Issue 2 June 2018

The Eyebrow

For and by PhD students of the Muenster Graduate School of Evolution

About the MGSE

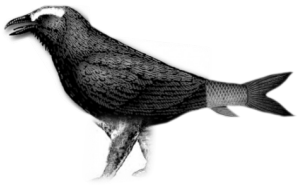
The Münster Graduate School of Evolution (MGSE) is an interdisciplinary association of researchers of the WWU, bridging the Faculties of Biology, Medicine, Geosciences, Philosophy, and Mathematics. Combining the already existing strength in evolutionary research at the WWU, the MGSE provides an interdisciplinary 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 Eyebrow logo - 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 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. Moreover, we will have a lab reportage in each issue where the work of an associated MGSE lab will be featured. This will preferably be done in context to the theme of the given issue and by the MGSE PhD student belonging to the lab in question. There is intention to include reportage articles (eg stress in academia), next to essays in future issues.

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 and want to write, tell or express something, or for any questions you may have, make contact: eyebrow.mgse@gmail.com.

EDITORIAL

Hello and welcome to the second issue of the Eyebrow–the student magazine of the Muenster Graduate School of Evolution. We launched the Eyebrow in February of 2018 as a forum for members and friends of the MGSE to communicate their thoughts and views on the evolutionary biology, science, art, and the world of academia.
The publication and dissemination of scientific work can be a difficult and arduous process. It is fraught with obstacles and setbacks–be they the byzantine labyrinth of an online manuscript submission system or the cruel rebuff from a capricious reviewer. As such scientific writing can be a disappointing and discouraging struggle.
The Eyebrow is our attempt to promote scientific communication–be it words or pictures–in a more casual and informal style. We encourage members of the MGSE to write and discuss topics, be it there on field of research, life as a PhD student, or the crossover of science and their myriad other interests.

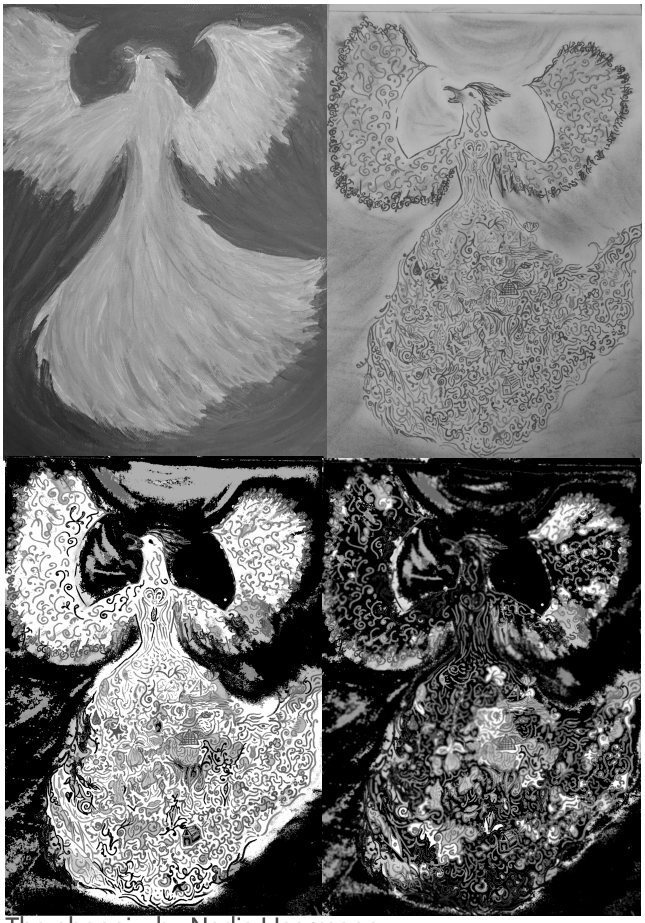
This issue certainly reflects the diversity of the MGSE, and we are proud that the current issue has grown in quantity and diversity with respect to content and contributors, Just to mention a few pieces briefly: Taking the concept of "the struggle for survival" a tad further, several pieces dive into the "question of resurrection". In the Living and Dying of Bacteria, PhD student Nadja Haarmann presents a bacterium's-eye-view of the goings-on in a microbiology laboratory. In the issue's lab reportage, MGSE alumna Liliya Doronia explores the potential and ethical complications of cloning and resurrecting long extinct animals, such as the woolly mammoth and the Tasmanian tiger. Moreover and on a different note, PhD student NS Gati reports on the causes and effects of stress on the mental health a PhD. This topic is getting increasing coverage in the scientific press so we see it nothing but appropriate to include this topic also into the Eyebrow. Recent studies indicate that mental health problems such as depression and anxiety are worryingly prevalent among graduate students [1, 2]. Maintaining work-life balance, high job demands, and low job control were associated with increases mental health problems. On the other hand inspirational supervisors and mentors mitigated the above risks [2]. We hope to see more contributions and angles to this topic in coming issues, as it deserves more awareness.

The Eyebrow has received a wealth of support and mentoring form the MGSE and beyond–both from PI's, postdocs and other PhD students. We also thank for the multiple artistic contributions from Miao, who also drew the frontpage. We thank you all for your assistance, the magazine would not be here without you. Until next time,

Daniel Dowling,
Editor in Chief

[1] Evidence for a mental health crisis in graduate education. Evans, Bira, Gastelum, Weiss & Vanderford (2018) Nature Biotechnology
[2] Ph.D. students face significant mental health challenges. Pain (2017) Science

Layout and design by A.S. Kleppe



The phoenix, by Nadja Haarmann

CONTENTS

Extended honours to Matthias Kiel, Alex Muttwil, Sergio Avila, Jasmin Kurafeiski, and Brennen Heames for contributions by input, editing and creative work. Special thanks to Miao Sun for beautiful artwork.

New News

Mercator Fellows EvoPAD 17/6 – 15/7

Prof. Dr. Thomas Flatt Department of Biology Chemin du Musée 10 CH-1700 Fribourg Switzerland Website: http://www.unifr.ch/biology/research/flatt/ Research: The Flatt group studies the mechanisms underlying evolutionary changes in life-history traits. Thomas Flatt will give a lecture in the MGSE "Evolution across fields" lecture series on 2 July on "The genetics of clinical variation and adaptation". Venue is IEB lecture hall (Hüfferstr. 1). His research in evolutionary biology addresses fundamental questions in evolutionary genetics of adaptation; life-history evolution; the evolution and mechanisms of aging and longevity (including the relationship between aging and immunity).

ETT Fellows 2018

Prof. Dr. Michael B. Hennessy, 1/5– 31/7 Department of Psychology, Wright State University, USA Website: http://psychA scholar.wright.edu/hennessy/ Research: Relation between neuroendocrine activity and behaviour, specifically during development. Plans for visit: Joint workshop with Christina Grozinger on 25-26/6 (see below). This will cover key concepts in behavioural research in vertebrates and insects.

Prof. Dr. Christina M. Grozinger, 4/6 – 28/7 Center for Pollinator Research, Penn State College of Agricultural Sciences Website: https://www.grozingerlab.com/ Research: Regulation and evolution of social behaviour in social insects, focus on honey bees and bumble bees; integrative approach which encompasses genomics, physiology, behaviour, chemical ecology, and ecology Plans for visit: a joint workshop with Michael Hennessy (see above) is planned for 25-26/6. This will cover key concepts in behavioural research in vertebrates and insects.

Upcoming Courses and Workshops 2018

MGSE lecture series "Evolution across fields"
This is currently ongoing and runs until 9/7. Lectures are given by MGSE researchers and invited guests and cover all fields included in the MGSE. The full schedule can be found at www.uni-muenster.de/Evolution/mgse/seminars/evolutionacrossfields.html

Arndt Telschow will give a talk on "Time series analysis" on 12th July at 11:00 for MGSE and EvoPAD members (most likely in Hüfferstrasse 1a).

1st Münster Evolution Meeting, 4/10 - 6/10
The Münster Evolution Meeting (MEM) aims to be a forum addressing questions for evolutionary biologists across different fields (e.g. Botany, Zoology, Microbiology, Medicine, Philosophy) and levels; from molecules to societies. Besides having the opportunity to share and learn about excellent research in evolutionary biology, MEM also aims to bring together evolutionary biologists working in German-speaking countries in a smaller setting, to allow for intensive networking and discussion.
An opening talk by Peter Hammerstein titled "The organism as evolved information processor: How genetic, epigenetic and sensory inputs are integrated and why endosymbionts have their own word to say!" promises to be a highlight, and will be followed by a panel discussion.
There are still a few slots available for poster presentations. Standard registration ends on 13/9/18. Registration fee 80 EUR. Follow the MEM website for updated information; http://www.uni-muenster.de/Evolution/MEM/main.shtml

Short-term visitors

Johannes Jäger, 17-20/06 (EvoPAD guest)
Complexity Science Hub Vienna, AT & Center for Systems Biology Dresden, DE. Will talk on 18/6 as part of the MGSE lecture series.

Martin Kaltenpoth, 18-19/06 (EvoPAD guest)
University of Mainz, DE. Will give the IEB seminar on 19/6.

Vidyanand Nanjudlah & Veena Rao, 10/7 – end of July (MGSE guests)
Centre for Human Genetics, Bangalore, IN. Both will talk on 12/7, starting at 16.30 in the IEB lecture hall.

Events outside of the MGSE

Bernhard Rensch lecture, 12/6
This year's lecture will be given by Prof. Dr. Charlotte Helfrich-Förster on *„Die innere Uhr im Gehirn – ein Streifzug durch ihre molekularen und neuronalen Mechanismen bei Mensch und Tier"*. The lecture starts at 15:15 in the Aula of the Schloss.

Eyebrow Photo Competition 2018

Nature around you: This is theme that the Eyebrow – you are holding it – has chosen for our new photo competition, which is open to all students, alumni, employees and friends of the Department of Biology of the WWU.

We are looking for your most beautiful pictures inspired by nature - your research or your environment. Be creative and send us your best picture by 31.07.2018.

The jury Fachschaft Biologie will select the best photos from all submissions sent online to eyebrow.mgse@gmail.com.

See online https://eyebrowevolution.wordpress.com for full guidelines. The winners will be announced online.

The Annual MGSE Symposium

"Really well organised and insightful"

"Very nice atmosphere and nice scientists, joined on a day filled with very insightful scientific presentations"

"The lecture hall exploded with Michael Lynch's talk"

"penis bones and error rates all over the place"

"Free Science and free food, always the best combination"

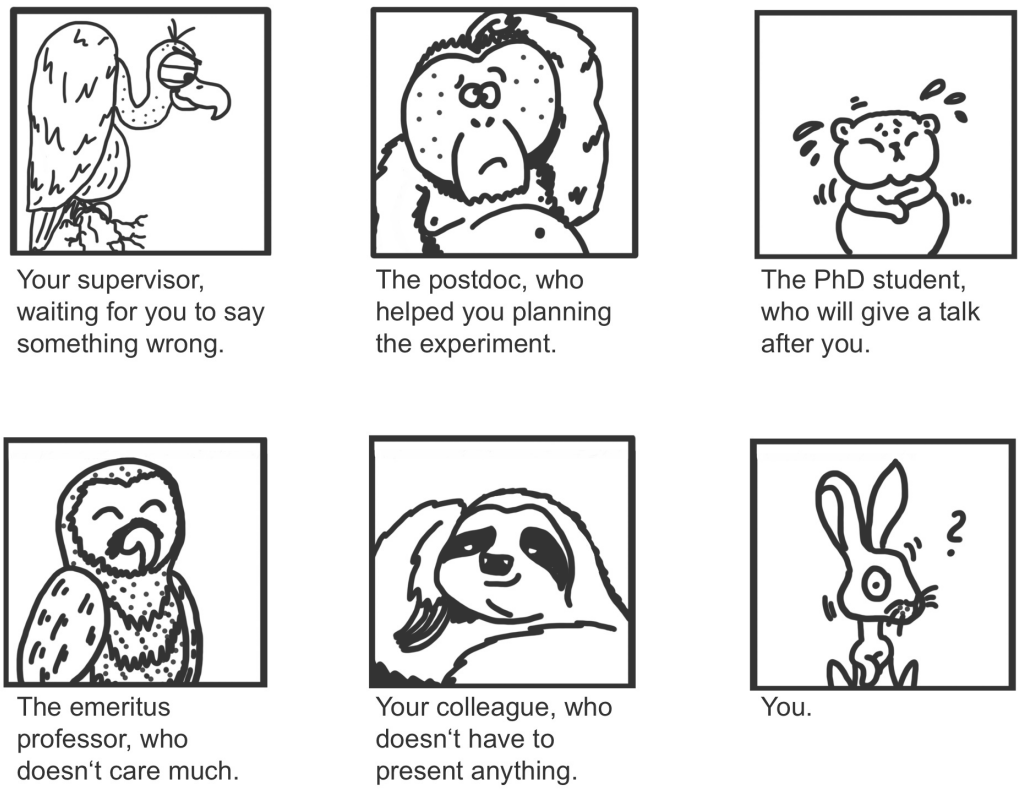
The objective report

The 7th MGSE Symposium was held on 21 – 22 March 2018 at the Institute for Evolution and Biodiversity at the University of Münster. Around 60 participants attended the two-day event which again offered the graduate students the opportunity to present their research in an oral presentation or a poster. For the first time, also PhD students from the Research Training Group EvoPAD – who are associated to the MGSE – were invited to share their first results, to network with evolutionary biologists in and around Münster, and to gain presenting experience. The programme was completed by talks of four MGSE Principal Investigators and three excellent keynote speakers: On the first day, Michael Lynch – member of the National Academy of Sciences and famous for his work supporting neutral theories of evolution – focussed on evolution at the molecular level. On the second day, Leo Beukeboom and Paula Stockley gave insights into the evolution of sex determination systems and post-copulatory sexual selection.

The subjective report

The MGSE symposium is an annual event where lectures and poster sessions are given by invited keynote speakers, MGSE PI's and PhD students. It is a popular event amongst the PhD students as the setting is intimate and the level of interdisciplinary interaction is high. It is an event where one gets exposed to someone or something novel, entertaining and frequently mindblowing. We decided to make a wordcloud by some of the attendees (see above).

When you have to give a talk...



Comic by Susanne Sangenstedt

Q & A with Michael Lynch

Michael Lynch was a keynote speaker at the MGSE symposium, where he gave a talk on the drift-barrier hypothesis. Michael Lynch is a geneticist who has been a major force in promoting neutral theories to explain genomic architecture based on the effects of population sizes in different lineages; he presented this point of view comprehensively in his 2007 book "The Origins of Genome Architecture". He is currently the Director of the Biodesign Institute for Mechanisms of Evolution at Arizona State University, Tempe, Arizona USA. We were happy to receive answers to some follow-up questions of lesser and greater importance.

Q. The drift-barrier hypothesis carries great power to explain the error rate, not only on a genotypic level, but also transcriptional and translational level. It is also a relatively recent hypothesis, published in 2012. Personally I think the hypothesis should have a draw to the field of mutations and expression errors. As the driving force behind the drift-barrier hypothesis, have you seen an increased attention to the field of mutation rate or is this more of a 'silent revolution'?

A. Given its significance to evolution, human health, conservation genetics, and many other areas, mutation has been a central target of evolution for a long time. I don't view the drift-barrier hypothesis as particularly revolutionary, but simply a logical explanation for the observed results. On the other hand, for those who view natural selection as the only mechanism of evolution, it would certainly seem revolutionary. I encourage people to think hard about alternative hypotheses, but this is where we are at this point.

Q. Much, if not most, of your academic work has been dedicated to non-adaptive processes in evolution. Some would argue that non-adaptive processes, e.g. drift and neutral evolution, are under-taught in most biology teaching programs. Do you have thoughts as of why this is - and do you have thoughts on a good approach in breaking this unfortunate pattern?

A. Well, unfortunately, natural selection so-engrained in most people's ways of thinking, and drift is viewed as a sort of pathological aspect of tiny populations. I think a lot of people have a difficulty understanding that evolution by non-adaptive processes does not mean maladaptive evolution. The central point is that there are many paths to evolutionary diversification that do not involve bottlenecks in fitness.

Q. As a follow up question, if a biologist finds her or himself intrigued by non-adaptive processes shaping evolutionary events (but was led astray by too-adaptionistic thinking), if a scientist would like to know more, without restarting their entire career path, what would you recommend as a good starting point?

A. My "frailty" paper published in PNAS a few years ago seems to be a popular starting point.

Q. To an educated layman who is interested in reading more on the topic of non-adaptive processes and who is done with "the selfish gene" and adaptive evolution - what literature would you recommend?

A. My book on the Origins of Genome Architecture. I am currently writing a sequel / extension on this – The Origin of Cellular Features, but it is still a ways off.

Q. Finally a crackpot question. Large, multicellular organisms, with long generation time - so called "K-species" - generally have smaller effective population size than smaller, short generation, single cellular species. Natural selection acts less efficiently on the K-species given their relatively smaller effective population size. From a distance it would look as if there would be an intuitive connection between inefficient natural selection and complexity. Do you think this is crackpot nonsense or is there something to it?

A. It's an interesting point, and I don't think crackpot at all. There seems to be an intrinsic belief in many camps that complexity is fundamentally beneficial, but the opposite case can easily be made, e.g., as layers of surveillance for various features arise, this relaxes selection on previous first-order functions, and not necessarily leading to any long-term benefits (and indeed a loss, as one must then maintain a more complex system to carry out fairly simple tasks, which costs energy, etc.)

Q. Another crackpot question (this is a satirical non-prestigious magazine after all). What is your favourite fringe scientific theory? E.g. the aquatic ape, bigfoot, the hollow earth.

A. Well, I'm not a real fan of the fringe-lunatic approach to science, of which we have too much in evolutionary biology, e.g., the "extended" evolutionary synthesis. If one wants to extend something in public, the responsible thing to do is to spend some time understanding the current field in a deep way. I would not be surprised if we eventually encounter some striking discoveries, such as life on other planets. The interesting thing will be to see if we are all still related by descent, or whether such evolutionary trajectories have been totally independent, and if so to determine the degree to which parallel evolution has occurred at the molecular / cellular levels.

A man with a beret

In the spirit of open access of honourable attempts with null results, we publish the image here by one of the editorial artists who are terrible at portraits but still got inspired.

Student portrait

We invited one of the newest MGSE members to present himself.

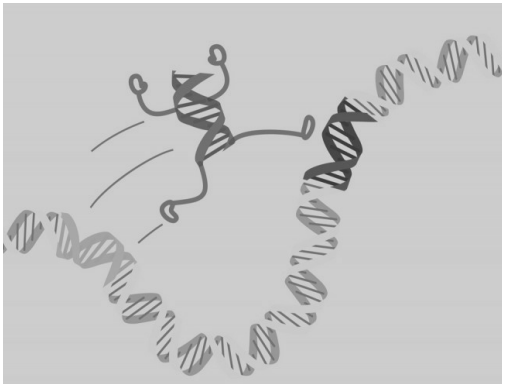
"Your work is to discover your world and then give yourself to it wholeheartedly." Before starting introducing myself and my PhD project, I would like to begin with three pieces of advice that my father, a retired teacher in Iran, has given me, because it has obviously been a road map for me during my academic life: I. 'Be honest in your life, especially in your academic work', II. 'Choose as your field of study not only something at which you are the best but also one that would make your work profitable to other people', III. 'no matter what you do, it is very important to put your best effort into it'.

I am Reza from Iran, a PhD student at the Institute of Bioinformatics, Faculty of Medicine, University of Münster and I have recently joined the MGSE.

Bioinformatics has been a fast-growing interdisciplinary field that involves research in application of computational tools and development of methods for utilizing vast amounts of biological data. In this regard, genome sequencing projects and resulting next generation sequencing (NGS) data have opened novel axes of investigation. On the other hand, medical science is continually making rapid advances: new medications and treatments are developed and introduced at a rapid pace, but we can better take advantage of these advances by taking evolution into account. Like all biological systems, both disease-causing organisms and their victims evolve. Understanding evolution can make a big difference in how we treat disease. Learning about the evolutionary origins of diseases may provide clues about how to treat them and considering the basic processes of evolution can help us understand the roots of genetic diseases.

By taking the above-mentioned issues about bioinformatics, medicine, and evolution into account as well as my interest in these fields, I made up my mind to join MGSE, because I do envision the MGSE as the right stepping-stone to pursue my dreams, develop my current strengths and capabilities, develop new ones, and finally to achieve my academic goals. So, it needs to be said that I am really satisfied with my decision to join the MGSE.

I would like to dedicate the final part of this paper describing my PhD project. With respect to aforementioned as well as special features of Mobile Element Insertions (MEIs) including a) MEIs are one of the important source of human genetic variation and they constitute about 25 % of the human structural variants, b) there is plenty of evidence that MEIs lead to human diseases, such as retinitis pigmentosa, hemophilia A and B, neurofibromatosis, cystic fibrosis, cancers, and many others, c) MEIs are interesting from the evolutionary point of view because, as hypothesized two decades ago, it may be a source of genome shuffling. With the recommendation of my advisor, Prof. Makalowski, I just started working on a research project for my PhD on the population-scale NGS data analysis to detect and decipher the population dynamics of MEIs in the human genome and their roles in driving human diseases. Briefly, there are three different transposable element (TE) families that are presently active in the humans: Ll, Alus and SVAs. While the Ll element is autonomous, the latter two depend on Ll molecular machinery to move around the genome. Consequently, all three elements share similar transposition signatures. Recent development of sequencing technologies resulted in thousands of human genomes available for analysis. Although sequenced at different coverage level and usually limited to short reads, the available data enable MEI studies at the population level. Therefore, I will investigate thousands of publicly available genomes of both healthy and disease phenotypes. Thanks to my supervisor's involvement in several large-scale genomic projects I will also have access to yet-unreleased data. The ultimate goals of the project is to understand population dynamics of MEIs, with a special focus on DNA transduction and their evolutionary consequences for human diseases, especially cancer. Finally, I would like to express my sincere gratitude to Prof. Makalowski for giving me the opportunity to join his team as a PhD student.



Definitions

Structural variation: refers to large scale structural differences in the genomic DNA that are inherited and polymorphic in a species. They are a result of chromosomal rearrangement – deletion, duplication, novel sequence insertion or inversion.

Transduction: is a mechanism by which L1s alter the genome. In other words, human L1 elements can produce DNA transduction events in which unique DNA segments downstream of L1 elements are mobilized as part of aberrant retro-transposition events.

In focus: The Retrogenomics Group

Principal Investigator: PD Dr. Juergen Schmitz
Institute: Institute of Experimental Pathology(ZMBE)
Postdocs: Dr. Gennady Churakov, Dr. Liliya Doronina
MGSE or Evopad students : Fengjun Zhang(EvoPAD)
Research field/questions: RNomics, Phylogenomics, and Functional Genomics
Research methodology: Systematic and comparative use of genomic and high-throughput experimental data to extract genomic signals of diversity that correlate molecular changes with their evolutionary impacts in animals

INTERVIEW WITH MGSE PI: PROF. DR. JÜRGEN SCHMITZ,
by Shrey Gandhi

Starting with microbiology and zoology, Dr. Schmitz evolved into a molecular genomicist and evolutionary biologist. Working with social insects, his pioneering work was to bring molecular aspects to zoology. As he moved the field, the field moved with him. Fascinated by the signals of history that genome holds, Dr. Schmitz is working on multiple genome projects focusing in particular on small RNA and transposons.

Q. How and when did you decide that you wanted to pursue this career path?
A. It was really early, when I was studying classical zoology and microbiology, a professor from Frankfurt working with molecular stuff in bees visited us at my institute. I was really excited to see his work and immediately asked him that I wanted to work on that topic. He agreed and that is how I started with my diploma and also my PhD later with him.

Q. Some interesting events in your journey?
A. During my PhD, I was not funded and I had no money, so I started looking for how to sustain myself. Also, at the same time I needed material of social wasps for my work. I came to know that the fire brigade very often asked our institute about how to handle insects as they get a lot of calls for taking away wasp nests. So, then I used to teach this, and they said, "Oh that's exciting, but can you not do our job?". And I said okay. I very quickly figured out that people were very afraid of wasp nests. The brigade took 50 euros for every visit and this was how I supported myself for at least a year. Also, it was mostly at nights when the wasps were not so active which made it possible for me to work in the lab in the morning. So, we used to go on these expeditions in the night to take both the samples and the money.

Photo: Christoph Steinweg, LWL Münster. Provided by Dr. Schmitz

Q. What is the coolest thing about your research?
A. I am fascinated to see the traces of the past in the genome and it is fascinating to see how they evolved over time.

Q. What is your life's philosophy?
A. I love what I am doing right now, and I feel that you can only invest a lot of time and energy into something when you really like it. It is really important to love what you do. I want to make the students as fascinated by the topic as I myself am. Also, I want to make science as accessible and simple to understand as possible for common people.

Q. What do you like to do when you aren't working?
A: I really do not have a lot of time for hobbies and am mostly working from early mornings to late night. But, I am very fascinated by nature and I like to go for walk for relaxation and here in Münster, where you can see a lot of nice natural environments.

Q. Who would you have been, if you were not a scientist?
A. I did not want to be a biologist in the beginning and it was only by chance. I wanted to be involved in something that involves protecting animals. Probably, I might have pursued that.

Q. What comes next?
A. We have to adapt to the situation and it is difficult to say. From the scientific aspects, it is perfect and I can spend the next 100 years with the projects that we have. But sometimes it gets difficult from a political standpoint and the situation in science right now is very difficult. We are also deeply involved with a lot of genome projects and every project brings out completely new aspects to explore.

Revival of extinct species: science or fiction?

Liliya Doronina
Institute of Experimental Pathology, ZMBE, University of Münster

The idea to live among animals long extinct is very attractive and has been imaginatively described in many books, including "The Lost World" of Sir Arthur Conan Doyle. However, as we cannot move back in time, why not move extinct species to our modern era, as imagined in "Jurassic Park"?

While the development of new methods has made working with the ancient DNA and genomes of more and more extinct species possible, ecological and ethical questions concerning resurrection or de-extinction of extinct species have arisen. However, the first question to consider is: is it principally possible to resurrect a species based on its DNA?

Initially, all hopes for species de-extinction were placed in cloning techniques, the aim of which is to produce genetically identical individuals. For some organisms like bacteria and plants cloning is the natural process of reproduction. In contrast, complex multicellular organisms like vertebrates, which are the usual prime targets for de-extinction, cannot be so easily cloned. In classical cloning via somatic cell nuclear transfer (SCNT), the nucleus from a somatic cell is transferred to an unfertilized oocyte whose original nucleus was removed. Ideally, such an oocyte gives rise to an embryo that is then implanted in a surrogate mother. As a successful example, Sooam Biotech in South Korea provides a service for cloning dogs for owners who want to compensate the loss of their loved pets by their genetically exact copies. Cloning extinct species presents a number of factors complicating this procedure. The SCNT method is effective if the somatic nuclear source comes from a living animal and is immediately frozen to avoid DNA degradation. Such material is not available from most extinct species. Even the mammoth material found in frozen soil does not contain completely preserved cells. Furthermore, the interaction between donated nuclear DNA from the extinct species and the oocyte cell environment is crucial for proper embryonic development. This means, only very closely related species can be used as oocyte donors. It is to note that not many extinct species are lucky enough to have such living close cousins. Thus, the SCNT technique might help when frozen material is available, encouraging the cryo-preservation of endangered species tissues and the creation of frozen zoos, but it is not promising for resurrecting already extinct species.

However, there is an alternative way that avoids some of the pitfalls of SCNT – genome editing. Using specific DNA regions of extinct species as a template we can modify the genome of the closest living relative using CRISPR genetic engineering. In this case we do not actually resurrect an individual genetically identical to the extinct one, but rather create an animal that has the key features of the extinct species. George Church and his team at Harvard University are now working to generate such a "mammophant" hybrid, an Asian elephant with the small ears, subcutaneous fat, long shaggy hair, and cold-adapted blood of the mammoth. The team has already made some progress editing the Asian elephant genome but has not yet crossed the boundary of creating "mammophant" embryos. In a next step scientists have to grow the created embryos. An additional difficulty is that, in contrast to lab mice, experiments on endangered elephants are from aspects of biodiversity conservation restricted. Implanting embryos to living female elephants may threaten the elephant reproductive system. To avoid this, the scientists plan to raise the embryos in artificial wombs that make the procedure even more complex. Thus, it is unlikely that we will see a mammoth-like elephant in the near future.

Another candidate for de-extinction that attracts public and scientific attention is the Tasmanian tiger. This largest marsupial predator of modern times inhabited Australia and New Guinea, but 2000 years ago was reduced to the area of Tasmania where the last individuals were killed by humans in the early 20th century. For a long time, de-extinction of the Tasmanian tiger was only a dream because, despite its recent extinction, no good non-degraded DNA was available. A year ago an amazingly good, ethanol-preserved, 109-year-old pouch young specimen from Museums Victoria, Australia was found to contain high quality genomic DNA. This enabled a consortium led by Andrew Pask from Melbourne University to sequence the complete nuclear genome of the Tasmanian tiger and provided new hope for its resurrection. However, even though the Tasmanian tiger went extinct much more recently than the mammoth, its de-extinction presents an even more complicated task. The Tasmanian tiger's ancestors evolved away from other marsupials around 30 million years ago. Their closest living relatives today are Tasmanian devils and numbats, whose morphological and behavioral characteristics are, nevertheless, both significantly different from those of the Tasmanian tiger. Furthermore, we still do not know which genes should

Tasmanian tiger painting by Jon Baldur Hlidberg

be modified or specifically regulated so that the Tasmanian devil becomes twice as tall with stripes on its back or so that the numbat forgets about termites and starts hunting small kangaroos instead. Thus, we are still far from creating viable representatives of extinct species.

Even if some extinct animals are resurrected in the future, there is still a huge gap between a single de-extinct individual and viable populations with their indispensable genetic diversity and required ecological conditions that might also be "co-extinct". Thus, species that went extinct millions or even just thousands of years ago will most probably remain extinct forever. But developing "de-extinction" technologies may in future be useful for conservation purposes focusing on species that went extinct just yesterday or are in the process of becoming extinct today.

Mental health among PhD students

NS Gati, Institute for Hygiene, Münster University Hospital

Undertaking a PhD in any part of the world is exciting and frightening in equal measure. Not only would you be considered as an expert in your chosen field, the prestige and honor that can come with it is enormous. However, for many the path to a PhD is often very lonely. Many PhD students suffer from mental health problems, ranging from acute to chronic anxiety and clinical depression. Several studies have demonstrated that PhD students are at a higher risk of mental health disorders than the general (highly educated) population (1) and other higher education students(3). These disorders vary from mild to very serious conditions - as shown by an Emory university study - that 7.3% of PhD students reported suicidal thoughts and 2.3% indicated having plans to commit suicide. Furthermore, a recent study demonstrated that one in two PhD student experiences psychological distress and one in three is at risk of a common psychiatric disorder either over a short or long term (3). "Feelings of being under constant strain, unhappiness and depression, sleeping problems due to worries, inability to overcome difficulties and not being able to enjoy day-to-day activities" are the leading cause of mental health problems according to Levecque et al3. Also isolated work pressure, loneliness and lack of supervision can also lead to mental health problems.

Are you experiencing any of these as a PhD student? Don't worry because you are not alone. Most PhD student will experience at least one of the above leading causes of mental health problems. One of the most important things, to avoid the progression into serious mental health issues, is the effective management of anxiety, depression etc.. The question that arises now is how do we as PhD students manage stress, depression, etc.? First, get enough sleep, exercise, eat a balanced diet and sometimes allow yourself to take a day off/work from home if necessary. Further, it might help to talk to other PhD students, friends and immediate family members. You should also talk to your supervisor or consult a Physician or mental health therapist to get professional help if necessary. The Graduate center of WWU also organizes seminars for PhD students on how to manage stress. It is advisable to participate in these events. Further participation in Yoga, which is offered as a sport at WWU, can also help. Try to maintain a positive attitude by appreciating the progress you've made so far and rewarding yourself for achieving goals that you set for yourself.

In conclusion, as a word of advice to all PhD students and those intending to pursue a doctoral degree, it is important to accept that you cannot control everything by putting your stress in perspective. Accept the process to achieving perfection. Instead of aiming for perfection, which is not possible, be proud of however close you get. Even though the path to acquiring a PhD can be very stressful, relax and enjoy all that life has to offer while aiming to achieving your research goals.

1. Evans, T. M., Bira, L., Gastelum, J. M., Weiss L. T., Vanderford N. L. Evidence for a mental health crisis in graduate education 2018. Nature Biotechnology 36, 282–284.
2. Garcia-Williams, A. G., Moffitt, L., Kaslow, N. J. . Mental health and suicidal behavior among graduate students. Academic Psychiatry, 2014, 38(5), 554–560.
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And while you're here... You are not alone, nor the first, if you would feel overwhelmed. The Graduate centre periodically arranges diverse events for all PhD students attending the University of Münster. We have listed here some workshops regarding stress and time management. Details of this Graduate centre at WWU can be found on the website https://www.uni-muenster.de/GraduateCentre/en/Programm/index.html.

- 12.06.2018: Support institutions for PhDs at WWU
- 14.06.2018: Living in Münster - intercultural crash course for internationals
- 11./12.07.2018: Fight stress in 5, 15 and 30 Minutes: stress management techniques (2-dayworkshop)
- 26.07.2018: The adventurous life of the PhD - planning your time-efficient journey through your PhD (1st year PhDs)

EvoPAD launches EES forum

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Our current understanding of biological evolution is a distillate of almost two centuries of knowledge. Visionary naturalists and uncanny scholars from very diverse disciplines contributed to the development of a unified evolutionary theory that is probably the most successful multidisciplinary achievement in biology. The flagship of biological thought. The theory explains a great deal of how organisms and genomes have evolved, and continue to evolve. Yet, if we look at the history of its development it was far from a smooth ride. Scholars have been fighting for decades over what constitutes the central causes of evolution, the main sources of variation, whether acquired traits can be inherited and how macroevolutionary changes can come about, just to mention few contentious points.

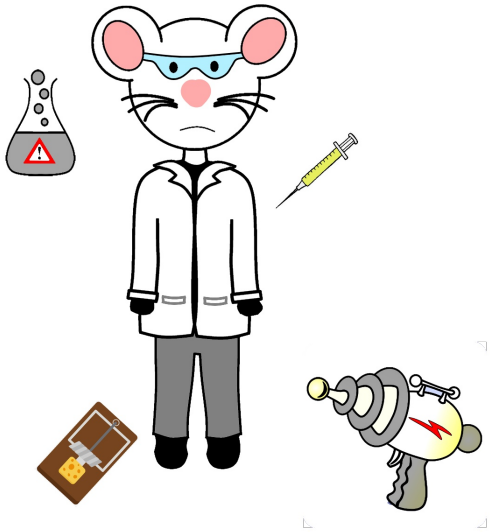
However, these fierce debates took place in the 60's and 80's and since the successful completion of the human genome project and the recent advances in all branches of biology researchers have now found widespread agreement and old debates have been settled for good, right? Actually no. The fight is on. And judging from the heated tones in respected peer-reviewed journals the debate between proponents of the so called Extended Evolutionary Synthesis (EES) and old school neo-Darwinists, guardians of the Modern Synthesis (MS), is not going to tone down any time soon.

At the heart of the disagreement lies the question of what represents the most important mechanism of adaptive evolution. The classical and universally accepted model of adaptive evolution is that natural selection acts upon the heritable variability generated by non-directed changes in the genetic material. Advantageous genotypes can then spread through the population. Genes are in charge. While proponents of the EES do not seem to question the importance of natural selection and heritable genetic variation in adaptive evolution, they do argue that mechanisms usually considered as oddities or at least marginal players in the evolution process, such as developmental plasticity and epigenetic inheritance to name a few, should steal the spotlight and be considered central to the process. Take developmental plasticity. Environmentally induced phenotypic changes can be genetically accommodated via natural selection of standing genetic variation. The causal arrow is reversed. The environment leads the game.

However, re-visiting a theory so central to the modern evolutionary thought is a tricky endeavor and faces many challenges. First and foremost a lot of experimental research is needed before alternative mechanism of adaptive evolution can enter the hall of fame side by side with the mutation-selection model. Secondly, a new conceptual framework is perhaps needed to synthesize the new findings under a new light. Whether the emergence of new theories that emphasize the importance of the environment and development in the evolution process will succeed in drastically remolding the current version of the evolutionary theory remains to be seen. For one thing, the EES-MS debate has spurred lots of new original research and several hypotheses are under thorough scrutiny. For another, some feel that well-established and experimentally validated principles of population genetics are being downplayed.

Amidst the aftermath of the EES-MS skirmish, within the structured PhD program offered by the Research Training Group in Evolutionary Processes in Adaptation and Disease (EvoPAD), Ana Sofia Lindeza and Professor Joachim Kurtz from the Animal Evolutionary Ecology group at the IEB launched the EES forum, with the participation of Jan Baedke, assistant Professor of Philosophy at the University of Bochum. The forum is intended to take advantage of and move past the EES-MS debate. PhD students from the Münster Graduate School of Evolution (MGSE) and the RTG in EvoPAD have joined forces under the guidance of Ana and Jan to frame the current knowledge gap and identify conceptual shortcomings of our current understanding of evolution. The forum has been very successful so far, with great participation from students enthusiastically engaged in constructive debates, and a working agenda has been put forth. The output of the EES forum is anticipated to be a joint multidisciplinary publication on theoretical evolutionary biology. Stay tuned!

Disclaimer: the thoughts and opinions expressed in this essay are solely those of the author and by no means reflect the views of the members of EvoPAD or the leaders of the EES forum.



Double-blind

By Nadja Haarmann

Based on the Interview with Prof. Dr. D. Bettenworth, Department for Medicine B, Gastroenterology and Hepatology

Clinical trials commonly use a placebo-controlled design to evaluate safety and efficacy of new drugs, vaccines or even novel surgical approaches. These trials contain three placebo-controlled phases: The first phase consists of 20-80 healthy individuals who are taking the newly invented drug in a very controlled setting. Here, safety is the major factor. Side effects and a secure dosage range can be analyzed. The second phase is divided into two parts. The first part aims to prove the mode of action of the drug in affected patients. The goal of the second part is to find the suitable dosage. Several hundred patients are usually involved in this part of a study program. The next stage, phase III studies, in which several 1000 persons are tested, is the last hurdle before the medicine's approval and launch. Phase IV studies (post-market) aim to exclude rare side effects and evaluate long-term treatment efficacy in, a so called, real-world population.

What are the most prominent features of a good clinical trial? Clinicians like Prof. Dr. Bettenworth and researchers will answer the following: To provide objective unbiased and valid results, an early study should be placebo controlled. Furthermore, it should be conducted in a double-blind fashion which means that neither study investigators (doctors) nor patient know whether they are being treated with the study drug (verum) or with placebo. Studies in the field of inflammatory bowel disease often include endoscopical evaluation of treatment response which is performed by a "central reader" who is also blinded regarding the treatment arm (verum vs. placebo).

Prof. Dr. Bettenworth is principal investigator in several phase II and phase III studies evaluating drug candidates for the treatment of Crohn's disease and ulcerative colitis. These chronic remittent diseases may affect all segments of the gastrointestinal tract and may crucially impact the patients' quality of life due to key syndromes such as abdominal pain, diarrhea and weight loss. One key treatment goal in ulcerative colitis is to achieve complete healing of the inflamed mucosa also referred to as mucosal healing. Successful induction of mucosal healing is associated with a positive course of disease characterized longer remission phases and reduced need for surgery. To achieve this goal medication is needed. Up to now, there are several treatment options. Not every medication works in every patient. Therefore, there is an urgent need for novel treatment approaches such as small molecules. Inventing and developing new treatment is an expensive and time-consuming task. Especially clinical trials are not cheap. Furthermore, it may be challenging to identify appropriate patients for the respective study. Several aspects have to be taken into account: Well defined inclusion and exclusion criteria have to be evaluated for every study to check if a patient is suitable. Patients are not allowed to sign the mandatory informed consent form on the same day of their consultation in the outpatient clinic. In addition, patients have to agree that they may be randomized to one or more placebo arms. But why do they still want to be the "guinea pig" of clinicans and the pharma industry? Well, the first reason is obvious: There is a chance to get the newest treatment which might have a huge impact on their disease and quality of live. Secondly, they are part of something important, affecting many other people as well.

During clinical trial, there might be even a different kind of placebo effect: the clinician as treatment. Participants of a clinical study are very well informed by the clinician (informed consent) but they are also very closely monitored. The time with "their" doctor, the attention and the caring can have a huge, beneficial psychological impact as well. Even if they "only" get the placebo treatment there is a chance that their health improves due to the caring of the doctors and nurses but maybe also because of their believe in the drug which might trigger somehow some kind of self-healing.

In the USA clinical trials are not only performed for new drugs but also for surgical approaches. These kind of treatment is called sham surgery. Since surgery in general is associated with higher risks for life and well-being the moral and ethics are highly discussed. One of the most famous articles concerning sham surgery is about osteoarthritis (1). J. Bruce Moseley reports that patients who underwent sham (=placebo) surgery showed the same improvements as the ones being treated by the regular surgical intervention (1). These results suggest that the surgery itself is more or less ineffective but the placebo effect e.g. the attention, the care, seems to improve the health of the patients. The ethical conflict here is grander than in clinical trials for new drugs because it is not double-blind anymore. Furthermore, in the declaration of Helsinki is written:"The health of my patient will be my first consideration" (2). Keeping this quotation in mind, sham surgery might be seen as unethical for a clinician but not necessarily for a scientist (3).

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2 World Medical Association. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. JAMA 2000;284:3043–5
3 F. G. Miller and Ted J. Kaptchuk, Sham procedures and the ethics of clinical trials, J R Soc Med 2004;97:576–578

The odds of De novo

by Dennis Gadalla
Master student at the IEB, working on de novo gene emergence

For todays' present variety of life to form, specific regulatory mechanisms and metabolism pathways had to emerge. This happened following continuous alterations to the DNA, and is more or less mediated by evolutionary processes. Proteins are of mandatory importance for such alterations, as they are the final performers of a vast majority of different cellular tasks. A proteins' function can often be estimated when investigating its architecture. In fact, most proteins can be divided into functional regions, domains, which show associations to specific functions, e.g. substrate binding and catalysis, compartment anchoring etc. The evolution of protein interactions, which is decisively determined by the combination of subordinate domains, strongly impacts an organisms phenotype and is one key for organism variety.

For long time, Susumu Ohnos' theory of gene duplication/gene divergence was believed to be the predominant source of novel genetic material. The appearence of protein coding sequence from previous non-coding sequence is called "de novo" gene emergence, and has long since thought to be most likely impossible. The reason for that is that for efficient gene expressions, too many factors have to be stably present. And such fine tuned parts of a clockwork can hardly form by chance - or can they?

Despite the increasing amount of fully sequenced genomes available to date, more and more cases of protein-coding genes without detectable homology to any other genome segment are being detected. They could either be artifacts of homology detection, e.g. caused by rapid sequence divergence - or they could have emerged following mechanisms other than duplication/divergence, e.g. de novo.

For one moment, consider the amount of raw DNA molecules that exists on our planet, and the information it can store. Earth is crowded with life. Ranging from simple bacteria with mere hundreds of genes to complex organisms with genomes spanning over 100 billion bp, life can be found in both the most casual, and the most extreme habitats. E.g., take a human skin cell, which contains on average 3 Gigabasepairs of DNA. Storing this flat data would require a standard 700 Mb. If you take a mere 10 000 skin cells and would store each and every DNA basepair as single letter, you would already require a whole total of 7 1Tb hard disks (which would cost you roughly €300 when bought on amazon!). It is needless to say that your body contains billions, if not trillions of cells, each having an impressive amount of raw DNA - and there is over 7.5 billion of us already! Now add in all those other organisms: fish, insects, bacteria etc, the raw DNA material that gets continously altered is immense.

Of course, DNA is well protected against (non-beneficial) alterations. Not only cellular mechanisms, but also environmental selective constraints shift it towards

A complex system.

optimized states of high fitness. Yet, not all genome regions underlay the latter. Several intronic or intergenic regions accumulate mutations without directly causing lethal harm to its host. Combining this with the gigantic amount of raw DNA present on our planet (and the occasional trend of some individuals wanting to fry it in tanning salons), it seems naive to state that nothing beneficial can ever appear somewhere and at some point, out of the blue. And if you still think that a complete de novo gene formation would be too unlikely, think of sequence incorporations into already existing genes. Here, the basic rails of stable expression are already set. Any random intergenic or intronic sequence incorporated into this framework now "only" has to not kill its host - and it may get slowly elongated, altered, fixed and gain domain-like structures, finally spreading through the genome.

Living and dying of bacteria

by Nadja Haarmann

When babies are developing within their mother, it is warm, dark and cozy. For me on the other hand, I am frozen at -80 °C, and it is dark, cold and scary (glycerol stocks). I will tell you what it is like.

Occasionally, we are transferred from the dark to the light. This process is loud. A round plastic thing (inoculation loop) comes down to us. It is huge and it is white. It is definitely better than the cold though. We are landing on a cozy, yellow mattress (agar plate). It is so soft and there is food, not frozen but fresh and nutritious. Thereafter I am again transferred to a dark place (incubator) but this time it is really warm. I am a bit exhausted but there is food, warmth and all my friends are with me. Now, it is time to grow.

The next morning I am many. We are picked by this white circle and put into liquid (liquid overnight pre-culture). Again, it is warm and it is moving like the ocean (37 °C and 180 rpm are standard). I am growing and multiplying (exponential growth phase). In the beginning it is really funny. Then the beer (glucose) is empty. Damn it. Why the hell is the beer empty? Well then, cocktails (alternative carbon sources e.g. fructose, lactose...) are also fine if you are enjoying the ocean. We are having the party of our lives. A few hours later the cocktails are also finished and we are so many that it is really crowded. Some of me have already drowned (stationary growth phase). This is not really funny anymore. I feel like I am dying.

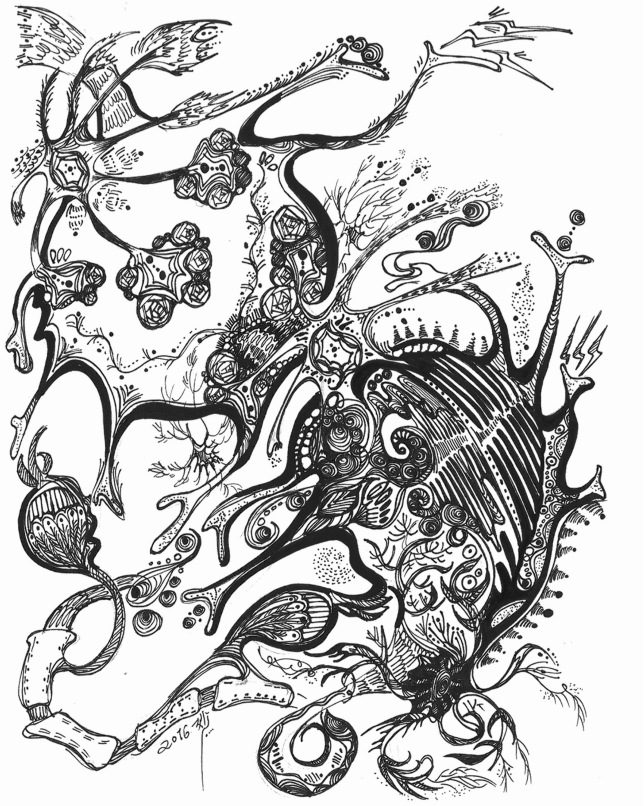
But I survived. On the next morning we are coming into an even bigger ocean (main culture). At first, it's funny, but then? After 3-6 hours we are put on ice (shock cooling to 4 °C). How uncomfortable! I will freeze to death. We are put into a "break dance" machine like on a funfair (centrifuge). Somehow everything is funny in the beginning but then it is very nasty. We are all pressed together and we are all sick. The only good thing is that we are not freezing when we are this close together. We are washed several times, always with cold liquid - and the worst is yet to come. At the end of the procedure I am ripped into 40 µl aliquots and thrown into liquid nitrogen. Liquid Nitrogen! You know how cold this is? -80 °C is warm in comparison! Now they call me an electro competent cell.

I am put on ice that is much warmer than -80°C. Can't get worse, can it? I am put in a vessel with metal at its side. What are they doing with me now? A tiny amount of liquid (plasmid) is added to my new prison cell. I really do not feel like having another night in the ocean, not even if there is beer (glucose). The liquid and me, we are put into another machine but it does not look the "break dance". It is a bit sca-grrrr...1500 V are ripping through me (Transformation: the plasmid is "shot" into the electro competent bacteria). It is only a few seconds but I really had enough of near-death experiences! I am weak, just between the line of living and dying. Oh, warmth, light... am I in heaven at last? But it is another ocean. It is lovely! I feel relaxed and comfortable for the first time in so many hours. The only thing troubling me is that there is something new (plasmid) in me. Is there a way to get rid of it? Maybe I should try. The minute I decide to do that I am put on an agar plate. I still carry the plasmid. It costs some efforts but I start to replicate it. Good for me! The yellow soft bed is filled with poison (antibiotics). I am not that easy to kill! On the plasmid is a gene saving me from this threat (antibiotic resistance cassette, to separate the successfully genetically modified organisms GMO). I am growing. A new day and I am a new colony. I am picked, put in the small ocean and on the next day into the big ocean. It is like a déja-vu.

Suddenly, my ocean is falling to the ground! Splatter, splash... I am everywhere on the floor. Soon, clouds are falling from the sky (tissues, to inhibit aerosol formation) and then rain (disinfection often based on ethanol). Alcohol for me! A lot of it...more than enough...enough! ...stop it! I am drowning in alcohol. Dead.

The E...

Part of me is landed on the shoe - my taxi to liberty. I am a GMO! I am a super bacterium. Outside I fall of and touch the ground of this wonderful world. Two bullies (*Bacillus anthracis*) are coming close, maybe I should go?! Too late, I am dead - again!



Battle for survival

Frozen: let it go?

by Maryna Samus

...my spirits sleeping somewhere cold
until you find it there,
and lead it, back, home.
Evanescence, Bring Me [back] to Life

Throughout history, humanity has longed for ways to increase our lifespan, or even live forever. Whereas some turn to God in their search for eternal life, others pin their hopes on science and technology. No wonder: the development of the latter never ceases to amaze us, bringing to life things that only a few decades ago were considered to be the realm of science fiction.

One such sci-fi idea, that today finds itself a reality, is cryonics. This technique is based on freezing human bodies at extremely low temperatures, in order to re-awaken them in the future, when it is hoped that the advanced technology will be able to cure them from whatever caused their death.
Although it sounds like an invention of recent years, the concept of cryonics is not new. Started in 1964 with the release of the book "The Prospect of Immortality" written by college physics teacher Robert Ettinger, it inspired the opening of four currently operating cryonics facilities (three in the USA and one in Russia). As the founding father of cryonics, Ettinger himself was the 106th person to be frozen and is currently stored in liquid nitrogen at a chilling 196 °C below zero.

If you already got excited about trying cryonics out yourself, here is how the procedure looks in practice. First of all, one has to be legally declared dead. The body is then placed into a portable bath filled with crushed ice and water, where it is connected to numerous equipment in order to keep the heart beating and to support respiration. At the same time, a number of medications are administered to prevent body decomposition. Next, the body is connected to a perfusion system, where over around three hours the blood is substituted with a cryoprotectant. The body is subsequently placed for five and a half days into a cooling chamber containing circulating nitrogen gas and finally into the liquid nitrogen container for a long-term storage. If you were expecting blood-curdling scenes, involving terrifying figures floating in giant transparent containers, you might be disappointed: all bodies are put into sleeping bags and stored in large metal tanks. They are always placed head-down, to make sure the brain is the last to defrost in case of emergency. Speaking of heads...if you find yourself on a budget, or just don't want to preserve an old or damaged body, it is also possible to freeze just the head. Supporters of cryonics believe that one day the wonders of regenerative medicine and nanotechnology will restore their physical appearance or, alternatively, that their neuronal networks will be uploaded to the cloud and they will be eventually brought back to life in digital form.

Even though today's cryonics is still far from mainstream, its popularity is steadily increasing. By now more than 300 people have already been placed in liquid nitrogen with thousands more signed up, hoping to be resurrected far in the future. One just has to fill out some paper work and remember to prepare their wallet, because a ticket to eternal life comes at a price. For example, American Alcor with its luxury conditions will charge you $200,000 for the whole body or $80,000 for neuropreservation, whereas budget Russian KrioRus offers its services for $36,000 for the whole body or $18,000 for the head.

One crucial question remains outstanding: is it even possible to survive a deep freeze? If we look to nature for answers – yes. Among invertebrates, the absolute champion in survival skills is the tardigrade or water bear. Being only one millimetre long, these creatures are able to withstand the harshest conditions on Earth, including freezing in liquid nitrogen. The keys to such superpowers are the nonreducing sugar trehalose, intrinsically disordered proteins and increased production of antioxidants. Some vertebrates, such as the wood frog (*Rana sylvatica*) and Arctic fishes, are also highly freeze-tolerant, due to the production of a large amount of glucose or the expression of certain proteins, which act as an anti-freeze.

However, even though nature provides many examples of "freeze-thawing" within the animal kingdom, when it comes to humans, things seem far from promising. While the freezing procedure itself has been performed many times, refreezing... not so much. Working flawlessly in science fiction, where the main characters awake far in the future bound for a distant planet, re-awakening of real people is currently not possible and it is not only for lack of the necessary disease cures.

Perhaps a more important question is; "is there anyone in those tanks to be awakened at all?" Formation of ice-crystals, which rupture cell membranes and tissues, coupled with the toxicity of cryoprotectants, causes substantial damage to the frozen body. Moreover, the brain, which cryonicists aim to preserve, is the organ most vulnerable to the cryopreservation procedure. Not only it is the hardest organ to be perfused due to the existence of the blood-brain barrier, but its complex and delicate network of neuronal connections is easily lost during freezing. That's why cryonics facilities are constantly being criticized for selling empty hopes to terminally-ill patients and for operating within pseudoscience. At the same time, supporters of "deep-freezing" claim that even the tiniest hope is worth investing in. Therefore, while scientists, sceptics and society continue to debate cryonics, people are rushing to sign themselves up and pay substantial sums of money to secure their cosy, cool place in a liquid nitrogen tank.

The first myth

April S. Kleppe

The moment when our ancestors first learnt to speak to one another in full sentences creating a storyline, what do you think the first story was? I would imagine that if it were on the savannah, leaving the lush forest behind, the first story would be about a diurnal cycle. The cycle that is just about to start in the moment of pitch darkness, just before dawn – and how dawn turns into a full bright day, followed by night again. I believe, if it be me, that I would like to tell about the day itself. Unlike in the forest, the air and light would be different. The main characters of the story would therefore be light and shadows, stars and darkness, the air's humidity, its dryness, upon a fairly unprotected skin.

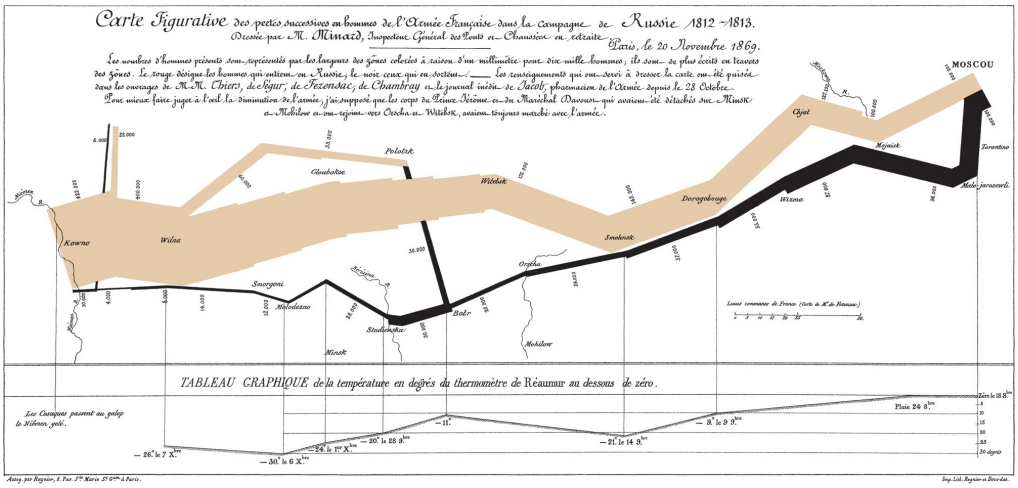
One of the very first known European poets – Sappho (1) – described the waves by the coastline as wine red. Long has it been discussed if this is not a current insertion – a linguistic loan – as the colour blue had not yet its own name at the time. Purple, lime, navy blue, scarlet red, and yellow – how do you describe a colour but in relation to other colours? It is a reference game, and you need to know the other characters. Pictures have the power to entail what the eye would see for which the tongue would need a thousand words.

I ended up in a discussion about VanGogh, where I claimed he is the most famous Dutch person ever to have lived. People may not know his name, but his paintings are easily visually embraced and adored. It is not the shape of sunflowers that he caught on the canvas. Rather, the sunflowers are the canvas whereupon the colours have been caught. Yet the colours can barely be contained or stay within the lines of the stalk and petals, and as such they bend. The colours bend as if imitating light waves. I believe humans have a childlike fondness of colours. Studies have found that we are better at sorting colours than shades of gray and we seem to have evolved a strong ability to identify a target based on colour (2). I would presume the ease of information processing also explains our appreciation of visual esthetics. However, why and what is esthetically pleasing is an entire different (and subjective) story. My point, however, is that it shall befall us natural to unite esthetics and information.

One argument to support the latter point is the trend of maps. Today's trends include e.g. making a map of your favourite town in a suggested layout for print and shipping, or - there are these books displaying old and odd maps (3). The old maps carry something special, as they are a blend of known information and known nonsense. For where the eyes did not reach into the oceanic abyss, the pen reached into the mind of the imagination. As such, the walls displaying old maps of Europe and the Atlantic contained both sea monsters and mermaids. However, the better the scientific method, the less was left to imagination in describing the world. In the old days of Carl von Linné - the Linnean disciples were either trained in drawing or were accompanied by artists on their expedition. It was a different thing to press a flower in Columbia and multiple months later attempt to dissect the plant in a laboratory in Uppsala, Sweden. The dry plant could crack and break, petals get lost, and colours and scent - later on found to be traits under co-evolution with pollinating species - were at constant risk to fade. In other words, vital information was at risk of being lost. To visually describe what the eye sees, was equally important as the written notes.

The unification of solid information, presented in a clear and esthethic form, to be visually devoured is seemingly not only a current - interiour, literature, museum, and communication – trend, but a necessity for science. The shaping of disciplines known as visual information design, data visualization and information architecture underlines this point. The latter, information architecture, is commonly used to describe the field of fancy pants who create and design webpages. If you recall back to 2014, the initial release of the Obama healthcare plan was a failure due to bad webpage platforms. The rugged welcome amongst the healthcare plan's supporters informs us to not shrug off the importance of good web design (4). In other words - visual communication matters. It is therefore perhaps not strange that your supervisor occasionally sends a ranting email about the importance of good and solid plots to display your data. Maybe the hunt of the perfect plot shall best be addressed as the first bold attempt of making your research esthetically pleasing to the reader. It is not unimaginable that the cave paintings by Cro-Magnon (5) and the Neanderthals (6) were visual story-telling. They were and are, not only informative, but transcending time and species lineages - beautiful enough to lure tourists and evoke interest outside the field of cave-palaeontology.

In other words – make your science pretty. All data suggest it pays off.



Charles Minard's 1869 chart, one of the first historical examples of effective data display. It displays the number of soldairs in Napoleon's army attacking Russia in1812, their movements, as well as the temperature they encountered on the return path. Image courtsey of Wikimedia Commons.

Reference list are available in the online publication.

Beakology – the next scientific revolution

by Anon Ymous

Beakology–the next scientific revolution

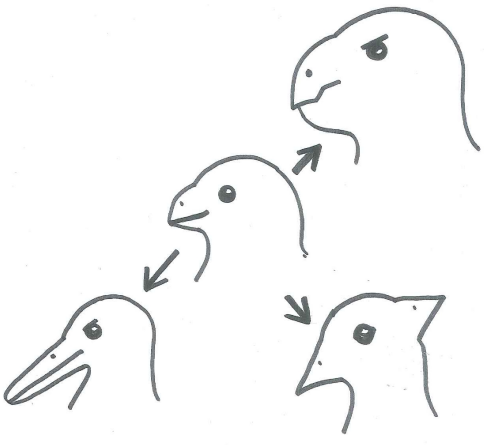
The diversity of beak shapes of Galapogos finches is a frequent example of evolution in undergraduate textbooks around the world. However, many scientists feel that the role of beaks in modern evolutionary biology is under appreciated.

Professor Bill Smith, founder of the academic journals Beakology and Beakology Letters, is one of the pioneers in the field of beakology. "My early work certainly ruffled some feathers", notes Smith. "Science has a definite pecking order so it can be difficult for a fledgling researcher with a radical idea to get his or her voice heard."

In the 1980s Smith proposed the beakosystem to study the interactions between beaks and their environment. "I felt that I had put the cat among the pigeons. It was a very hostile reaction initially but now I am used to it. It's water off a duck's back to me now".

Another Scientist working on beakology is Dr Robin Jones, a former PhD student of Smith. "I had a rather conventional grounding in evolutionary thought. Mutation, changes in allele frequencies, speciation through isolation of interbreeding populations–that kind of thing. But the more I thought about it the more I felt tired of parroting textbook dogma. I looked around and thought what about beaks? They are everywhere, pervasive in nature yet look at a Hardy Weinberg equation and show me the beaks? Scientists have been neglecting beaks for decades. Bill took me under his wing during my PhD and showed me how important beaks are to understand evolutionary processes".

Both Smith and Jones stress that they do not want to discard modern evolutionary theory entirely but extend and augment it. "Beaks are an important evolutionary process" says Jones, "up there with natural selection. I just want to see beaks get the attention they deserve".



Science progresses swiftly notes Smith. "When I started my PhD I was using classical beakology methods. But with the new technologies we can do incredible things. I can see researchers from other fields flocking to beakology. The next big thing is the beakome. The rate of change really is astounding".

A review of the absence of a book review

Dr. Moss

I know a man who reads a book. I keep encountering him reading the same book for several months now. I ask the man if he likes his book and he keeps informing me, he surely does. But he seems to not cover many pages despite the time dedicated. "You see, I bought this book over a year ago and somehow I fail to truly keep at it. It is not bad and I do like it, but somehow I keep falling out of it. And it is always a struggle to get back into the book." The first time I answered him by "O, it is one of those books". He looked at me puzzled. "It is one of those books which you can feel obliged to read, either because someone you trust recommended it to you or because of an initial first conviction that it somehow will sweep you away, after the "tough parts". Thing is, it never does. So you never succeed to finish it." He insists this is not the case, that the book is brilliant, and that he will succeed finishing it as it is a jolly good book. We have had this conversation multiple times, but the man being one quarter teddy bear and partially consisting of fluff, seems to be defensive of the book and protective of its acclaimed quality. I am sure the author is a very clever individual and potentially the book is enriching and nice. "But also" I add, "some books demand a certain mental state in order to be accessible to the mood of the story that is being told. One can not jump from enjoying Mozart to enjoying Michael Jackson. There is such a thing as timely transition, my dear Mr Fluff". The man looks at me with a smirk.
The book in question is called "The Gene - an intimate history" and has been on the NY Times bestseller list of 2006. I would love to know if it is truly worthwhile as the topic seems interesting enough. Another good friend of mine suggested that the reason some books become bestsellers, despite its tardiness, is because "maybe, all individuals took forever to read it so the backcover were visible to all on the NY metro - and the lengthy paperback exposure worked as commercial, slowly recruiting more readers working on their subconsciousness or active interest." Perhaps so. Mr Fluff has not yet finished the book but started another on a famous naturalist. Maybe for the next Eyebrow issue there will be a book review of that one.

Interview with Barbara Hasert

by Nikki Demandt

I had the pleasure to interview a very highly appreciated and loved biological-technical assistant of the Institute for Evolution and Biodiversity (IEB) who recently retired (April 2018), Barbara Hasert. Barbara, originally graduated as a veterinarian medical technician, and started working at the IEB in 1992. At that point, the lab was completely different and was focused on embryology, histology and electronic transmission. The first molecular lab was only opened in 2000. Over the last 26 years, Barbara worked with many model systems; from sea grass to axolotl, from rain worms to beetles. Her favourite organism is the Nematode *Caenorhabditis elegans* as it was so easy to work with. As Barbara herself said: "You could just freeze it whenever you didn't need it and defrost it when it was necessary again".
Barbara is a highly valued member of the lab and even known by the scientist in the institute who do not work in the lab, e.g. some of the bio-informatics. She has a lot of knowledge on the functioning of a lab and was always present for all scientists and students in the lab.

Q: For scientists technicians are essential, without them the lab would not even run. However, I have a very vague idea of what a technician actually does. What is, actually, the job of a biological-technical assistant?
A: A technician's job consists of many different aspects. Firstly, we organise the lab and ensure that we are present when a scientist or students has a problem that they cannot solve themselves. We ensure that all students and scientists have the equipment they need for their experiments and we also teach new students/scientists how they should work in the lab, e.g. we teach them the routines of the lab.
Sometimes we are involved with the execution of a research project from a PhD student or another scientist. In such a case, we could be testing new methods, testing new kits or run some qPCR's for the scientists. When there are experimental animals present within the lab we also often take care of these.
Another major task for the technicians is ordering stuff and having contact with companies to order stuff. In the past, this was much easier as we just had to call the companies to order something. However, these days it is more complicated as we need to use the SAP system. This also means that we have to check *everything*.

Q: What was the biggest challenge for you as a biological-technical assistant in the last few years?
A: The biggest challenge for me was also the most interesting thing of working in this lab, namely the big changes over the last few years. These changes made my work more exciting and prevented the formation of a routine. Over the years there have been a lot of changes; e.g. from changes in the model systems used (e.g. sea grass, axolotl, beetles) to learning new methods.

Q: As you have been working in a lab for such a big period of your life, and you most likely know more about the organisation of a lab then most people, what advice would you give on structuring a lab?
A: One of the most important things in a lab is assigning responsibilities to one or more scientists. It has to be clear who is responsible. This is especially important for the students, so that they know whom to ask. It should also be clear who takes care of some things being done and that the scientists in the lab actually take some responsibilities. Further, it could be useful to have a moderator for the lab meetings, so that the discussions are more efficient. This moderator should be someone who is often in the lab.

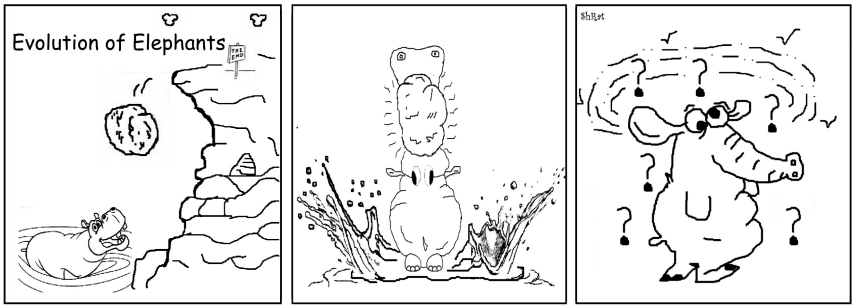
Respected and trusted. Barbara Hasert (right of picture) with PhD student Ana Korsa.

Q: Imagine some young scientist joining a new lab. He/she is unfamiliar with this process. Can you give some useful tip(s)?
A: I would advise every new scientist within a lab to first look. Look at what the scientists in your new lab are doing, which methods they are using and ask a lot of questions. Even if you are used to a different method, your new lab might have a good reason for adopting their method. So do not directly criticize a method, talk to the scientists in the lab and communicate with your new colleagues, but do not hesitate to point it out when something is going wrong in a lab either. People make mistakes and feedback is one of the most important things in all situations.

Q: Two final big questions. What will be the first thing you will be doing after retiring and what will you miss the most?
A: The first thing I will be doing is preparing the barbecue for the institute and after that have a nice holiday. Further, I do not have any real big plans. I would like to try some new stuff, meet with friends, spend some time with my garden and the bees. But mainly I will just see what is coming up.
From the lab I will miss the people and the contact with them the most.

SCRAbbLe

Murphy's Law 1: Anything that can go wrong will go wrong



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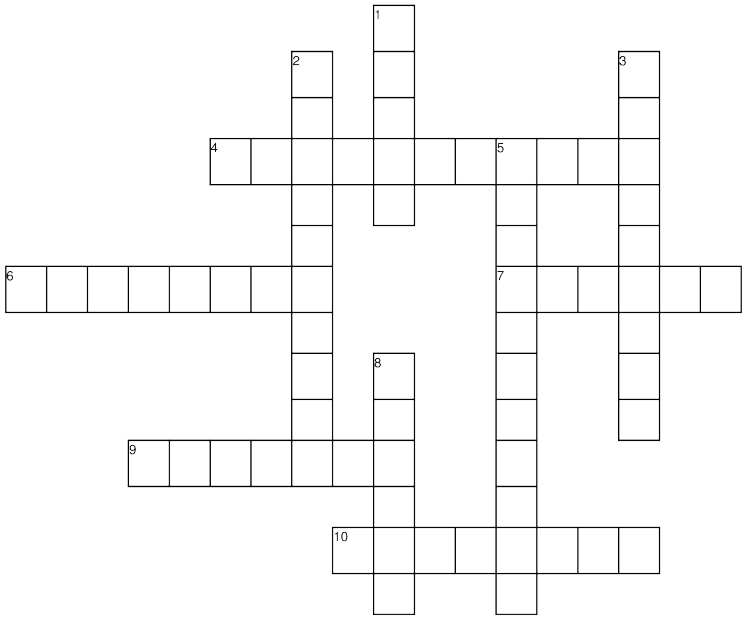
M C B O O W Y V I L O X L N G X T
G R E B N I E W Y D R A H O R O G
E X U G G U H Y V S F N Y V X O X
Z T U D E U K A R Y O T E A Y T G
G D R N M U T J U B B E G N A P X
N B S A J F E V I T P A D A N O N
J C W Z I O G O I E P S B P O A V
S C T W F T Q M L V L S U X X I W
T Q Y G O L O T N O E L A P I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

The answer is a nine letter word. You can find it by rearranging the first letters of the words hidden in the wordsearch above.

Crossword



Across

4. Jumping genes
6. Small non-coding RNA class
7. Ship which Darwin sailed on
9. Gotta catch em all(Popular animation series based on
10. Age of Fishes

Down

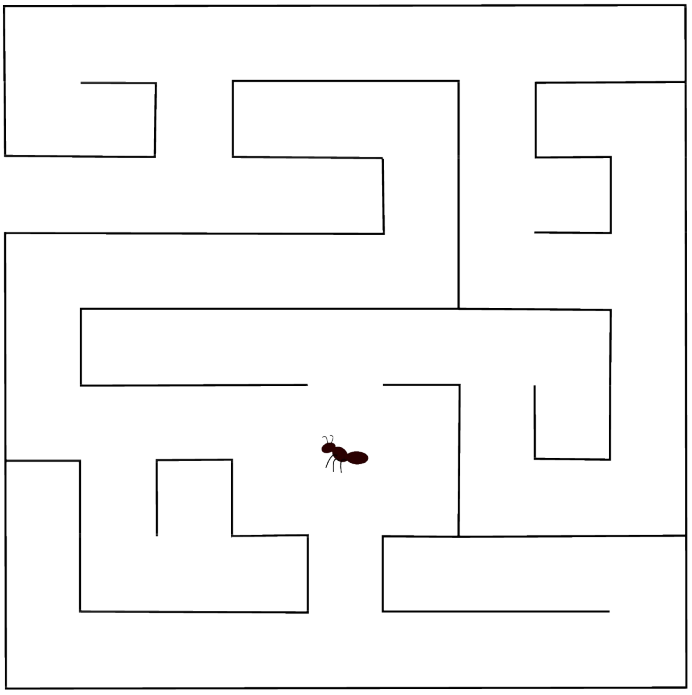
1. Explosive search algorithm
2. Slow and steady change
3. Functionless structures
5. _____ selection favours average individuals in a population
8. Pea loving monk

Signs that you are turning into a freaky laboratory scientist

- You call your daughter Lysine and your son Aspartate
- You leave your house via Exocytosis
- You start your PCR at prime time
- You apply posttranslational modifications to your son's Latin homework
- You sign your name in italics
- You name your phone 'answering machine coupled receptor"
- Problem solving solutions exists for you between 0.5M and 2.5M
- You check your protein shakes using Bradford assay
- You bring along biofilms to video nights
- You are counting time in generation times of your favourite bacterium
- You try to book your next flight with pJET
- If you watch a crime movie, you think the motif of the murderer is bHLH or Leucine zipper
- In the club you only dance on the Alexa Flour
- Your favourite musical composition is Ludwig van Beethoven's 'Für ELISA"

The amazing do it yourself "Sharpie Ant Maze"

Will your chosen ant be able to brave the countless dangers of the sharpie maze? Send your champion to the depths of the maze and watch it defy the intricate paths or get lost forever…(or rather until you take it out!).



All you need:
1x smellie
sharpie
1x ant
a stopwatch

INSTRUCTIONS:
(1.) Go outside. Bring your sharpie and the magazine!
(2.) Find some ants. Observe them closely to pick your "chosen one"
(3.) Use your sharpie to trace the lines of the maze
(4.) Put you chosen ant into the center of the maze
(5.) Measure the time how long the ant needs to solve the maze!
(You can submit records online!)

Background: Most ants are repelled by the smell of sharpies / markers, so they will avoid crossing lines drawn with them (Trible *et al.*, 2017).
Disclaimer: We do not condone mean treatment of ants! Be careful when handling them and avoid hurting them! When they are done or stuck release them back to the wild! :)