Issue 5. Vol 2

May 2019

The Eyebrow

About the MGSE

The Münster Graduate School of Evolution (MGSE) is an interdisciplinary association of researchers of the WWU, bridging the Faculties of Biology, Medicine, Geosciences, Philosophy, and Mathematics. Combining the already existing strength in evolutionary research at the WWU, the MGSE provides an interdisciplinary network of scientists working on diverse topics in evolution.

The MGSE provides a structured study program for doctoral students of the different faculties in the general field of evolution. The program ensures interdisciplinary networking. The doctoral students of the MGSE address a broad range of questions, from the evolution of earth to the evolution of evolutionary theory.

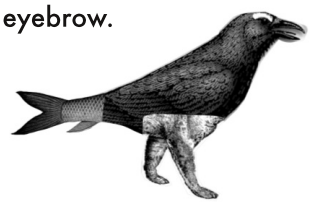
Since its founding in 2011, the MGSE has aimed to sustainably improve the curricula of the disciplines involved. It has demonstrated that doctoral training in a multi-disciplinary research landscape can be structured based on a unifying conceptual framework. Thereby, the MGSE serves as a role model or a novel approach to doctoral training.

A central element of the MGSE is the Evolution Think Tank (ETT). Similar to an idea mining approach, the ETT provides a framework for the development of sustainable interdisciplinary research and education structures. Activities within the ETT include the invitation of internationally outstanding scientists and the organisation of workshops and symposia for scientific exchange.

The Eyebrow is financially supported by the Evolution Think Tank of the MGSE and the DFG Research Training Group 2220 EvoPAD.

The GMO bird

Gruntled Majestic Organism - that is the name of the Eyebrow's logo. As the stories will have it, it began with the maddening of scientists. The farmers stood with their hayforks and barrels of oil, yet the madmen in their ivory tower refused to listen. "Nay!", they said. "We shall combine the best of beasts into a single creation!". The legs of the cheetah, the fins of the fish, the wings of the crow - fly, run and swim. Fantastic it was. And bestowed upon it, the greatest trait of humanity - the human eyebrow.



MÜNSTER GRADUATE SCHOOL OF EVOLUTION

RTG 2220 EvoPAD

Santander UNIVERSITIES

About the Eyebrow

The magazine is intended to function as a platform and forum for interaction between PhD students and associated labs of the MGSE. The Eyebrow is a magazine that is primairly intended for PhD students to express their ideas, or lack of them.

The magazine is intended to inform about upcoming and past events that are of relevance of the MGSE environments. Each issue includes a range of articles, including but not limited to lab reportage highlighting the current work of MGSE-associated working groups, essays about challenges within academia, and satirical essays.

We need diversity of skills and interests. If you enjoy drawing, layout, poetry, popular scientific book/film review, editing, comics, but not writing essays or articles, you are still very welcome and needed. You can contribute just once and that is fine, you can even contribute multiple times.

If you are a PhD student - within or outside the MGSE - and want to write or express something, or for any questions you may have, make contact: eyebrow.mgse@gmail.com.

Hello and welcome back. Like the spring perennials sprouting along Münster's *Aasee* and *Promenade*, the Eyebrow has emerged from a solid winter hibernation.

The Eyebrow, now in its second year, is a student run magazine started by members of the Münster Graduate School of Evolution (MGSE). The magazine was started as means for PhD students in the MGSE to publish essays, comments, poems, stories, jokes, artwork, various miscellany related to the study of evolutionary biology.

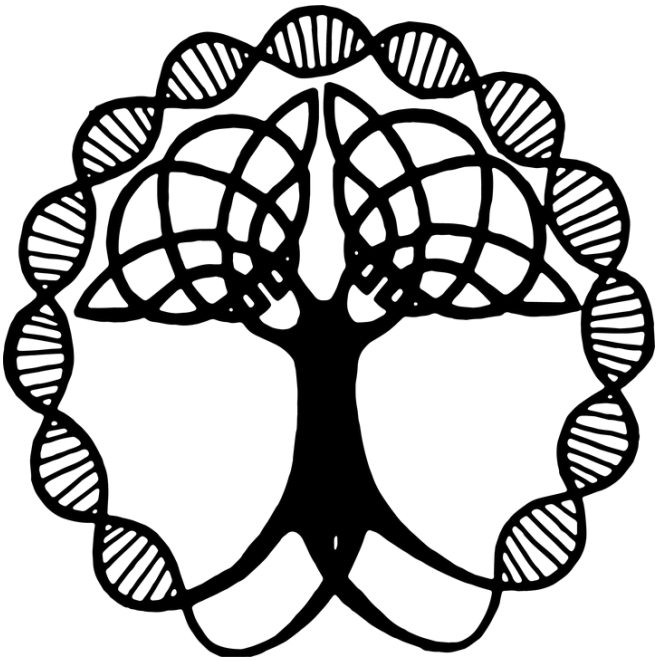
We have now expanded to take in topics more tangentially related to evolution such as the ethical issues arising from modern molecular biology techniques (see *Should we pimp our genomes?* on page 6) or biases inherent in the distribution of knowledge (see *Whose knowledge is represented on Wikipedia?* on page 10).

A primary goal of the Eyebrow is for PhD students to share their research topics with others. To this end we set three researchers the Up-goer 5 Challenge (pages 16-18). The challenge, which originates from the Randall Munroe creator of the webcomic xkcd, is to describe the topic of your PhD work using only the 1000 most commonly used words in the English language. The limited vocabulary meant that the authors needed to be creative and coin new phrases to explain their projects.

So, with Spring well and truly sprung why not take your copy of the Eyebrow outside with a temperature-dependent beverage (or antihistamine or umbrella) and enjoy.

The editors.

If you are interested in contributing to the next issue email us at eyebrow.mgse@gmail.com.



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News

UPCOMING CONFERENCES

28 – 29 May 2019
The joint Symposium of MGSE, RTG 2220 EvoPAD, and CRC-TRR 212 NC3 will be taking place in the Auditorium and Foyer of the Münster Schloss.

UPCOMING COURSES, WORKSHOPS, AND LECTURES

4 June 2019, 11:15, Auditorium in the Münster Schloss
Jürgen Heinze from the University of Regensburg will give this year's Bernhard Rensch lecture.

The MGSE Discussion Club meets monthly to discuss thought-provoking papers, blog posts, TED Talks, etc. All with an interest in evolutionary biology are welcome; contact Marko Bračić at bracic@exchange.wwu.de to be added to the mailing list or if you have an idea for a discussion topic.

The MGSE hosts the public lecture series "Evolution Across Fields". These lectures take place Monday evenings at 17:00 in the northern Kavaliershäuschen. This lecture series runs from 29 April 2019 through 8 July 2019. More information can be found on the MGSE website.

The SFB-TRR 122 NC3 hosts a seminar series with the theme "Individualisation in Behaviour, Ecology and Evolution". These lectures occur biweekly on Fridays at 11:15 and alternate between Bielefeld University and University of Münster. More information can be found on the website of the SFB-TFR 212 NC3.

SCIENCE PUB

These talks occur on the third Monday of the month at 19:15 at Ratskeller from May through July and are intended to promote understanding of and enthusiasm for science in the public.

20 May 2019 Tobias Jogler (LWL Planetarium Münster): "Gammastrahlenastronomie: Ein Blick in das extreme Universum"

17 June 2019 Martina Schrallhammer (University of Freiburg): "Faszination Symbiose"

22 July 2019 Susann Wicke (WWU Münster): "Mit Supercomputern und Diät-Cola den Geheimnissen von Schmarotzerpflanzen auf der Spur"

MGSE GRADUATES

Congratulations to Niklas Kästner for successfully defending his thesis titled "Of anxious males and angry females: how genes related to serotonergic neurotransmission, social experience, and the female reproductive cycle affect anxiety-like and social behaviour in mice".

Congratulations to Nora Schultz for successfully defending her thesis titled "The role of nucleic acid methylating enzymes in the red flour beetle *Trilobium castaneum*".

29 May 2019, 9:00, Institute for Landscape Ecology, Heisenbergstr. 2, Room 242
Yeisson Gutiérrez will defend his thesis titled "Insect responses to environmental stressors – canalization, plasticity and evolution".

2018 - 2019 EVOLUTION THINK TANK FELLOWS

From May – July 2019 Professor Sara Brownell from the School of Life Sciences at Arizona State University will visit as a Fellow of the Evolution Think Tank. Sara is a trained neuroscientist turned full-time education researcher who teaches undergraduate biology while studying biology education.

From July – December 2019 Jack Werren from the Department of Biology at the University of Rochester will visit as a Fellow of the Evolution Think Tank. Jack's research takes a multidisciplinary approach (which combines molecular, genetic, genomic, evolutionary, and ecological perspectives) to study basic questions in biology, genetics and evolution.

For indidvidual workshops, ETT-fellows, and seminars, please see the website of the mgse and evopad.

Should we Pimp Our Genomes? A Call for Our Ethical Duties

Matteo Rizzato, Institute of Cellular Virology, WWU Münster
Raphael Max, Chair of Business Ethics and Global Governance, TU München

"Is it more ethical to edit embryos, or to screen a lot of embryos and throw them away? I don't know the answer."

Jennifer Doudna

Genome editing in humans is no longer science fiction. During a press release last November Dr. He Jankui revealed to the scientific community the birth of Lulu and Nana, the first humans "engineered" with CRISPR/Cas9 technology.

The twins' CCR5 gene, which encodes for a cellular receptor involved in immune response and intracellular processes, has been selectively mutated. In fact, CCR5 is also involved in HIV infection process. The twins' father is HIV positive, and Dr. Jankui reasoned that the procedure would protect the twins from HIV infection. However, the likelihood of the father to transmit the virus to his daughters is extremely low, according to the scientific community. The risks posed on a mutation of a fundamental gene, on the other hand, are way greater than the presumptive benefits, making this approach questionable. Most importantly, the whole procedure has been conducted secretly and without approval of any official ethics committee.

Since its introduction in 2012, CRISPR/Cas9 technology has shown great potential for genome editing. It has proven as an extremely valuable tool in research, healthcare and industry. As the technology may lead to fundamental changes of human beings and their interaction, many unsolved anthropological and ethical questions arise: Should we edit our genomes? What constitutes a human? How should mistakes be handled?

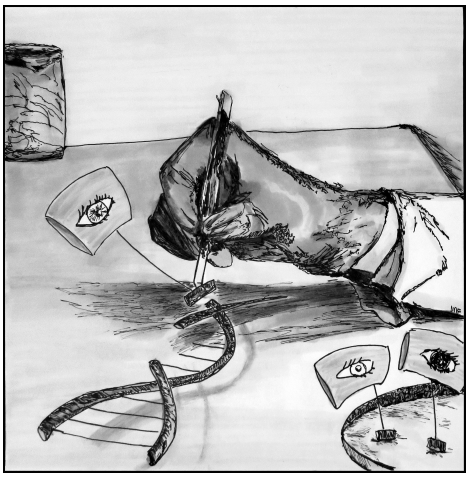


Image by Martina de Fede inspired by the image available at https://www.verdict.co.uk/gene-editing-roadblock-emerges-as-crispr-cas9-genome-damage-found/

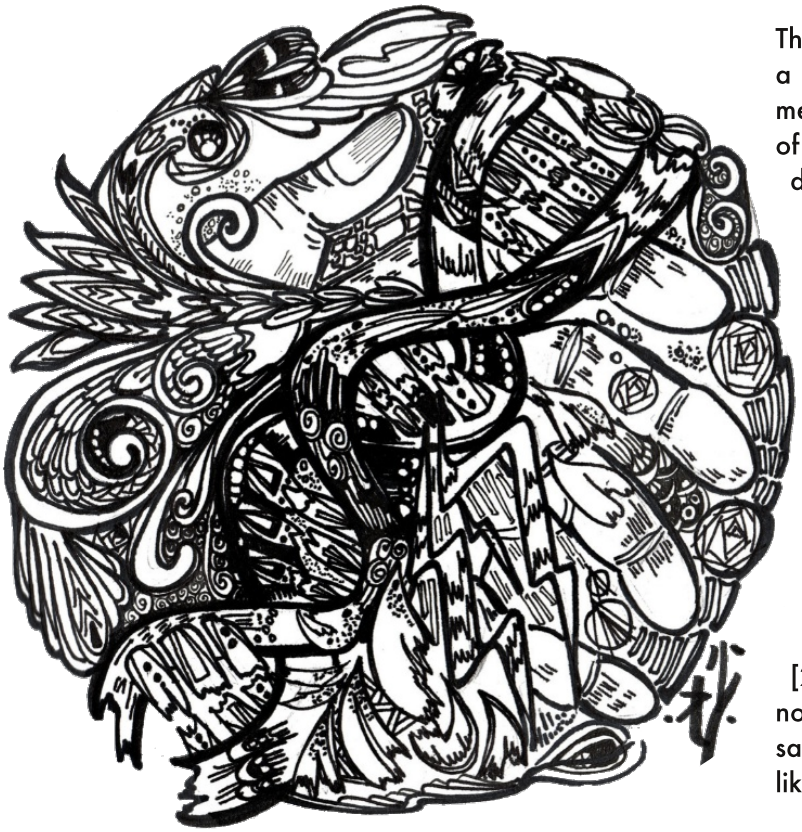
Due to prevailing uncertainties about the impacts of this new technique, the complexity of technical details and the strong economic interests, ethicists ought to focus on these questions. It is necessary, at this early stage, to establish international agreement on ethical principles because the consequences of CRISPR/Cas9 cannot be assessed ex-ante, and the outcomes will have a global impact. These agreements are difficult to establish due to different cultural, religious, philosophical and juridical concepts present worldwide. Thus, relying on old ethical concepts and well-known schools of thought may not suffice for this purpose.

We suggest to adopt Habermas' discourse ethics to address these questions. Jürgen Habermas' discourse provides an approach for explorative and uncertain situations such as human genome editing. All members of societies, and in this case scientists in particular, have a major responsibility to enter and prompt this discourse.

Discourse ethics attempts to establish ethical rules by examining the preconditions of the discourse itself. It differs from deontological and consequentialist concepts in that results are produced in an intersubjective process. Thus it is also suitable as a mean to solving ethical problems that go beyond individual interests and experiences. Discourse ethics does not give concrete indications in the evaluation of moral principles but rather outlines a procedure to promote an ideal discourse circumstance.

Jürgen Habermas defined some rules according to which a discourse must take place (Habermas 1990, p. 86):

1. Every subject with the competence to speak and act is allowed to take part in a discourse.
2a. Everyone is allowed to question any assertion whatever.
2b. Everyone is allowed to introduce any assertion whatever into the discourse.
2c. Everyone is allowed to express his (or her) attitudes, desires, and needs.
3. No speaker may be prevented, by internal or external coercion, from exercising his (or her) rights as laid down in (1) and (2).



The discourse is hence based on reciprocity and equality of all individuals. This provides autonomy to all members of the discourse but at the same time it demands responsibility, as ethical judgments are not coming ex-cathedra from elites or commissions.

This method is well-suited to discourse on this particular subject because of its uncertain nature. CRISPR/Cas9 technology is fairly novel, and the future implications are difficult to assess as of now. Genome editing on humans is an explorative field with high complexity; it seems therefore challenging to develop well-founded ethical guidelines without the ethical discourse. Discourse ethics enables and encourages the entry into dialogue of each individual. Because of its very nature, it entails the potential of adding new perspectives and solutions.

Of note, it is not mandatory to identify the best possible solution in advance and to arrive at a sustainable ethical judgment. It is more important to recognize errors and to correct them constantly, as in a trial and error process.

Consensus on the subject will be found only when scientists will present their expertise clearly. As we experience an asymmetric distribution of knowledge and understanding of CRISPR/Cas9 technology, all findings must be shared with the broad public in an understandable and objective way.

The theoretical prerequisites for a good dialogue, in a discourse ethics approach, may be difficult to meet. Many interests accompany the developments of CRISPR/Cas9 and will be introduced into a discourse. Strong political and economic actors could manipulate the discourse to their advantage. However, discourse ethics presupposes structurally rational actors and can only claim validity of an argument under the conditions stated by Habermas. The complexity of the matter together with subjective individual interests may pose challenges; nevertheless, this should be an incentive rather than a reason to discard discourse ethics.

As for the scientific uncertainties that may arise within the discourse, the improvements on CRISPR/Cas9 technology in the last seven years [2], concomitantly with the characterization of novel, more precise Cas enzymes [3], suggest that safety and precision in human genome editing will likely be achieved.

We now need a non-dominated communicatory action in order to find an ethical consensus. This can be achieved by applying the discourse ethics rules of Jürgen Habermas. The action should be actively promoted by the scientific community in the first place. Researchers should, therefore, provide information in an understandable way to the society while actively involving it into an ethical debate.

The scientific community must engage in the ongoing discourse, rather than trying to arrive at finalized, certain principles. The changes in society through technologies such as CRISPR/Cas9 must not be a reason for rash and dogmatic decisions but only an incentive to lead a constructive and open discourse with all participants. Therefore, we, as members of the society and scientists, all have a special duty in this process.

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Whose knowledge is represented on Wikipedia?

Nina Kranke

Imagine you are at a talk and the speaker uses a term you are unfamiliar with but you would like to know what it means. What is the first thing you do? Yes, you google it and the first hit will most likely be a Wikipedia article. Wikipedia has become one of the most popular and widely used online information resources. In January 2019 the English Wikipedia had more than eight billion page views and the German Wikipedia had more than one billion views [1]. But have you ever asked yourself who compiles all the information we find on Wikipedia? Most people know that Wikipedia is a crowdsourced “free encyclopedia that anyone can edit” [2]. Sure, at least in theory, anyone could edit but who actually does? Who are the people behind the articles? And, more importantly, who does not edit Wikipedia articles?

To learn about the demographic of Wikipedia editors (Wikipedians), several surveys have been conducted. According to a Wikimedia Foundation survey, the typical Wikipedia editor is a computer savvy 30-year-old US-American or European man with a college degree [3]. The results showed that most of the contributors live in countries of the Global North and are male. Only about ten percent of the Wikipedia editors are female [3,4,5]. The lack of diversity among Wikipedians is problematic because it can lead to a bias in coverage and selection of articles. In other words, college-educated 30-year-old white men write about topics that interest college-educated 30-year-old white men, which results in an imbalanced coverage of subjects and perspectives.

Indeed, the underrepresentation of large segments of the world population in Wikipedia editors is reflected in the content of Wikipedia articles. Most articles on wikipedia about places or locatable events are geotagged with latitude and longitude coordinates. A study showed that 84% of all geotagged articles across all Wikipedia language editions are located in Europe and North America [6]. It is remarkable that more articles were written about Antarctica than any country in South America or Africa, and only one percent of all geotagged articles are placed in China. Clearly, the distribution of Wikipedia articles does not reflect the distribution of the world’s population. Not only people from countries of the Global South, but also people of color are underrepresented within Wikipedia’s editor base. This is seen as one reason for the gap in the coverage of black history on Wikipedia [7].

Women, on the other hand, are covered well in many Wikipedia language editions, and articles about women tend to be longer than articles about men. The way women are portrayed, however, differs from the way men are portrayed. For instance, in articles about women, their romantic relationships and family related issues (e.g. number of children) are more extensively discussed than in articles about men. Researchers also found that articles about women often emphasize the fact that they are about a woman [8]. Both by explicitly mentioning roles as wives and mothers, and emphasizing the fact that she is a woman (e.g. “the first women to…”) and her gender becomes more central than her achievements [9]. The different ways of portraying men and women introduce a subtle form of bias, which can probably also be found in articles on people of color.

The lack of diversity among editors is only one aspect of the problem. Another problem lies in Wikipedia's infrastructure that reinforces already existing power relations and biases. Take, for example, the notability criteria that are used to decide whether a given topic deserves its own article. According to Wikipedia, people are notable "if they have received significant coverage in multiple published secondary resources that are reliable" [10]. Articles about women, people of color, and minorities often fail to meet the notability criteria because mainstream Western media and academic research has been, and still is, focused on white men. In general, topics for which "reliable" sources are not easily available to the average Wikipedia editor, e.g. if they are not published online or not available in English, are underrepresented on Wikipedia.

The problems have been addressed by communities, Universities, and the Wikimedia Foundation. Several edit-a-thons in different countries have been organized by women, people of color, and LGBT communities as a way of bridging information gaps on Wikipedia. These events typically include editing trainings for new Wikipedians, provide an opportunity for people to come together, to edit or to add new articles of a specific topic. The Wikimedia Foundation acknowledges the problem of systemic bias and initiated several outreach programs. The Foundation made efforts to make editing easier,more user-friendly, and also started the 'Community Health Initiative' to reduce the level of harassment on Wikipedia. Nevertheless, Wikipedia still has a long way to go to reach its founders' goal of representing the sum of all human knowledge.

References [edit]

[1]https://stats.wikimedia.org/v2/#/en.wikipedia.org/reading/total-page-views/normal|bar|All|~total

[2]https://en.wikipedia.org/wiki/Main_Page

[3]https://meta.wikimedia.org/wiki/Editor_Survey_2011/Executive_Summary

[4]http://www.ris.org/uploadi/editor/1305050082Wikipedia_Overview_15March2010-FINAL.pdf

[5]https://meta.wikimedia.org/wiki/Community_Engagement_Insights/2018_Report

[6]https://www.oii.ox.ac.uk/archive/downloads/publications/convoco_geographies_en.pdf

[7]https://en.wikipedia.org/wiki/Racial_bias_on_Wikipedia

[8]Wagner, C., Garcia, D., Jadidi, M., Strohmaier, M. (2015): It's a Man's Wikipedia? Assessing Gender Inequality in an Online Encyclopedia. Proceedings of the Ninth International AAAI Conference on Web and Social Media, 454-463.

[9]Graells-Garrido, E., Lalmas, M., Menczer, F. (2015): First Women, Second Sex: Gender Bias in Wikipedia. Proceedings of the 26th ACM Conference on Hypertext & Social Media, 165-174.

[10]https://en.wikipedia.org/wiki/Wikipedia:Notability_(people)

“Ode to the retina” - a snapshot of my PhD

Dr. Bianca Brüggen

If you close your eyes
and then open for me,
how long do you think does it take you to see?
Not a moment, you do see immediately,
well, let me explain here the tissue that´s key.

In all vertebrate eyes the structure is the same,
the retina is wrapped in limiting membrane,
three nuclear layers have cell bodies, which send,
dendrites that in two plexiform layers extend.

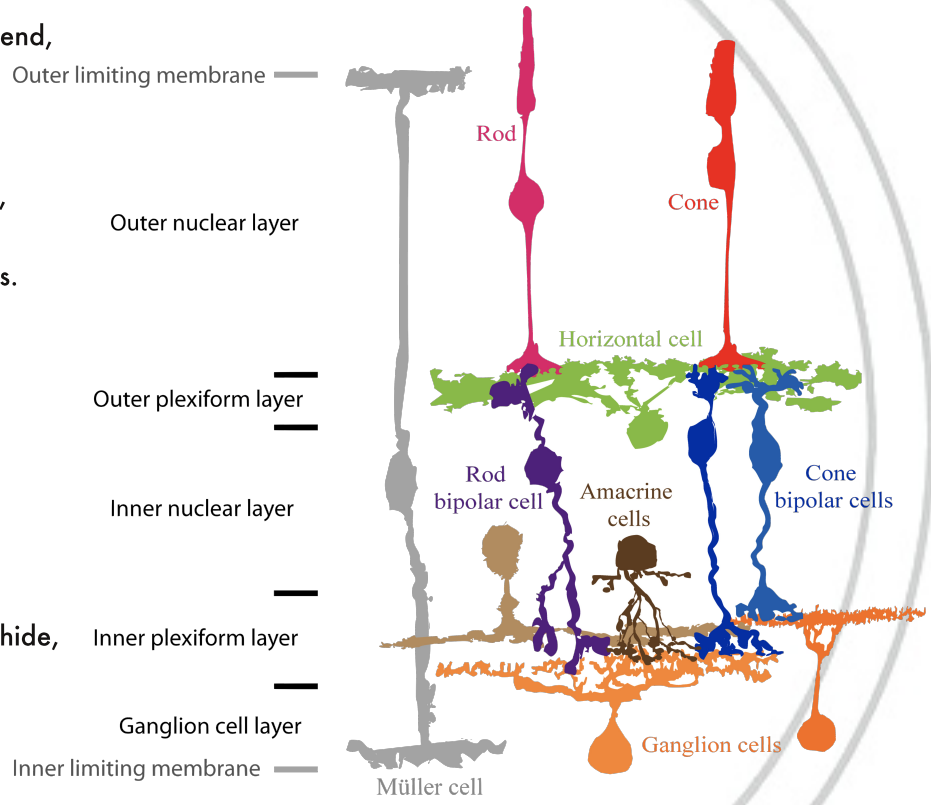
It may be the bright sun or the moon at night,
from the ganglion cell layer shines in the light,
detected by outer segments glutamate spells,
from rods and cones and reaches bipolar cells.

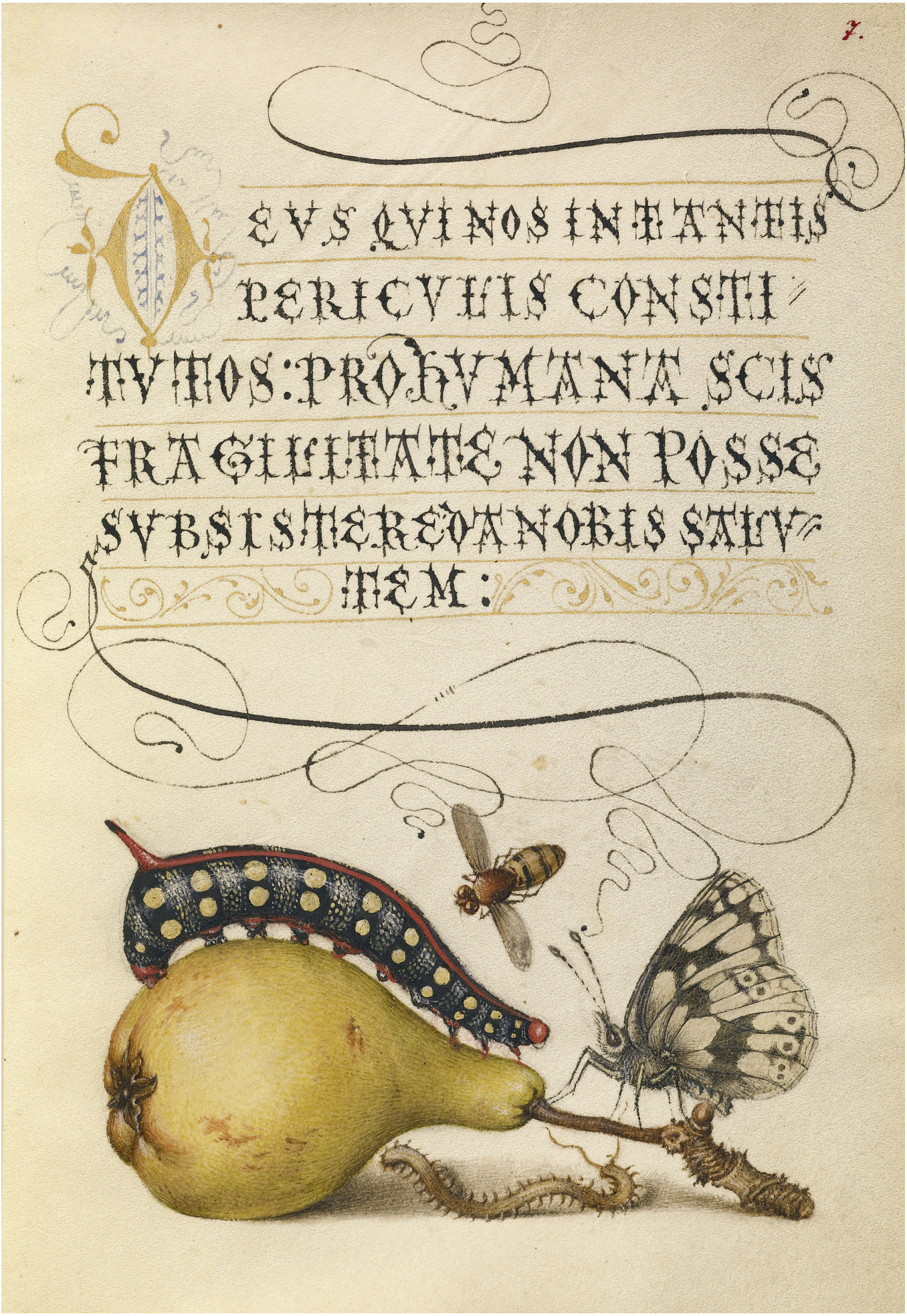
Horizontal and amacrine cells modulate,
the electrical signals, which then stimulate,
ganglion cells whose axons remain,
bundled together and project to the brain.

Now, if one cell is in an excited state,
in the axonal terminal vesicles wait,
to be fused to the membrane, they no longer hide,
and release the neurotransmitter inside.

Electrically every type of cell,
is coupled via connexins as well,
in clusters the gap junction channels are tied,
and connect the cells´ cytoplasm inside.

Unraveling the numerous pathways and roads,
staining areas, nuclei and neuronal nodes,
it is always a battle, the scientific success,
but thrilling and fascinating nevertheless.





"Mira calligraphiae monumenta"
By Joris Hoefnagel (Flemish/Hungarian, 1542-1600), Georg Bocskay (Hungarian, died 1575)

Evolution of biological theories

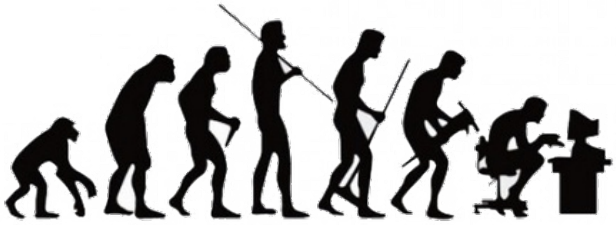
By Jasmin Kurafeiski

Scientific progress relies on the fallibility of scientific theories and keeping them in agreement with recent discoveries. For example the history of understanding evolution and the origin of life are riddled with ideas that were replaced over time. Often, this progress is just the refinement of an idea. In 1871 Darwin was musing about a warm little pond being the place of life's origin. Later the pond changed to the primordial soup, and now the origin of life is suspected to have taken place in underwater hydrothermal vents. All those ideas are connected through the common theme of water. But now, let us have a look at some of the more 'out-there' ideas people have come up with.

Let's start with a theory that is quite commonly known: preformationism. This early attempt at developmental biology suggested we all start from a very tiny version of ourselves that have always existed, and just grow when it is time to be born. By today's standards this can easily be shown to be wrong. However, it is still a fascinating theory rooted in ideas from Pythagoras and Aristotle, namely that the vast majority of a human's characteristics come from the sperm. Leading up to the famous illustration of the tiny human as a sperm cell.

Figuring out the mechanisms of evolution is quite the complicated endeavor. Every new piece of information helps. Now compared to the early days of the theory of evolution there are still many of pieces of the puzzle missing. So how to explain heredity without knowledge of Mendelian genetics? One idea was organic memory, proposed by Ewald Hering in 1870. According to this theory, all organic matter acquired and held memories. Said memories could be passed from generation to generation via germ cells. The theory remained popular for a long time, especially among proponents of Lamarckism but was in the end disproven through advances in genetics. Which is sad! Just imagine how cool it would be if your genes carried the memories of all your ancestors.

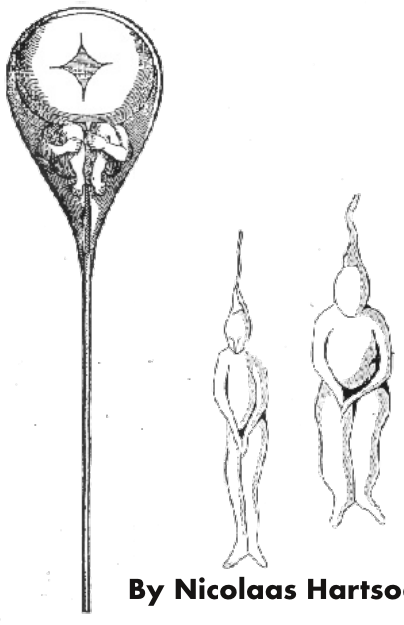
Today we know evolution does not have a goal in mind. Whatever works is successful, no matter how weird the solution (for a collection of funny examples I recommend the book "WTF, Evolution?! A theory of unintelligible design"). The theory of orthogenesis suggested that all organisms strive towards a common goal of constantly increasing biological



complexity; implying that complex organisms are superior to simple ones. Some layouts of phylogenetic trees should be avoided, as they (wrongly) give the impression of direction towards a goal. Another reason why this line of thinking should be avoided is its connection to creationism, as some supernatural force guiding evolution towards a perceived goal.

Last but not least, a theory that can be placed in the realms of pseudo-medicine: animal magnetism. The term was coined by Franz Mesmer in the 18th century and refers to a force comparable to electromagnetism that can be found in animals and plants. In essence, he claimed skilled people can wave their hands around or use magnets to fix any issues with a person's magnetic field, curing any pains or neurological issues. Though generally rejected, this theory explains the existence of magnetic bracelets sometimes peddled on teleshopping shows.

This is just a snapshot of obsolete biological theories. Somewhat weird, often just an attempt to understand nature while lacking information that is obvious to us now. But like nature, science adapts and changes with everything we learn. Knowledge is the natural selection removing misconceptions. For me, this is the true beauty of science.



By Nicolaas Hartsoeker (1695)

Clouds

By Dr Moss

Yes! I just had another beautiful interaction with the universe. I was approaching an idea, an angle of the universe's corner, yet it is so refined I needed to scale out. From afar you know, it looks like a spherical cloud with a trillion stars. So, what I do is to scale it in like zooming in on a picture. The process was cloudy, but the closer I got, the higher the resolution became. Yet, only until a point. The trouble is not to scale in, but knowing how to scale in. The corner became cloudy and clogged, like a computer screen refusing to reload and you sit there in agony and impatience. I waited, and I waited. I left it all together, and then I woke up after a night's sleep, full with fury and anger. With fury and anger, little can be done. It is like a haze of fierce emotion, all very vivid and energetic, but without clear sight. Once able to pull the words out from my gut, the anger got formulated and once formulated, it lifted. I could focus on my table again. There it stood, clear and stable. Not an inch had altered. But my invitation list had altered.

The people you bring into conversation about the universe, they are precious. They are the ones to first falsify your ideas and thoughts, they are the first to interact with your very precious, individual thoughts. Thoughts that may be the seeds of novel theorems, thoughts that may bounce back and find a better suited place on another limb of the universe. "Your saw has no purpose in this china and porcelain shop, but here in the furniture restoration department it is of utter most value!". You may not be the one running the department, but they may be clever enough to see the purpose of your saw. Foremost, the people you invite to conversation are the ones to continue your inspiration. Usually, you would not converse or engage with those who do not seek themselves. Yet, how precious they are! For they dance at the same rhythm if yet a different tune, thus you may dance together. It is in the conversation that true understanding is yielded. That is at least one interpretation and understanding of Socrates' many teachings and supposed statements. I find it curious that I loved this claim, as I loathed Socrates' followers, passionately and unapologetically, as a student in philosophy class. But it points to a curious scientific problem - today we have a relatively poor understanding of how and what processes makes the human brain learn. One observes that children learn, but the neurological process is not sufficiently understood to create a scientifically proven methodology for how students best learn novel

"The Book of Life: The Spiritual and Physical Constitution of Man." by Dr. Alesha Sivartha, 1898.

information. Memory and imitation are not siblings of understanding. Rather, they are the method behind acquiring novel information. However, they do not reveal how one best may communicate. This is also a favourite accusation against AI and deep learning: if scientists can not instruct "how to learn", as we poorly understand what it is "to understand" - an AI is nothing but a gagging algorithm focused on memory and imitation. Those are common accusations of the limitations of AI. However, this is not a text about AI, nor a defense or attack upon its potential or future. I would rather point to the fact that conversations are wondrous, and until AI may tell me a joke of its own creation, I would judge it a poor conversation partner.

For the people you choose to play with when studying the paths of life, they are often as important as the people you choose to tread with in life. In the conversation with the universe itself, where you dissect the mate choice of *Drosophila* or termites, the combinations of old and novel protein domains, the niche choice of *Tribolium* - where little by little, the world reveals another bit of information about itself - nothing but the best companions are worthy. These companions with whom you engage scientific discourse contribute not only to the road towards discovery. They also influence how you look at it. And when observing the universe, one has made a fallacy if the high resolution convinces you to not zoom out to also marvel at the gathering of stars.

Alchemy

By Nadja Haarmann

Many people today know the Harry Potter books. The first book's title is „Harry Potter and the Philosophers's Stone“. We are told that this stone helps to gain immortality and wealth. One may ask where this idea comes from and if there are some hints to history. And indeed there are. Nicolas Flamel, the creator of the philosopher's stone in Harry Potter, was, in reality, a famous and successful writer and estate agent in France. So, why do people think he was an alchemist? Well, there are two reasons: First, the people did not know how he gained his wealth. The answer is quite simple: His wife had been married twice before him and had therefore a huge inheritance already. Secondly, other authors used his name for alchemistical manuscripts. There are even rumors that he just told people he had succeeded in producing this famous stone to evade tax fraud. Apropos fraud, there were so many fake alchemist during the 12th and 13th century that Pope John XXII issued an edict in 1317. The German people even invented a new word for these charlatans who sold useless potions for a lot of money. They were called “Betrüger” (fraudster). But what was the basis of Alchemy in general? The most famous goal for alchemy was the following.

Alchemy was meant to create gold from lead with the help of the philosopher's stone as catalyst. The stone was meant to provide his owner with special and total health and hence immortality. Alchemy had its roots in Greek philosophy. It was believed that all things in existence were made of the four natural elements fire, water, earth and air. It was the science of change. This change was called transmutation. A lot of influential nobleman had their own alchemists at hand to increase their wealth. Of course it was not really possible to make gold from lead and so a lot of these scientists had to escape sooner or later. Otherwise they were hanged on a golden scaffold and decked out in tinsel. They did not make gold but they were killed by it.

A very famous alchemist was Paracelsus. His full name was Theophrastus Bombastus von Hohenheim and he was born around 1493/4. To be precise; he was not only an alchemist but also a physician, astrologist, theologist and philosopher. He was the first who recognized that every material can be toxic but that this characteristic is always dependent on the concentration. Somehow this observation can be seen as the birth of pharmacy. He even stated that it is nonsense to put feces in an open wound. Obviously he was very right about this theory.

Did you know that there was even a female alchemist living sometime between the first and third century? Her name was Mary the Jewess. There are not many facts about her but some people describe her as first true alchemist in the western world. It is hypothesized that she invented the “Tribikos”, which is an alembic with three armes. It was used to obtain substances purified by distillation. She also got credit for an apparatus (Kerotakis) with which one could form a tight vakuum. The third and last invention even carries her name: Bain-marie; It is a double boiler which is not only used in chemistry but also in the kitchen.

The evolution of science is quite a fascinating topic. Some mystical substances like the above mentioned philosopher's stone have never been forgotten. Not only do we find them in Harry Potter but also in Victor Hugo's novel “Notre Dame de Paris” (1831) or even in films like “The Da Vinci Code”.

A lot has changed in science but some observations remain true until today, quod est demonstrandum.

Comic Book Peer Review: Major revisions for Prof. X's latest paper.

By Daniel A. Pritchard

If Neil DeGrasse Tyson, astrophysicist and Director of the Hayden Planetarium, can ruin your favourite movies with science, then I, a slightly bemused evolutionary geneticist and PhD, can use that same over-analysis to improve a few comic book storylines you've never heard of.

Under the dissection microscope this issue is:
New X-Men, E is for Extinction.

I can think of no better way to start this series than with the X-Men, a team that are a few colourful spandex bodysuits away from being the cast of 90210. But it is in those colourful spandex bodysuit elements where we find those moments of sciencey shlock to be picked apart by the likes of me. Though it is not the dodgy science behind the mutants of X-Men themselves that are the topic here. It is another piece of genetic tomfoolery, that is arguably stupider, that is the subject here: The E-gene or The Extinction Gene.

The Extinction gene is surprisingly not a newly characterised *Drosophila* gene that someone let their 13-year-old gothic nephew name, but a dormant gene that will cause the extinction of humanity. That is not how any of this works at all, but there's more, this gene is expressed then another 'more evolved' species becomes globally dominant, and this is what wiped out *Homo neanderthalensis*. So why is this a problem for humans? We're sitting pretty on top of the food chain, or at least we are until honey badgers discover fire. It is because of another aspect of Marvel's mutants that we have yet to explore. The single X-gene that results in the wide array of fantastic abilities of the titular X-Men, also makes them a different species; *Homo superior* (subtle I know). So here we see the problem; at some point in this universe early hominids developed the E-gene as some sort of Darwinian Highlander ("There can only be one!"), and it now threatens to wipe out humans because some hairy Canadian was born with the ability stab people with retractable metal claws.

However, what if we were to take the 'Extinction Gene' at face value - could some genetic factor reactivate under specific circumstances and spell our doom? A gene would not act in the way described in the story, however it is possible if we consider latent viral elements within the genome. In this scenario the E-gene will be named E-virus and could be one of several types making up an E-virus family, taking a form similar to the Herpesviridae family. In order for this E-virus to act in a similar manner to the comic description it must fulfil several criteria; it must be ubiquitous in the population, it must be latent, and finally it must activate under certain conditions. So, using the example of herpesvirus, which across its 8 types infects close to 100% of the adult population [1], therefore it is feasible that our hypothetical E-virus family can do the same. Next is the ability to be latent, one of the key viral strategies employed by herpesviruses; to insert into the genome of its host to remain undetected. Finally, the ability to reactivate, or to switch from latency to replication, this can occur in herpesviruses under stress [2], so our E-virus can do the same, to decidedly more deadly results. In the comic this activation is a result of a higher population of a 'more evolved' species, a new apex predator. Though this in of itself would not be sufficient stress, however a new competitor to humans, taking up resources like space, and altering it to their needs as we have to other species, as well as the diseases from this new species may activate the E-virus in many.

This of course is baseless speculation about a silly plot point in a comic. Viruses of this type often have a long-term evolutionary relationship with their host system, and thus are mostly benign [1]. The host system is needed for replication and therefore being lethal to said host would be far from the most convenient evolutionary path.

I make this case not to argue that comics should be more realistic, the discovery of the E-gene is made by a blue cat-man unironically calling himself beast, realism was never the goal here. But that by using aspects of real science even within a melodramatic narrative can further ground that narrative and its characters into something understandable to our everyday lives. Here what is supposed to be a terrible threat to us the reader comes off as a cheap trick, but by altering it with a little reality, seems much more dreadful.

1. Grinde, B. Herpesviruses: latency and reactivation – viral strategies and host response. J. Oral Microbiol. 5, (2013).
2. Traylen, C. M. et al. Virus reactivation: a panoramic view in human infections. Future Virol. 6, 451–463 (2011).

UP-GOER 5 CHALLENGE - A DESCRIPTION OF MY PHD

The Up-Goer 5 challenge was an attempt by webcomic xkcd creator Randall Monroe to make science understandable to a lay audience, albeit a comical one. The original comic involved translating the blueprint of the Saturn V rocket, that took humankind to space, into the most used 1000 words in the English language, hence 'up-goer 5'.
Here several Eyebrow writers attempt to describe their PhDs in those same 1000 words to some silly results.

Daniel A. Pritchard

My doctor's learning is about the relationship between ageing and under the covers dancing using sweet ball food flies. In most animals there is a fight between these two, animals that can't dance live longer than those that put more focus into dancing. A good way to show this is in see through thick lines, where taking away the balls makes them live longer.

But this is different in friend group small flying many legs, where group heads are the only friends that dance, but live longer. Flies are alone small flying many legs so will be used as a different group to see if friend group small flying many legs have changed the use of ageing/dancing pass down parts.

We will do this by knocking down key pass down parts in important ride forwards to see how it changes fly ageing and dancing. There are a few key ride forwards in ageing and dancing that we will knock down from, the food grabber ride forward and the inside body attacker turned off by doctor food ride forward.

Next we will check how other surrounding pass down parts are changed. With this we hope to find key middle pass down parts inside the ride forwards that will turn everything on or off, using a computer.

We are doing this to better know how the fight between ageing and under the covers dancing in small flying many legs works.

Glossary
Doctor's Learning = PhD
Friend group = Social
Food grabber ride forward = Insulin/IGF-1 Signalling (IIS) pathway
Inside body attacker turned off by doctor food ride forward = Target of Rapamycin (TOR) pathway
Pass down part = Gene
Ride Forward = Pathway
Sweet ball food = Fruit
See through thick line = Nematode Worm
Small Flying many leg = Insect
Under the covers dancing = I Shouldn't have to explain this

Brennen Heames

Inside every living cell are many stuck-together-letters, which say how to make the small things that cells are made from. For a long time, people thought that new things inside cells could only be formed by making small changes to the stuck-together-letters that already say how to make a thing in the cell. But people that find out new things now think that any stuck-together-letters can be used to say how to make new things.

These new things probably wouldn't be good at doing jobs in the cell, at least to begin with. But after a long time they might find something they can do well, like sticking to other things in the cell or making things go faster.

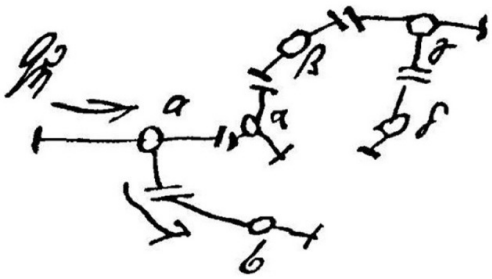
Turning not used stuck-together-letters into used stuck-together-letters can happen in many different types of cell, but seems to take place more often in bigger living things like animals. We now want to find out how often these new things are formed, and how often they are able to do something good.

This is important to know, because living things are very good at fixing problems, especially when they live somewhere new - and that is often only possible thanks to new small things inside cells.

For now it's very interesting to know where new things inside cells come from in real life. But one day we may even be able to write stuck-together-letters in the right order to make completely new things when we need them.

Glossary

Stuck-together-letters = Gene
Small things inside the cell = Proteins
Complete set of stuck-together-letters = Genome
Very-new = de novo
People-that-find-out-new-things = Scientists



Miao Sun

I want to know how the part above the person's neck works, especially it has lots of tiny living guys who talk with each other all the time and control our whole day life.

On the face of tiny living guys, there are many balls which are important for talking and learning between them. And those balls also work together with other balls with different body figures. Every balls is important, when I kick one type of ball out, the tiny guys can not talk to each other well anymore.

I study on one group of balls. In the group, different balls have their own jobs, and this group is one of the most important balls which helps the tiny guys talk. They use very little points as words. We can get those points for our body from food looks like water with white color. This group work with another longer balls, which are important to tell their faces of the tiny guys.

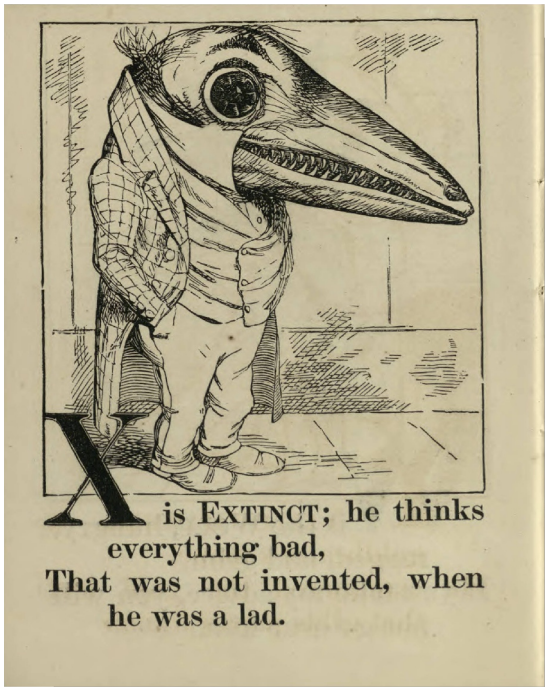
So my job is to find out how exactly the longer ball play with the group of balls. To do this, I put the group and the longer balls in another type of tiny guys, because they have very few balls on their faces. Then they will not get bothered by other different balls, and they can only play with each other. I use is made by a cool but hard to understand box which have computer parts and glasses. This box is usual way to write down little voices from the tiny guys. I have listened their words for two years.

Glossary

Part above the person's neck = Brain
Tiny living guys: Neurons
Their face: Synapse
Another type: Cell model HEK cells
Write down little voices: Currents recording
Their words: Recording signals
Talk to each other: Neurotransmission
Balls = Proteins
Group = Voltage-gated calcium channels
Parts = Subunits
Longer balls = Neurexins
Talking and learning = Transmission and synaptic plasticity
Very little points = Calcium ions
White water = Milk
Recognize and stick to = Cell adhesion and recognition

N Q G E D F M N W G V E C B B
B X J H I T U X G O V M N I O
R X D B V O I E D J E U V R M
N L R S G M S P E I H F H D B
W M E T A M O R P H O S I S U
A F W P Y L P S L N B I H O S
P T O G I D M V N N F Y R N B
S M L B L H Y N B O Y A B G O
G Y F E C U S C B T W J A L M
O K F D I D E T N D O D V R B
R L X F J D S T R E H S R N U
F T F O V R G B J U L K C O S
J W W E T A M I L C O L V D P
A R E T P O D I P E L C O Y Q
M I G R A T I O N C V L R P O

The New Age. (Portland, Or.) June 29, 1901, Image 5



From "Beasts, birds and fishes : an alphabet for boys & girls", by Charles H. Bennett, 1855.

Moment of Zen

If Lamarckianism would be true, the Kardashian children would actually be(come) beautiful.

Plastic surgery would no longer be vanity, but charity. The PR billboard's for plastic plastic surgergy would be "Think of the children - do it for them!"
(overheard at the Hüfferstr.1 A)

"*We implement Bayesian [methods] - we do not understand it.*" - overheard advice from an eminent PI

You can always change your face - but not your hair.
- advice of consolation after IEB's institute picture

From "A Collection of Fashionable English Words" by Tsunajima Kamekichi, 1887.