body axis in majority of animals, creating a unique A/P code which plays a pivotal role in segment specific morphogenesis. Such transformations, like that of an amputated antenna into a limb, have been observed as far back as 1901[1] and has only relatively recently re-emerged as an area of scientific study. Spontaneous transformations and induced regenerations is fascinating research that is fast becoming a reality and some scientists are postulating that it may be possible that the hox genes could be central to limb regeneration in the future [2]. Conceptually the possibility of manipulated animals has been pervading in our literature from myths and mythologies of different civilizations to popular fiction over the ages. Many of these creatures are well set in our collective consciousness with stories that are told to us as children.



Figure 1: Legs on the head: Antennapedia mutation in the fruitfly, causing legs to grow in place of antennae.

### **Background**

The Hox Zodiac project and philosophical dialogue took place alongside the continuous development of Blue Morph, a major work developed in collaboration with nanoscientist James Gimzewski. Meditations and numerous discussions about the multi-dimensional interpretations of the metamorphosis of a chrysalis into a butterfly frequently brought to attention various issues concerning biotechnology of the human body and mind. Most intriguing of all and perhaps least anticipated was the audience relationship, approach and participation with the installation. Vesna and Gimzewski discovered that there was a pervasive need for people to connect to the spiritual aspect and grasp the meaning and, in many cases, the pain of major paradigm personal / collective change. More recent

research that Gimzewski is conducting in his lab deals with the idea of the artificial brain that involves molecular imaging of neurons taken from transgenic mice and rat brains. Vesna started questioning the fact that the scientist, just as most humans, had a string fear and repulsion of the animal but does not consider this when doing research. Although the controversy of using animals in labs is widely known and often violently opposed, the artist in the lab questions how this research impacts our collective consciousness, especially with the growing trend of brain-computer interfaces and particularly synthetic telepathy. This relationship of the human to the metaphorical meaning of the animal kingdom brought to mind Jung's research on metaphors, symbolism and archetypes, which became central to the *Hox Zodiac*. While Jung's work is of little importance in contemporary psychoanalytic practice, it remains widely influential in such fields as religious studies and literary criticism and is frequently summoned in this inquiry.

Ramakrishnan's research is based in neurosciences and he worked on zebrafish development when this project commenced. In discussion about his research, he introduced the idea that Hox genes seem to be a somewhat neglected area of scientific research. Vesna observed the difference in the approach of the Scottish scientist, Gimzewski to the Indian scientist, Ramakrishnan and both confirmed that the Western mind in the science labs almost violently forbids any ideas of the "soul" or "intelligence" and that bringing the unknown into the discussion can endanger if not destroy a scientific career. As the off-line discussions swerved to the unconscious realms occupied by mythical creatures and gods such as Shiva, the idea of hox gene manipulations shifted from the materialistic manipulations of the genes to an inquiry into the way humans deal with metamorphosis and our relationship to the animal kingdom. Being that this research is centered around biotechnology, the dark side of the human endeavor to control nature inevitably emerged. But also due to Ramakrishnan's Indian background, the artist and scientist frequently framed their discussions interest in Indian mythology in relation to scientific ideas around genetics, evolution and recent biotech research.

### **Chinese Zodiac as interface**

When invited to participate in an exhibition in Shanghai, China, Victoria Vesna decided to test the concept and she was at first baffled by the problem of creating an interface for a master gene, which is essentially shared by all animals. Inevitably, the idea of the Chinese zodiac came up when researching and it seemed a perfect vessel for portraying the human relationship with the animal kingdom that goes beyond the materialistic view of the scientist or daily interaction with pets or animals as prey. Further, the influence and role of China in almost every aspect of our existence is nothing short of overwhelming to the West. This was a way to create an interface into the cultural impact of this rising power. Many confronted the Chinese zodiac for the first time but a surprising number were fully aware of their corresponding animal and it became interesting to think about how this is merging with the Western zodiac. Although the majority claimed that they did not believe in the predictions of their corresponding zodiac animal, we came across very few people who did not know their sign in at least one tradition.



Figure 2: Physical interface for the Hox Zodiac

Ramakrishnan brought to the Hox zodiac table the Indian philosophical approach to astrology that became an important element as we proceeded. India's influence on the sciences, through philosophy, yoga and IT is much larger in the West than most people are aware of, and this is definitely true in relation to the animal, the myth and philosophy of life. Here Jung's work became a necessary reference, as the psychology he developed is based on psychic totality and psychic energetics. He postulated two dimensions in the unconscious—the personal (repressed or forgotten content of an individual's mental and material life) and the archetypes (images, patterns, and symbols that are often seen in dreams and fantasies and appear as themes in mythology and religion) of a collective unconscious (those acts and mental patterns shared by members of a culture or universally by all human beings).

The Chinese calendar / zodiac is a scheme that relates each year to an animal and its reputed attributes, according to a 12-year cycle. This system, with some variations, is used by a large part of Asia including Korea, Japan, Vietnam, Thailand. The animal signs are used for dating the years and represent a cyclical concept of time, rather than the Western linear concept of time. The Chinese Lunar Calendar is based on the cycles of the moon, and is constructed in a different fashion than the Western solar calendar. In the Chinese calendar, the beginning of the year falls somewhere between late January and early February. The Chinese have adopted the Western calendar since 1911, but the lunar calendar is still used for festive occasions such as the Chinese New Year.

According to Chinese legend, the twelve animals quarreled one day as to who was to head the cycle of years. The gods were asked to decide and they held a contest: whoever was to reach the opposite bank of the river would be first, and the rest of the animals would receive their years according to their finish. All the twelve animals gathered at the river bank and jumped in. Unknown to the ox, the rat had jumped upon his back. As the ox was about to jump ashore, the rat jumped off the ox's back, and won the race. The pig,

who was very lazy, ended up last. That is why the rat is the first year of the animal cycle, the ox second, and the pig last.

In the process of development, it became interesting to note that half of the animals on the wheel are those used as test models in the lab – rat, pig, monkey, dog, sheep and rabbit. The ox, tiger, horse, snake, rooster are considered mythical and the dragon could easily fall into the category of a genetically modified creature that is to re-emerge in the future. Here we focus on the first and last animal of the zodiac, the rat and the pig, for the pig heart and rat mind are symbols for the paradox of science that uses animals in ways that is on one hand disconnected and on the other connected through research results concerning medical and food products we consume.

### **Rat/Mouse**

“Rats!

They fought the dogs and killed the cats,  
And bit the babies in the cradles,  
And ate the cheeses out of the vats,  
And licked the soup from the cooks' own ladles,  
Split open the kegs of salted sprats,  
Made nests inside men's Sunday hats,  
And even spoiled the women's chats,  
By drowning their speaking  
With shrieking and squeaking  
In fifty different sharps and flats.”

The Pied Piper of Hamelin poem by Robert Browning was contributed to this paper by Gimzewski, who knows the verse by heart and pointed out that it was taught in England to all young children. Based on a medieval legend concerning the departure or death of a great many children from the town of Hamelin in Germany, it is speculated that they disappeared due to death by plague. Although this dark image of the rat is firmly in the scientist's subconscious, the connection to this dark image is avoided by working with the abstracted rat neurons in the petri dish.



The rat and/or mouse, in many ways is a perfect starting point for this exploration of cultural and scientific global mutations. Unquestionably, it has a dark side that goes beyond the physical aspects with which virtually every country in the world deals – it is deep in the human psyche, connected to our fears. In the Chinese zodiac, if one is born in the year of the rat, he or she is marked as forthright, tenacious, intense, meticulous, charismatic, sensitive, intellectual, industrious, charming, eloquent, sociable, artistic, shrewd, and can be manipulative, vindictive, self-destructive, envious, mendacious, venal, obstinate, critical, over-ambitious, ruthless, intolerant, scheming. At their worst, rats are ruthlessly power-hungry, vindictive, and Machiavellian.

Because of their destructive ways, mice and rats were considered unclean creatures of ill omen. They were symbols of evil, pestilence, death, decay, infirmity, plague, demons, and the Devil. Like Satan and his minions, mice and rats were believed to thrive off the misfortunes of the children of God and to enjoy bringing humans to ruin. Ancient Greeks carried mouse coins to protect themselves against the mouse's evil eye and in India rat temples were built to appease the demons associated with these creatures.

One could easily complete a global survey of mythology and stories related to rats and mice whose activities are frequently believed to be quite prophetic symbolizing extreme good or bad omens. Frequently they are said to flee sinking ships and houses where death was imminent and appeared in large numbers as an omen of war - most likely ready to feast upon the impending destruction. In Rome, white rats brought good fortune. In Germany, white mice brought either good luck or death with them. The scurrying and squeaking of mice indicated that a storm was approaching. An unhappy turn of events was foretold when a mouse or rat chewed on religious items.

Rat tails were associated with tangles of confusion, misfortune, and rumor. To show the passage of time, Renaissance art sometimes depicted night as a black rat and day as a white one. Chinese mythology states that the rat brought the gift of rice to humankind. There and in other places, it is a symbol of prosperity, wisdom, and prophecy.

The rat appears in contemporary symbolism as well -- the desert rat has been used as an emblem of British soldiers in desert campaigns in the Gulf War. Having this general sense of the power of the mouse and rat in the human psyche, we turn to the booming population of the genetically engineered species in labs around the planet.

Research among rats and mice has been going on for so long that there are now specific lab-bred strains of these creatures that lack similarity to the wild species. There are rat and mouse models for a variety of physiological dysfunctions ranging from morbid obesity to epilepsy to alcoholism<sup>iii</sup>. Transposgen Biopharmaceutical is one of many companies that serves as an example of the kind of research that has resulted in a mutated mouse that now is part of our (suppressed) collective unconscious and we explore the meaning of the mutated animal. Announcing the updated website, company's CEO made a statement that clearly shows the thinking behind this kind of work: "We are now able to communicate to a global audience the benefits of using Transposagen's MutaRat™ technologies in drug discovery research," said Dr. Eric Ostertag, CEO of Transposagen Biopharmaceuticals, Inc. Transposagen Biopharmaceuticals is a privately held biotechnology company based in Lexington, KY. The company is dedicated to providing unique animal models of human diseases for drug discovery and development. The production of animal models is a \$1.2 billion/year market and is expected to grow 12% annually through 2010.

A recent article in Nature magazine refers to a large-scale investment in mutant rat models that is being pushed in Europe<sup>iv</sup>. Moving from mice to rats is explained in the Knock Out Consortium site: "Rat models are superior to mouse models for testing the pharmacodynamics and toxicity of potential therapeutic compounds, partially because the number and type of many of their detoxifying enzymes is very similar to those in humans."<sup>v</sup>

This factory breeding of strains and mutants of mice and rats has also given rise to the concern that they are far removed from the species in their natural setting and that the research solely based on such 'artificial animals' may be flawed. For instance, studies on

effects of bisphenol A, an environmental estrogen found in plastic, resulted in varying results depending on whether the research was conducted by the EPA/plastic industry or by university researchers. It was later found that the strain of rats used by the EPA/plastic industry were insensitive to estrogens<sup>vi</sup>.

Despite all the concerns, rats and mice are the predominant models of mammalian research, especially those in relation to development and the brain. Indeed a wealth of information regarding our learning and memory, neuropathology and stress-induced behavioral responses are a direct product of research on these animals. When science delves into the intricacies of brain function - the basic building blocks of a neuron, the assembly of such nerves to form functional circuits and the response of such circuitry to external environmental inputs – when broken down into these parts, the similarities in working between all beings is glaringly clear. In a fundamental way, the Hox genes also speak to such a fundamental similarity amongst all animals – a common blueprint that underlies all body forms.

Mice and rats have also featured predominantly in the field of Hox gene research. Studies have shown the importance of Hox genes in defining the different regions of the brain, organ development and even in regeneration of bones<sup>vii</sup>. While such studies involve Hox gene manipulations, they have not resulted in producing multi-limbed rodents or mice with tails on their heads, as most such drastic alterations render the embryo unviable. But the underlying potential for such transformations exist, opening up the possibility of a world of hybrid entities. One line of work that is slowly gaining traction is the mouse-human chimeras. Images of the mouse with a human ear on its back are popular, but recently there have been debates over the possibility of a mouse with a human brain<sup>viii</sup>. That, in essence, would be the true hybrid.

This scientific trend sparked interest in not only the emotionally charged animal rights protesters, but also those who grappled with the complex nature around this kind of research. Theorist Donna Haraway inspired many across disciplines with her exploration of the “OncoMouse” (Modest Witness@Second Millennium. FemaleMan meets

OncoMouse. Routledge, 1997), using literature and arts to help define and explain her feminist viewpoint of techoscience, as coined by Bruno Latour – to deal with the separation of what we define as “science” and “society”. In 2006, artist Kathy High created an important work “Embracing the Animal” addressing our relationship to the rat in the labs



Figure 3: Kathy High. “Rat Hero” (2005), Embracing Animal installation at the MASS MoCA exhibition. Echo, HLA B27 transgenic rat. Photo: Olivia Robinson

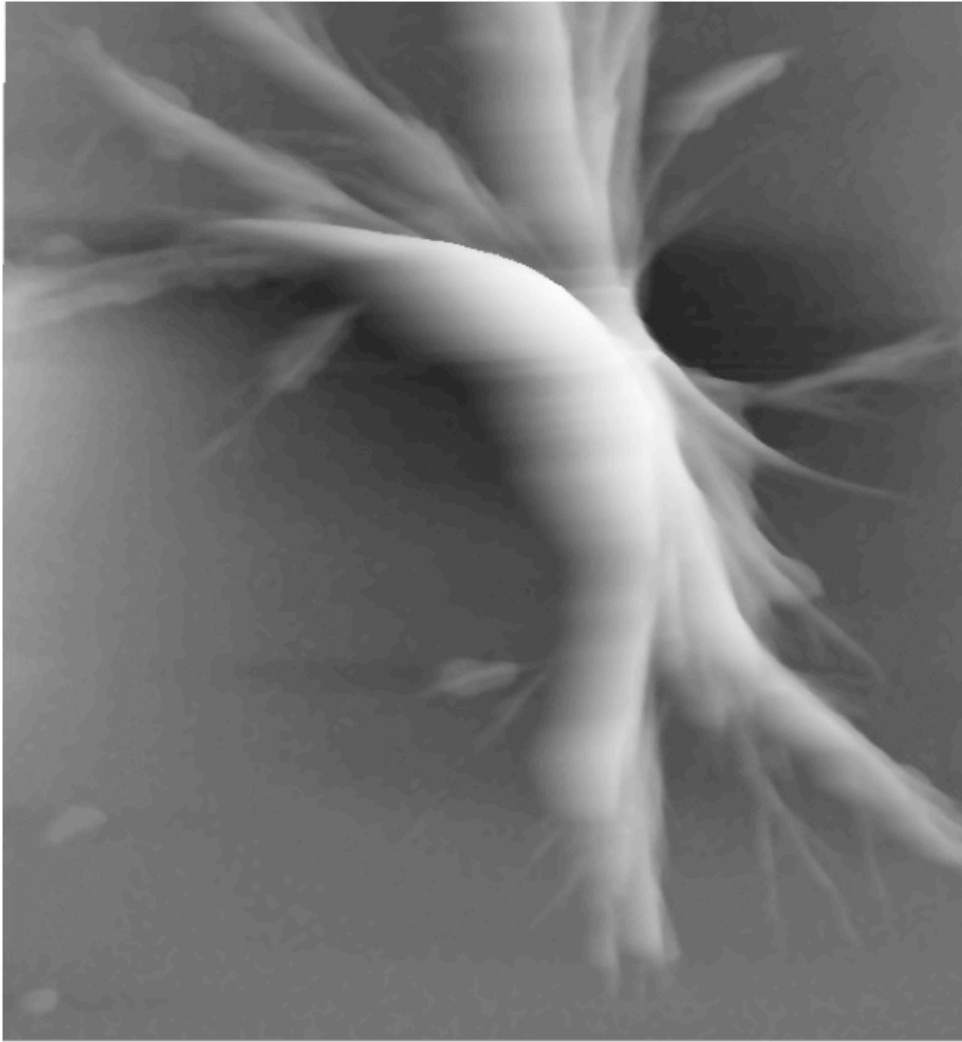


Figure 4: AFM images of rat neurons by James K. Gimzewski and Shivani Sharma CNSI, 2010

### **Question of the “Soul” or “Intelligence”**

Considering that most of research in neuroscience is based on rat neurons the artist in the lab wonders if by creating specialized species of rats or other animals influences our human condition in a deeper way that is linked to our unconscious? Imagining the human mind or body related in any way to a rat brain creates an uncomfortable feeling given our relationship to this animal in mythology and daily life. Scientists see the neuron abstracted from the complex, entangled relationship with the animal and make assumptions based on a materialistic, rational approach that may limit the possibilities of research. This is not a case for or against using rats, mice or any animals in research but

instead suggesting that if we are inherently connected and similar in our genetic structure, this must go beyond the physical matter, including the neuronal level. Most would rather not face this possibility or dare mention the idea of the soul or an intelligence that exists even at the nascent, cellular, nano level of neuronal development. And so it is buried in our collective unconscious and is kept safely locked with no scientifically based thesis and thus no possible attempt to prove the unknowable. Indeed the very mention of this word in a scientific context will bring up instant distance and, in some cases, distrust and animosity. This brings us back again to Carl Jung whose wide and deep explorations into the collective human psyche and archetype led him to consider the idea of the soul. When he crossed this threshold, he was unofficially disqualified by the scientific community and only recently is being reconsidered as a serious psychoanalyst in those circles. By approaching what cannot be proven by existing scientific methodologies, he entered the realm occupied by artists, musicians, poets and philosophers. We did notice however that this is not as true for scientists from India although they too have to be careful, as the field is so global and the world is small.

The relatively young field of biotechnology along with the new science of nanotechnology are by definition comprehensive and have to balance specializations such as the neurosciences, behavioral psychology, cognitive sciences, neuroendocrinology – all of which collectively can be taken to debunk philosophies of old concepts such as the soul [Pinker, Steven. *How the Mind Works*. New York: Norton, 1997]. There are some scientists who are more open to possibilities opened up with the science of quantum mechanics. Most never cross the dangerous line that enters the unknown realm of what we refer to as the “soul”, afterlife and any ideas of “god”, unless highly successful and well into their career and life path. Recently a young neuroscientist David Eagleman dared to address our collective ignorance and when asked on NPR what his belief system is, he coined the term “possibilian”. What surprised him is the number of people who related and embraced this idea that is overdue from the scientific community. It was interesting to note during our discussions that the concept of science and religion had no conflict with the Hindu philosophy, but was rather bound to it. It may be that the

perception that these concepts are not mutually exclusive as portrayed in the western scientific philosophy, but more of a cultural, social climate of where such scientists are cultivated. Neuroscientist V.S. Ramachandran, famed for his extraordinary work phantom limbs, discusses the brain's ability to develop metaphors as an important function and may be helping bridge this separation with his thesis of "the artful brain". (A Brief Tour of Human Consciousness, 2004)

Neuroscience is concerned with figuring out human consciousness and the main path to this research is via the rat or mouse that is genetically modified for a specialized, reduced area of a particular focus. Memory, vision, time perception, subjectivity, objectivity and the huge mass of the deep unknown space of the unconscious are edited out in the process. The brain, made of hundreds of billions of cells we call neurons, each holding the entire human genome in it with biochemical actions and signals and having about thousand connections with the neighboring neurons. One cubic meter in the brain has as many connections in it as there are stars in the milky-way galaxy. So, we are looking into a mirror of our brain that has hundreds of trillions of connections, which, for lack of a better way to explain it, short-circuits the system. We know what we don't know and this is very confusing – this is the dark matter in our collective consciousness.

When the artist enters the lab, she has the poetic license and is allowed to ask the uneasy questions that emerged out of this dialogue: "If scientists consider the fundamental structures at the cellular level to be the same, and thus justifying the research results of rats and pigs to be considered for humans, are we connecting closer to the essence, the nature of these animals and what does that mean for us? If we consider that all animals including humans are organic life forms, which on a very minute, microscopic (or perhaps in this day and age, nano-scopic) scale are founded on the same building blocks - lipids and proteins, protoplasm and ectoplasm, cells and tissues, do we automatically assume that they possess the same nature, or what some refer to as a soul? Do we ignore this question because it is not possible to prove the existence or non-existence of the soul based on our limited perception of reality in the current paradigm? Is a brain just a collective of neurons that is fitted into a set of equations? If the neurons are the basic

parts, do they always add up to the expected ‘whole’? In essence, there is an unknown factor that translates (perhaps transcends) the machinery that builds the network, making it a being. Some may say that this is as yet ‘not discovered’, and some may call it the soul. Taking all of the above in consideration, how do you relate to your zodiac sign, especially if you are a rat or a pig?

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Further reading:

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