Games of Chance: Explorations into Our Animal Selves

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Abstract

The authors come together from very different disciplines – (media) art and (neuro)science – in order to create an interactive work that engages the audience in a way that takes them out of the anthropocentric point of view. With this collaborative project, the authors wish to break this “human” barrier and allow an exploration and identification of the diverse world of the animals around us. The Hox Zodiac allows the human audience to experience the shared history and potential of genetic diversity among animals. Here, the idea of the Hox gene as a binding element is introduced, and the Chinese animal zodiac and dinner
table as the structure/space for discussion is employed, allowing the format to build based on the audience interaction. In neuroscience this is a principle known as the emergent property of network connections, where a simple array of neurons can give rise to complex behaviors through interactions and adaptations.

Responding to the emergent nature of the game-like environment of the ancient Book of Changes, the I Ching, and the related work of John Cage serves as base for the conceptual framework of the project. Similar to Cage’s ideas of chance and indeterminacy, this work looks to the ancient Eastern philosophies along with the scientific research, seeking the balance between rational and irrational, conscious and unconscious – in relation to our interconnectivity with the animal kingdom. This chapter describes the research process and variations that emerged with audience participation and interaction.

**Keywords**

Hox gene • Chinese zodiac • I Ching • Neuroscience and art • Animal-human relationship • Biotech and art

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**Introduction**

The eight trigrams are symbols standing for changing transitional states; they are images that are constantly undergoing change. Attention stands not on things in their state of being – as is chiefly the case in the Occident – but upon their movements in change. The eight trigrams therefore are not representations of things as such but of their tendencies in movement.


Our perception and experience of the world around us is limited by an anthropocentric viewpoint – in part a physical limitation of our senses – but largely because we forget that as animals we share a common inheritance both genetically and ecologically with the myriad of species around us. This chapter will detail a few explorations that the authors have embarked on in order to break down this filter that limits our world view.

While we humans tend to place ourselves on a higher plane than the other animals around us, the fact that we share both evolutionary and genetic history with other organisms and currently coexist (albeit tenuously) within shared ecosystems and biomes cannot be escaped. Animals feature prominently in our stories and myths (from origin of the world stories to incarnations to tales of banishments), are commonly used as comparisons in linguistic usage (sly as a fox, strong as an ox), and within some societies have an indelible link with the human experience. Domestication of animals has also led to the success of the human species, transforming us from a hunter-gatherer to an agrarian society. The role of animals as pets and sources of emotional comfort has also emerged, leading not only to an increased awareness of animal needs but also to a co-evolution between humans and animals. Further, quality of human life has improved tremendously over the last
two centuries primarily because of the role animals play in laboratory science, medical research, and drug testing. This is about to explode further in the near future as technology advances, and we are on the cusp of creating hybrid beings (species enhanced with capabilities of others) and xeno-harvesting (harvesting human organs grown within “donor species” Cooper and Lanza 2000).

With all the entwining of lives of humans and animals, in terms of shared spaces, genetic material, as a society, we do not often pause to consider how connected we are to all organisms around us. Our education strives to make the distinction ensuring that humans are considered different and not part of the animal “whole.” Primal instincts such as sexual lust and fear are dismissed as animalistic and beneath our more perceived higher evolved state of being. Even life scientists, who in the past began their training broadly as “naturalists” and “zoologists,” are now immediately thrown into studying humanistic models of diseases, with no foundation of placing humans in the context of the animal kingdom.

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**The Hox Gene and the Book of Change Come Together in a Dinner Table**

The matter of interest seems to be the configuration formed by chance events in the moment of observation, and not at all the hypothetical reasons that seemingly account for the coincidence.


The authors come from two different worlds – (media) arts and (neuro)science – and do not identify themselves with the gaming world. Despite hardly participating or playing games, allowing the audience to take the helm in this project, it took on a game mode very quickly. At one point in the development of this topic and the parallel search for best interfaces, a game designer was hired, but the established rules and expectations of the established gaming world did not apply well to the explorations in this work. Indeed, after experimenting with various formats and strategies, a conscious decision was made to not include any technology but focus on creating the context, the circumstance that makes the table into one giant petri dish. The “play” that was felt much more appropriate is based on the *I Ching*, also known as the *Classic of Changes* or *Book of Changes* in English, an ancient divination text and the oldest of the Chinese classics. Using the classic translation by Richard Wilhelm and Cary Baynes, it is seen not as a mysterious source of oracles but as a source of the Taoist and Confucius philosophies that tap into the collective unconscious.

Further, the approach to this work is closer to that of conceptual artists who applied these “rules” such as John Cage (1912–1992) (Jensen 2009; Larson 2013). Cage utilized the *I Ching* in his composition of music, writing, and visual art throughout his career, and one could safely make the assumption that *chance operations* are based on his study of the *Book of Changes*. It is known that the *Music of Changes* was composed entirely with the use of the *I Ching* and his
fascination with the 64 hexagrams. It should be noted that Cage’s work with the idea of chance is frequently misunderstood – he, in fact, insisted that there is no such thing and that we experience different forms of order in relation to our perception based on our societal barriers. The idea of chance was used more as a framework to point out the various different possibilities of interpretation.

With this collaborative project, the authors wish to break this “human” barrier and allow an exploration into the diverse world of the animals around us. The Hox Zodiac project allows the human audience to experience the shared history and potential of genetic diversity among animals that very much includes us, the human animal. It is an exploration of the rich differences among the animals around us while iterating the shared themes and common constructs that underlie the genetic basis of all body plans, humans included. These experiments are ongoing for a number of years and (2008 to present) and are modified based on play testing and audience feedback from exhibitions around the world.

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**The Hox Zodiac: Genetic Games of Chance**

It necessarily follows that chance alone is at the source of every innovation, and of all creation in the biosphere. Pure chance, absolutely free but blind, at the very root of the stupendous edifice of evolution: this central concept of modern biology is no longer one among many other possible or even conceivable hypotheses. It is today the sole conceivable hypothesis, the only one that squares with observed and tested fact. And nothing warrants the supposition – or the hope – that on this score, our position is ever likely to be revised. There is no scientific concept, in any of the sciences, more destructive of anthropocentrism than this one.

Jacques Monod, *Chance and Necessity* (Monod and Wainhouse 1972)

Genetic information is the foundation of all living creatures seen around us. The DNA sequences are used to codify numerous functions – from keeping the cells alive to helping them survive. The basic genetic code comprises of four nucleotides A, T, G, and C which serve as a four-letter code (Watson and Baker 2013). Three nucleotides in sequence (e.g., ATG, UUU, GGG) are the code for an amino acid, thereby allowing the translation of the genetic sequences into functional proteins. Thus, 64 nucleotide triplets \(4^3\) are used to translate into the 26-letter alphabet of amino acids (Pierce 2013). It is of note that the *I Ching* also has 64 different hexagrams within its coda (Huang 2010). A few philosophers and mathematicians have compared the *I Ching* to the DNA language and researched how the 64-bit code of the DNA and *I Ching* match up (Shoenberger 1992). Further, the *I Ching* is based on the principle of the yin and yang – the combination of male and female energies, the epitome of sexual reproduction, which forms the basis of heredity and variation in genetics (Wilhelm et al. 1967). Lao Tzu wrote in the *Tao Te Ching* that the Tao gave birth to one, the one to two, the two to three, and the three gave birth to all things (Le Guin and Tzu 1998). This could be just as easily applied as a description of the 64 codons of genetics.
Genetic information, despite the basic simplicity of its nucleotide bases, has the ability to code for basic cellular and organismal functions – such as breathing, using sugars to create energy, reproduction, etc. But aside from such “housekeeping” functions that keep an organism alive, the DNA also codes for form and function – somewhat surprising if you look at the varieties of shapes and sizes of organisms around us (Carroll et al. 2004; Watson and Baker 2013). Though the world is composed of creatures of myriad varieties, there is an underlying commonality among all of them that defines certain body structures that determine the timing of their development and where they are located in the growing embryo. This specific set of information is coded in a set of genes called the Hox genes (Carroll et al. 2004).

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. Despite all the differences, our human form is as similar to that of a goat or a tiger – the coded entities making our foot and also codes for a pig hoof or a chicken leg – and a mouse eye is similar to the snakes and to us (Carroll et al. 2004).

The Hox genes are arranged in a specific order in animal chromosomes – with the order of arrangement corresponding to the body alignment from head to the torso and limbs, abdomen, and hind parts. This parallel arrangement of the genes to the body structures is termed as collinearity and is also conserved across evolution (Pourquie 2009). While in mammals there are multiple copies of Hox genes, to create a cushion of redundancy, the underlying set of eight Hox genes and their collinear arrangement with the body remain the same – highlighting the fact that this common principle underlying body plans has been conserved across species through evolution (Carroll et al. 2004).

Chance is the only true source of novelty.


With the current trends in technology, we are able to modify and target genes to alter how the information is coded, fast moving toward engineered organisms and humans. Laboratory manipulation of Hox genes is common in animals such as flies and tadpoles. It is commonly used as a means to understand developmental programming and the timing of development of different body structures. When does the brain develop? What structures of the brain develop first? What are the origins of the limbs? Why does the snake have a long torso and not a turtle? Why do octopuses and snails look so different even when they are mollusks? What is the timing of development of the heart? How are changes in the uterine wall during menses related to genes? How do genes play a role in transformation during puberty? These and many more are questions that can be directly answered by studying Hox genes and their mutations (Fig. 1).

Now it is fair game to modify a fly to have legs on its head or grow ears on mice – thereby creating creature blends where the demarcation between human and animal will soon be hazy. What is even more surprising is that hybrid creatures have been a
constant feature in our myths – from the winged Pegasus to the snake-haired Medusa to the animalistic Egyptian deities to the many-armed Indian gods (Evslin 1988). Iconography and detailed description of these mythic creatures have prevailed centuries of human civilization. Hybrid creatures have also long served as themes in speculative fiction – from insect-headed humanoids to vampiric predators to superhumans with animal DNA in them (Brem and Anijar 2003). These are interesting times that we live in where myth and speculation are fast becoming reality – which raises the question of how much myth is based on history and how much speculation is based on foresight.

Genetic information is the ultimate game of chance – a success of evolution that is based on heritability, mutations, and variations that promise of survival, species propagation, and enhancement. With the advent of technologies, more accessible and readily available to a wider variety of people, we are now at the cusp of playing and toying with this game of chance (Greely 2003). The Hox Zodiac participatory project has been created to bring forth to the consciousness of the audience the commonality that we share with the animals around us by expanding the idea of their zodiac animal sign.

**Hox Zodiac 1.0: Origins, Shadow Hox (2009)**

When the artist (VV) and the scientist (SR) first met, the concept of Hox genes as the common blueprint of all animal body plans came up and they agreed that this underlying commonality is important and that – a nuance raising awareness about this would hopefully allow people to relate to the world of animals around them in a more empathetic way. This formed the crux of their collaboration. The intersection of art-science partnerships is not easy. There is a constant struggle between the
scientific principle and the artistic interpretation. While the design and the representation by the artist provide the aesthetics and accessibility to the work, without consideration of the underlying scientific principle, the work misses an important dimension. The collaborative process between the artist and the scientist is one with emergent properties, with the final result (at least in this case) being an ongoing series of changes to the initial concept, in order to achieve the best audience immersion. The evolution of the audience-driven games that emerged from this collaboration is a direct evidence of their continued evolution as an artist and a scientist and the amalgamation of their partnership.

The first iteration of the Hox project involved capturing shadows of the audience in front of a screen and then projecting different limbs of animals onto them (Fig. 2). Depending on how near or close the participant was, they acquired the limbs of a horse, wings of a cock, or the body of an elephant. Body parts could be interchanged while preserving the basic body plan. However, the electronic nature of the medium felt remote, and the message of common genetics was not conveyed effectively. Further, it was felt that the interface was not allowing a longer engagement or interaction with others, which was necessary for the layered meanings to be absorbed and appreciated. This led to reimagining the piece to not involve a computer interface but be purposely “unplugged.” Having considered using the roulette as an interface and noticing that our discussions often took place around the table led to the reimagining of the table more as a place for discourse about the issues the project was trying to bring to the forefront (Fig. 3).

Hox Zodiac 2.0 at Microwave Hong Kong (2011)

When invited to present the Hox Zodiac project in Hong Kong for the Microwave New Media Festival, it was decided to revisit the project from a different angle. One of the issues is that the Hox gene is shared by all living creatures and it was unclear how to narrow it down to a number that made sense. Thinking about presenting this project in China gave VV the idea to use the Chinese zodiac as a framework – it immediately offered the 12 different animals representing the morphological diversity that we encounter in the animal kingdom, and the zodiac offered a rich template to work on. Further, it was intriguing that people already had a default identification with the assigned animal based on their birth and that it came from the Chinese culture that is currently becoming more and more influential globally. Through work with the interface, it was revealed that six of these zodiac animals are commonly used in scientific labs (rat, pig, sheep, dog, rabbit, and monkey), while five others are wild (tiger, bull, snake, horse, rooster), with the dragon being the mythical creature from the past or the mutant hybrid of the future. This pointed to yin-yang symbology that is based on contemporary human-animal relationships and gives another dimension to the idea of the zodiac.

The zodiac allows people to relate to each other on various levels – the fact of having a birthdate grouping you with certain people and the fact of being human with form also grouping you with all forms of life. For instance, zodiac signs are
interpreted in relation to career, relationships, health, and wealth. Animal personalities are assigned to humans based on these signs as well – making the zodiac an excellent anthropocentric link for us to work with when talking about common genetic blueprints encoded within all living creatures. With the Hox Zodiac the authors wished to bring forth to the consciousness of the audience the commonality that we share with animals by expanding the idea of their Chinese zodiac sign. Westerners not familiar with the zodiac discovered a new animal they had a relationship with, and those parts of or familiar with Chinese or Asian culture were confronted with a new point of view.

Thus, Hox Zodiac took form as a dinner table for 12 that would seat one person belonging to each zodiac sign. At the center was a lazy Susan (that could be rotated by the audience), with a clear mannequin representing the body as a vessel,
containing an aqueous solution (Fig. 4). Four bottles filled with different colored liquids dripped into the mannequin, representing the four nucleotides that make up our genetic codes A, T, G, and C. Audience manipulation of the lazy Susan would alter the way the color dripped into the “body” – an analogy to the genetic manipulation that is currently happening in labs around the world.

Even as the installation was progressing, the place began to reshape some of our ideas. While SR was on location in Hong Kong, he was looking for materials while jet-lagged and encountered a shop where an herbalist highlighted the connection between traditional Chinese herbs and the zodiac. Much of this information was gleaned by pointing, interpretation, and shaking of heads on both sides. For example, the tiger rules the lung, while the monkey is linked to the bladder (Table 1). It was also discovered that Chinese herbs were ingested that could cure ailments associated with each of these body parts – the snake governs the spleen which is treated with radish seeds, and the ox rules the liver treated with peppermint. Given the fact that the exhibit was to create a dinner table, with guests who were linked to the zodiac signs, it was decided to incorporate these edible herbs into the exhibit (Fig. 5).

The Hox Zodiac dinner was set, and people from the audience who belonged to a specific zodiac sign were seated at the table. Twelve audience members assumed
Table 1 Herbs associated with each body part governed by an animal of the Chinese zodiac

<table>
<thead>
<tr>
<th>Animal</th>
<th>Body part</th>
<th>Herbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiger</td>
<td>Lung</td>
<td>White mustard seed, genkwa flower, Agastache, ephedra, hyacinth Bletilla, plantain seed, lily bulb, mulberry leaf, ginseng, Glehnia root, magnolia bark, dried ginger, Lepidium seed, Chinese yam, tangerine peel, cinnamon twig, chrysanthemum, radish seed, astragalus root, scrophularia root, peach kernel, honeysuckle flower, polygala root, macrostem onion, forsythia fruit, dang shen, Schizonepeta, black plum, Ophiopogon root, gypsum, wolfberry bark, anemarrhena rhizome, wolfberry fruit, Isatis leaf, Cape jasmine fruit, dahurian angelica root, scutellaria root, inula flower, perilla seed, platycodon root, Pinellia tuber, Trichosanthes fruit, motherwort, kansui root, licorice root</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Large intestine</td>
<td>Kansui root, rhubarb, magnolia bark, macrostem onion, areca seed, pumpkin seed, genkwa flower, inula flower, immature bitter orange, hemp seed, Coptis root, peach kernel, Phellodendron bark, arborvitae seed, honeysuckle flower, Cistanche, pulsatilla root, black plum, Trichosanthes fruit, perilla seed, bush-cherry seed</td>
</tr>
<tr>
<td>Dragon</td>
<td>Stomach</td>
<td>Scutellaria root, inula flower, honeysuckle flower, Pinellia tuber, hemp seed, dahurian angelica root, atractylodes rhizome, Isatis leaf, scrophularia root, gypsum, white atractylodes rhizome, Cape jasmine fruit, dried ginger, Agastache, amomum fruit, oriental wormwood, evodia fruit, Ophiopogon root, immature bitter orange, magnolia bark, germinated barley, radish seed, Quisqualis fruit, areca seed, pumpkin seed, Glehnia root, hyacinth Bletilla, notoginseng, grass-leaved sweet flag rhizome, licorice, dendrobium stem</td>
</tr>
<tr>
<td>Snake</td>
<td>Spleen</td>
<td>Pinellia tuber, radish seed, ledebouriella root, atractylodes rhizome, amomum fruit, poria, Pueraria root, Psoralea fruit, germinated barley, corydalis tuber, curcuma root, ginseng, dang shen, astragalus root, white atractylodes rhizome, inula flower, Agastache, oriental wormwood, Quisqualis fruit, tangerine peel, immature bitter orange, evodia fruit, hawthorn, cinnamon bark, Chinese yam, black plum, licorice, Chinese angelica root, white peony root, bitter cardamom, lotus seed</td>
</tr>
<tr>
<td>Horse</td>
<td>Heart</td>
<td>Isatis leaf, Isatis root, prepared Rehmannia root, moutan bark, red sage root, forsythia fruit, Cape jasmine fruit, Coptis root, poria, dried ginger, cinnamon bark, field thistle, corydalis tuber, Curcuma root, safflower, peach kernel, wild jujube seed, rhubarb, arborvitae seed, bush-cherry seed, polygala root, grass-leaved sweet flag rhizome, ginseng, licorice, Chinese angelica root, Ophiopogon root, lily bulb, light wheat, lotus seed</td>
</tr>
<tr>
<td>Sheep</td>
<td>Small intestine</td>
<td>Bush-cherry seed</td>
</tr>
<tr>
<td>Monkey</td>
<td>Bladder</td>
<td>Ephedra, Trichosanthes fruit, pubescent angelica root, ledebouriella root, notopterygium root, Lepidium seed, tetrandra root, umbellate pore fungus, Lysimachia, motherwort</td>
</tr>
<tr>
<td>Rooster</td>
<td>Kidney</td>
<td>Eucommia bark, Psoralea fruit, cinnamon bark, Cyathula root, bitter cardamom, arborvitae seed, Chinese yam, moutan bark, dendrobium stem, kansui root, Epimedium, hawthorn fruit, fleeceflower root, anemarrhena rhizome, Cistanche, lotus seed, pubescent angelica</td>
</tr>
</tbody>
</table>

(continued)
the role of their given animal signs and began a conversation that discussed the industrialization of food, laboratory testing, sacrifice, and animal/human relationships in our contemporary society as well as tapping into the ancient philosophies around this subject. Fear of mutation and the laboratory manipulation of genetics
were being raised as well. They were encouraged to partake and taste from the herbal specimens at their plates, with frequent cross-pollination occurring between participants. All the while, the body at the center was rotated and moved, creating a dizzying alteration in the colored “nucleotides” that dripped in the center (Fig. 6).

“Hox Zodiac” participants related to each other on various levels as humans sharing similar body designs, assuming animal persona and shapes, and as creators of mutant creatures, thereby playing the role of scientists in labs. Experts emerged from the audience themselves, and within moments, a dinner where information was being shared became one of learning from the expert at the table.

While the audience engaged in the Hox Zodiac and the reception was tremendous, one main drawback was that the concept of modified Hox genes resulting in mutated body plans was not emphasized. Audience participants who were more interested in the scientific basis of the project could have explored further via the website, but there was concern that some of the takeaway message was being lost in the installation. Participants also wanted to have food at the dinner table leading to the reimagination of the next version.

**Hox Zodiac 3.0: Dinner at MOCA Taipei**

The success of the Hox Zodiac dinner at Microwave Festival 2011 led to an invitation to showcase the piece at the *Post-humanist Desire* Exhibition at MOCA Taipei in 2013. The authors continued to push their boundaries in making the Hox Zodiac more interactive and create a dinner table game that would evoke different conversations (Fig. 7).

The *I Ching* reemerged as a tool to play the genetic game of chance. The representation of the lines in the *I Ching* cards resembles the cartoons of chromosomes in cell biology textbooks – with the broken lines in the *I Ching* appearing
similar to the process of crossing over and genetic information transfer during meiosis in our cells. The process of crossing over in the chromosomes where genetic material is exchanged is how we get variation in our genetics and how we appear as individuals and not identical clones of our parents. This basis of heredity and variation is once again a universal principle among all creatures (Watson and Baker 2013).

Further, certain I Ching cards represent specific signs of the Chinese zodiac (Fig. 8) and have also been linked to the coding sequences underlying amino acids (Fig. 9, Castro-Chavez 2012).

Other patterns began to emerge – the Hox genes are activated in a time-dependent manner; if things go wrong, the head would develop later than the foot, leading to many developmental defects (Graba and Rezsohazy 2013). The Chinese zodiac itself is represented as a clock, with the rat beginning at 11 pm–1 am moving forward with the ox (1–3 pm) and so on all the way to the pig (9–11 pm). The goal was to provide a game framework that could appear highly simplistic but has layers of details underneath for the interested participant (Wu 2010).

The Hox Zodiac presented at MOCA Taipei was set up as a circular table with a large translucent egg in the middle. This represented the proto-embryo, the potential of what could be once the genes play into its development. Twelve lab coats
with the symbols of the Chinese zodiac painted on them were lined up against the wall. The table was set for 12 – one for each animal of the zodiac. Audience participants belonging to each zodiac sign were invited to sit at the table. Once the table was full, the game began.

At each place setting was present a petri dish containing the Chinese herbs associated with the zodiac animal (Table 1), a repository for the DNA of the participant (either hair or saliva), dining tools in the form of forceps, a little repository of little known facts about the animal, and finally a drawing book. A set of cards with 12 symbols from the *I Ching* corresponding to each animal (Wu 2010, Fig. 10) and a “mutant” human card were also placed at the table.

The rules of the game were initially set but were flexible based on the audience participation and level of complexity. Every animal at the table started by placing their DNA in the repository – this was their essential commitment to the game. Then all the animals began by drawing their own head (rat with a rat, ox with an ox, and so on). The rat always began first (as the head of the clock). It started by reading a fact about the animal – these ranged from medical use of animals, animal use in cooking, or in herbs or any form of biological role. Then the rat drew from the deck of cards. This new animal now became part of the rat mutant and was drawn into the books. The play then shifted to the animal on the right.

Within a few iterations, a whole new combination of mutant creatures emerged – monkeys with horse limbs, snakes with rabbit ears, and a mishmash of different creatures. Artists began to emerge among the participants, many of whom informed

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**Fig. 8** *I Ching* hexagrams representing Chinese zodiac signs

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Animal</th>
<th>Hexagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat 47</td>
<td>Ox 6</td>
<td>Tiger 54</td>
</tr>
<tr>
<td>Rabbit 4</td>
<td>Dragon 59</td>
<td>Snake 7</td>
</tr>
<tr>
<td>Horse 46</td>
<td>Goat 18</td>
<td>Monkey 39</td>
</tr>
<tr>
<td>Chicken 14</td>
<td>Dog 62</td>
<td>Pig 32</td>
</tr>
</tbody>
</table>
us that they had not engaged in such creative exercises in decades. They ranged from young children to older experienced scientists, who all explored the role of the mutants, learnt from the factoids and the herbs, and created hybrid creatures in the process (Fig. 11).

**Fig. 9** *I Ching* representation of amino acids

**HOX 4.0: Zodiac Dinners**

what is it that’s not art & not science? I asked, & I finally got the answer, discourse, which stands in both, and behind both. It is our discussed world, so brought into being.

Robert Kelly 1974
Since hosting the Hox Zodiac in Taipei, the project has undergone yet another revision. Paring down the installation models suitable for museum set pieces, the new avatar of the Hox Zodiac resembles more closely a simple dinner table set for 12, with the conversations and the food becoming more of the focus.

Dinners have been organized at the UCLA Art | Sci Center (December 2014), at a private artist residence (February 2015), as a part of the College Art Association (February 2015) and for high school students taking part in the Sci | Art Nanolab (July 2015). The participants at these dinners have ranged from groups of 12, specifically invited for the zodiac dinner party game, to large crowds of up to...

**Fig. 10** The *I Ching* zodiac cards

**Fig. 11** Audience draws mutant hybrid animals
80 people, depending on the audience, level of knowledge, and time the game is scaled from intimate gatherings to event specials.

The focus is brought back to the idea of animals, their different body plans, and how they can be manipulated in labs. Participants enter the dinner game relating to the animal portrayed in the Chinese zodiac. Food is served at the table based on food groups relating to each animal of the zodiac, and whatever one ingests symbolically brings into the genetic mutation. Research into the Chinese signs revealed that each animal is associated with specific food groups that are recommended for curing ailments relating to that sign, as well as for continued health and well-being. Based on these sources, a menu was created and food served at the first dinner hosted at the UCLA Art | Sci gallery in December 2014. Participants were seated at a table for 12 at their specific zodiac signs. Each “animal” was served an appetizer, entrée, and dessert specific for its sign. When food was shared, it was noted as sharing of traits between animals, creating hybrids and mutants (Fig. 12).

Patterns emerged – even though the seating was for 12, frequently there were excess audience in the room, leading to packs of tigers, huddles of sheep, and a horde of monkeys at certain parts of the table. Some participants were unwilling to eat food recommended for their own animal, having preference for others. Some specifically wanted traits of other animals, so willingly bartered for food across the table. All were provided with notebooks for drawing and making notes and comments about the experience, and chimeras were duly formed. The audience loved the interaction, the edible nature of the evening, and the sharing of traits and ideas. The bare-bones simplicity of the dinner table helped aid the process.
In large installations, audience members were invited and seated in groups of ten around a number of round tables. After a brief introduction to the concept of the Hox genes and their importance in body plans, food was served pertaining to each of the animal signs of the zodiac, starting with the rat. As food was served, the uses of each animal in scientific research were highlighted, and the Chinese zodiac qualities of the animal were also expounded. Participants would imbibe foods of

![Hox Zodiac information playing cards](image)

**Fig. 13** Hox Zodiac information playing cards
animals whose qualities they wanted to incorporate or if it was a delicacy that they enjoyed. It was interesting to note that when some of the scientific uses of animals were elaborated, it altered perceptions of some participants, and they would then either accept or refuse the food selections. As they ate, participants were encouraged to draw their chimeras on their plates, with the qualities that they had gained from creating such hybrids.

The setup for a larger participatory public was pretty much in place, and the next challenge was to figure out a more formal way to play the Hox Zodiac in a smaller private setting. This opportunity came in the form of an invitation by author, environmentalist, and curator Linda Weintraub who was interested to test this at her homestead in upstate New York. Having a farm with animals, she contributed to the evolution of the project by suggestions such as asking each of the invited guests to bring their offering based on their sign. They were sent a set of ingredients along with information about their sign well in advance, and all came with their food prepared. Each of the 12 guests presented their food offering with a narrative, offered to the rest, and cleaned up. Thus, a 12-course dinner emerged and gave a new meaning not only to the zodiac but also to the idea of slow food and creation of

![Fig. 14 Hox Zodiac private dinner at Linda Weintraub’s homestead, February 14th, 2015](image)
an environment for meaningful dinner table discussions (Figs. 14 and 15). In a smaller setting, it became clear that it would not be so easy to have 12 people with all signs represented, and this led to the decision to highlight the absent animals. Thus, it was decided that the hosts prepare dishes and present information about the animals not present.

While there will be initial suggestions of food groups and menus associated with the dinners and zodiac signs, over time audiences who indulge in the dinners will add to the menu repertoire, creating novel dishes suited for pertinent signs. The future iterations of the Hox Zodiac dinner game will become more minimalistic, with the setting and the basic ingredients provided but with the details created by the participants themselves. Hox Zodiac cookbooks are available to use and add recipes to online.

The idea is to create the Hox Zodiac in a box that will have all the elements for anyone to set up a “dinner table”. The contents will be table cloth with zodiac signs, plates, petri dishes, and a set of books that give information about individual signs: general zodiac meanings, evolutionary, how it is used in science laboratories, the
benefits and abuse, and as food (Fig. 13). In public presentations, we supply lab coats with the zodiac signs and empty lab notebooks that audience fills in with their findings. The basic setup is the following:

People sit down at their animal sign as assigned by the Chinese zodiac. The first 30 min is spent on learning about themselves and making notes on thoughts, responses, and questions. For appetizer, basic grain dishes and drinks are offered, ideally from local origins, and a menu with the various animals is passed around. Herbs associated with their signs are the plates already in the petri dish and description of the organ.

Appetizer: The first question asked is – would you eat yourself, i.e., the animal that you are represented by? If not, which animal would you eat? You have to survive so a choice is necessary, and by picking one, you are starting to evolve your being to a new variation. Either remain within yourself or start a dialogue with the animal you need to continue on. You write down your recipe and/or draw what you are creating by your choices.

Fig. 16  Hox Zodiac interface
Main dish: Choose something related to scientific use of your animal if one of the lab creatures, and/or find out which animal is used in relation to your organ. Write out your dish based on this.

Desert: If you wanted to create a hybrid of yourself, which of the animals would you use? What mythical/fantastic powers will you gain by this? What would this mythical beast taste like, smell like, feel like, and see like? Write your recipe for this.

Drink: By drinking the essence of the animal, you change the organs of your body. What aspect of your body do you want altered? What do you feel about this? Given such a miracle essence, would you take it (Figs. 16 and 17, Tables 2 and 3)?

Conclusion

The authors have spent a few years developing the Hox Zodiac project with the initial goal of introducing audiences to the Hox gene and our animal nature through genetic similarities. Experimentation with different approaches was deliberately open ended and allowed the audience to shape it. Over a period of 5 years, with a number of iterations, public and private, the project has evolved into a dinner table game. The participants bring to the table ingredients and share the knowledge as they ingest the food and consider the inherent deep connection to the animal world. The idea of the zodiac is expanded to contemporary scientific use of animals and
Table 2  Laboratory use or evolutionary research of animals in the zodiac

<table>
<thead>
<tr>
<th>Animal</th>
<th>Use in research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rat</td>
<td>Rats and mice serve as primary genetic models of diseases Rats are predominantly used in understanding mechanisms of learning and memory tests Rats are also used extensively in addiction studies for alcohol and drugs Cancer models are also created in transgenic rats and mice</td>
</tr>
<tr>
<td>Ox</td>
<td>Used to extract fetal bovine serum used in all cell culture experiments Cow eye dissection is used to teach anatomy Milk used as blocking agent in immunochemistry</td>
</tr>
<tr>
<td>Tiger</td>
<td>Cats are used to study locomotion and spinal cord control Tiger vocalizations and vocal chords are studied The craniomandibular ontogeny (development of the jaw) is a prime field of study from both a current and evolutionary perspective</td>
</tr>
<tr>
<td>Rabbit</td>
<td>Many antibodies used in staining protocols are made in rabbits The rabbit retina is an excellent model to study vision Used as a model in hepatitis E infection and vaccination Eyeblink conditioning reflex in rabbits is a standard model of study</td>
</tr>
<tr>
<td>Dragon</td>
<td>Dragon is a neuronal adhesion protein Komodo dragon feeding is an established area of study</td>
</tr>
<tr>
<td>Snake</td>
<td>Snake venom has new uses in cancer therapy The snake venom was an important tool in understanding neuromuscular control using acetylcholine</td>
</tr>
<tr>
<td>Horse</td>
<td>Horses were historically used as model anatomical organisms in medical schools Horses are now being studied as model organisms for depression Muscle control and metabolism are studied using horses</td>
</tr>
<tr>
<td>Sheep</td>
<td>Sheep are used in sleep research Hormonal regulation is studied using sheep model systems Rams are used to study homosexuality in the animal kingdom Goat serum is extensively used in antibody staining techniques</td>
</tr>
<tr>
<td>Monkey</td>
<td>Monkeys are studied extensively in relation to their visual circuitry Motor control of movement and mirror neurons are studied in monkeys Monkeys serve as models for depression and neurodegenerative diseases Brain-computer interfaces are extensively tested on primates</td>
</tr>
<tr>
<td>Rooster</td>
<td>Embryogenesis is studied using chick models Chickens were the model system to study cholera The first oncogenes were discovered using chickens We can now create transgenic chickens as their genome has been sequenced</td>
</tr>
<tr>
<td>Dog</td>
<td>Pavlov’s conditional learning is a famous example of dogs in experiments Dog genomics are powerful to understand evolution Dogs are models for studying hepatic chemotherapy Dogs may also help us understand autoimmune diseases</td>
</tr>
<tr>
<td>Pig</td>
<td>Pigs are used as models to understand cystic fibrosis Pigs are also serving as host models for culturing artificial organs Pig neonatal models are more comparable to humans than mice Pigs are also used to study inflammatory bowel disease and other gut diseases</td>
</tr>
</tbody>
</table>
### Table 3  Factoids by animal

<table>
<thead>
<tr>
<th>Animal</th>
<th>Rule</th>
<th>Season</th>
<th>Disorder</th>
<th>Personality Characteristics</th>
<th>Successful careers</th>
<th>Recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rat</strong></td>
<td>The rat rules the gallbladder</td>
<td>Winter</td>
<td>Psychopathy</td>
<td>The rat is quick-witted, clever, charming, sharp, and funny</td>
<td>You should be happy in sales or as a writer, critic, or publicist</td>
<td>Stewed cane rat: Skin and eviscerate the rat and split it lengthwise. Fry until brown in a mixture of butter and peanut oil. Cover with water and add tomatoes or tomato purée, hot red peppers, and salt. Simmer the rat until tender and serve with rice. A rat can eat a third of its body weight each day. They are true omnivorous scavengers but mostly prefer grain, livestock feed, and meat.</td>
</tr>
<tr>
<td><strong>Ox</strong></td>
<td>The ox rules the liver</td>
<td>Winter</td>
<td>Schizophrenia</td>
<td>The ox is steadfast, solid, goal-oriented leader, detail oriented, hardworking, stubborn, serious, and introverted but can feel lonely and insecure</td>
<td>The buffalo would be successful as a skilled surgeon, general, or hairdresser</td>
<td>Oxtail stew: Season oxtails with salt and pepper. Add to pot; cook, turning once, until golden brown. Add tomato paste, ginger, garlic, onions, carrot, and celery; cook until soft. Return oxtails to pot with stock, allspice, thyme, and chilies; cook and cover until oxtails are tender. Oxen can eat forage, hay, grass, and grains. They can eat 30 lb per day. Mad cow disease is transmitted from bovines to humans. Bovine tuberculosis has the ability to affect us.</td>
</tr>
<tr>
<td><strong>Tiger</strong></td>
<td>The tiger rules the lung</td>
<td>Spring</td>
<td>Hysteria</td>
<td>Tigers are authoritative and self-possessed, have strong leadership qualities, and are charming, ambitious, courageous, warmhearted, highly seductive, moody, and intense; and they’re ready to pounce at any time.</td>
<td>You would be excellent as a boss, explorer, race car driver, or matador</td>
<td>Tiger sauce: Worcestershire sauce, distilled white vinegar, tamarind nectar, hot cherry peppers, sugar, water, Marsala, sea salt, and pectin. All ingredients should be mixed, boiled for 3 min, simmered for 20 min, and then mixed in a blender. They mainly eat large mammals, such as pigs, deer, antelope, and buffalo. A tiger can consume up to 40 kg of meat at one time, but individuals in zoos are given 5–6 kg per day. Tiger conservation is an important topic as most tigers across the world are endangered species.</td>
</tr>
<tr>
<td><strong>Rabbit</strong></td>
<td>The rabbit rules the large intestine</td>
<td>Spring</td>
<td>Schizophrenia</td>
<td>Rabbit enjoy being surrounded by family and friends. They’re popular, compassionate, and sincere, and they like to avoid conflict</td>
<td>You are successful in business but would also make a good lawyer, diplomat, or actor</td>
<td>Place the browned rabbit pieces into the Dutch oven, and pour in the beer and chicken stock.</td>
</tr>
</tbody>
</table>
Bring to a boil over high heat, then reduce heat to medium low, cover, and simmer until the rabbit is very tender, 25–30 min

Wild rabbits spend much of their time foraging in meadows and fields eating wild grasses, herbs, flowers, leaves, and twigs. They also consume some fruits, vegetables, and grains

A rabbit should be given about 2 lbs of veggies per 6 lb of body weight

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**Table 3** (continued)

| Dragon | Dragon rules the stomach |
| Spring | Psychopathy |
| Dragon rules the stomach | Dragons are energetic and warmhearted, charismatic, lucky at love, and egotistic. They’re natural-born leaders |
| Spring | You would be well suited to be an artist, priest, or politician |
| Psychopathy | Blue dragon: Mix three parts vodka and one part blue curacao with crushed ice, shake or stir, and strain into a martini glass. Garnish with orange slice and cherries |
| Dragons are energetic and warmhearted, charismatic, lucky at love, and egotistic. They’re natural-born leaders | Dragons are known to eat any living thing that has flesh. These include bears, killer whales, giant squid, birds, walrus, leopard seals, and other animals |
| You would be well suited to be an artist, priest, or politician | Dragon boat racing has a positive effect on breast cancer survivors |
| Blue dragon: Mix three parts vodka and one part blue curacao with crushed ice, shake or stir, and strain into a martini glass. Garnish with orange slice and cherries | The venom in the saliva of Komodo dragons and its role in predation |

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**Snake**

Snake is in charge of the spleen

Summer

Paranoia

Snakes are seductive, gregarious, introverted, generous, charming, good with money, analytical, insecure, jealous, slightly dangerous, smart, hardworking, and intelligent, and they rely on gut feelings

Snake would be most content as a teacher, philosopher, writer, psychiatrist, and fortune teller

Recipe: Kill a viper, skin it, and take out the entrails; cut the flesh into small pieces and put it into the broth, with the heart and liver cut across, two blades of mace, and a small bit of cinnamon; cover it up; and let it boil till it is reduced to a pint; by this time the flesh of the viper will be consumed; strain it off and press it very hard

Snakes will eat birds, fish, and eggs. Some snakes eat insects and spiders. There is one type of snakes that will eat plants

They usually only eat once every 7–10 days, and they get older and larger only about once a month

Snakes use infrared “vision” to navigate the world

Snakes modulate constriction in response to prey heartbeat

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**Horse**

Horse governs the heart

Summer

Anxiety

Horses love to roam free. They’re energetic, self-reliant, and money-wise, and they enjoy traveling, love, and intimacy

You should be an adventurer, scientist, poet, or politician

Recipe: In a mix of 90 % olive oil and 10 % truffle oil, fry sliced onions and mushrooms for 5 min. Add green pepper slices, and fry 2 min more. Throw in a 60/40 mix of shredded roast beef/smoked horse, and stir for a few minutes till the roast beef is browned. Add some black pepper. Add a few slices of cheese on top and put a lid on the pan

Horses eat eggs, chaff, apples and carrots, bran, barley, linseed, maize, horse nuts or mixes, cod liver oil, root vegetables, oats, salt, seaweed, dried sugar beet pulp, and mollichop

(continued)
Table 3 (continued)

An adult horse should eat between 1.5 and 3.5 % of its body weight a day. That comes out to roughly 15–35 lbs for an average 1,000 lb horse

Individual recognition among domestic horses extends to humans

**Sheep**

- Sheep govern the small intestine
- Summer
- Anxiety

Sheep eating grass, clover, forbs, and other pasture plants

A sheep eats about 2–3 % of their body weight

**Monkey**

- Monkey rules the urinary bladder
- Autumn
- Personality disorder

Monkeys thrive on having fun. They’re energetic, upbeat, and good at listening but lack self-control. They like being active and stimulated and enjoy pleasing self before pleasing others

Your sign promises success in any field you try

Three-legged monkey: 1 oz whisky, 1 oz amaretto almond liqueur, 1 oz pineapple juice. Shake and strain into rocks glass

Sheep eat about 2–3 % of their body weight

**Rooster**

- Rooster governs the kidneys
- Autumn
- OCD (obsessive-compulsive disorder)

Roosters are practical, resourceful, observant, analytical, straightforward, trusting, honest, perfectionists, neat, and conservative

Recipe: With fingertips, separate skin from meat on each breast half. Rub equal amounts of seasoning mixture under skin of each breast. Sprinkle chicken with salt and pepper. Place chicken on grill over medium heat, and cook about 25 min or until juices run clear when thickest part of breast is pierced with tip of knife, turning over once

Chickens are omnivores and will eat grain, seeds, fruit, other vegetation, corns, worms, and other insects

A laying hen will require approximately one fourth to one third of a pound of feed every day or roughly 1.5 lb of feed per week

(continued)
A discussion of food and while creating hybrids and chimeras also considering the influence of Eastern, in this case specifically the ancient Chinese culture.

Table 3 (continued)

Dog

- The dog rules the pericardium
- Autumn
- Dependence disorder
- Dogs are loyal, faithful, honest, distrustful, often guilty of telling white lies, temperamental, prone to mood swings, dogmatic, and sensitive. Dogs excel in business but have trouble finding mates.
- You would make an excellent businessman, activist, teacher, or secret agent
- Suyuk (a boiled dog meat): Put dog meat, gravy, and ingredients into pan, steam it with a weak fire, and eat with sauce. One can eat with boiled leek. Perilla powder, perilla oil, mustard, and vinegar are to be added to the sauce.
- The amount of food that dogs eat will all depend on the weight of the dog. Some dogs will easily eat around 25 lb of dog food a week, and some will only eat 1 lb a week.
- They do eat meat, but they also eat vegetable and grain matter in small amounts

Pig

- Pig rules San Jiao
- Winter
- OCD (obsessive-compulsive disorder)
- Pigs are extremely nice, good mannered, and tasteful. They’re perfectionists who enjoy finer things but are not perceived as snobs.
- The pig would be best in the arts as an entertainer or possibly a lawyer.
- Heat oil in a large nonstick skillet over medium-high heat. Flatten each pork piece to 1/2 in. thickness using your fingertips. Add pork to pan; spoon soy sauce mixture evenly over pork slices. Cook 3 min or until browned. Turn pork over; cook 3 min or until done.
- Farm grains such as corn, barley, oats, and wheat make up a balanced diet for a pig.
- Approximately 3–5 lb per day

Recommended Reading

F. Castro-Chavez, Defragged binary *I Ching* genetic code chromosomes compared to Nirenberg’s and transformed into rotating 2D circles and squares and into a 3D 100% symmetrical tetrahedron coupled to a functional one to discern start from non-start methionines through a Stella Octangula. J. Proteome. Sci. Comput. Biol. 1, 3 (2012)
B. Evslin, *The Chimaera (Monsters of Mythology)* (Chelsea House, NYC, 1988)
M. Jensen, John cage, chance operations, and chaos game: cage and the “I Ching”. Musical Times 150(1907 (Summer)), 97–102 (2009)


M. Schönberger, The I Ching & the Genetic Code (Aurora, Santa Fe, 1992)

J.D. Watson, T.A. Baker, Molecular Biology of the Gene, 7th edn. (Benjamin Cummings, Menlo Park, 2013)
