BioS Reports

glimpse into the activities of the Master's course „Biology in Society"

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EXCURSIONS AND OTHER NEWS

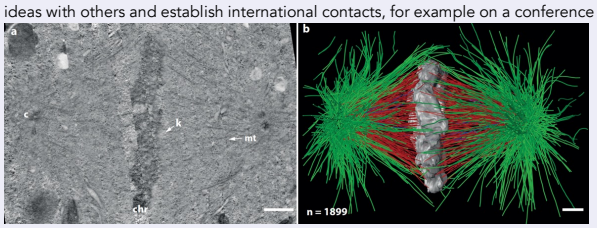
Small insights in student's or professor's points of view, field trips, and other stuff we do.

Exploring cell division- insights into a student's job

by Maria Köckert

I work a student job as research assistant at the Müller-Reichert lab at the Universitätsklinikum of TU Dresden, which performs basic research on cell division. A deeper understanding of cell division helps to draw conclusions on how defective cell division and diseases, like cancer, can occur. Basic research is the foundation of all scientific activities in which an attempt is made to "track down" the fundamental processes in nature. Basic research does not directly lead to the development of therapies in medicine but stimulates further efforts to combat many human diseases and contributes to an in-depth understanding of fundamental processes .

I have been working there for the past three years and I am in the lab around 10 hours each week. Since I can schedule my hours flexibly, I can conveniently coordinate my work to fit my university schedule. I assist, in evaluating the data obtained from doing research on cells of the roundworm *C.elegans*. As a research assistant one has the opportunity to take first steps into research, contribute to publications, and get in touch with other scientists. I was able to expand my knowledge and interests in cell division, exchange ideas with others and establish international contacts, for example on a conference



Electron microscopic image of a *C.elegans* embryonic cell in the moment of cell division (l), serving as the basis for 3D reconstruction of the process involved (r). Scale bar 500nm.

FACT CHECK

In this section students evaluate the scientific evidence behind a certain urban myth.

CRISPR/Cas9 technology: "Crazy", "unethical", "dangerous" or great therapeutical advance?

by Klaudia Ostatek, Kajol Bajaj, Julia Hempel, Natalia Wulff

In 2012, Jennifer Doudna and Emmanuelle Charpentier discovered the gene editing tool CRISPR/Cas9 based on a defense mechanism of bacteria to protect themselves against viruses[1]. This immense scientific breakthrough also created new possibilities for human gene therapy.

Gene therapy can be used to edit human genes and intends to correct existing genetic defects. There is a consensus that CRISPR/Cas9-based therapy can be applied in the case of fatal diseases that occur during life and are not heritable[2]. At present there is scientific progress in the application of CRISPR/Cas9 in preclinical and clinical research. Various treatments for genetic and infectious diseases considered incurable are in the pipeline. There are clinical trials and first treatment attempts using CRISPR/Cas9 technology for haematological diseases[3] and lung cancer[4]. Additionally, research in animal or cell culture models, CRISPR/Cas9 helps to better comprehend fundamental mechanisms underlying HIV-infections or cancer. In 2020, researchers used CRISPR/Cas9 in rhesus monkeys to disable SIV-DNA, which is considered to be the origin of HIV. This could be a progress towards new HIV therapy[5]. Another example for promising CRISPR/Cas9-based therapy is that Human-Papilloma-Virus-induced cervical cancer was prevented from growing in mice[4].

In theory CRISPR/Cas9 can be also used to treat heritable diseases and prevent kids from diseased parents from inheriting the disease and becoming sick themselves. This technique is called human germline gene-editing (HGGE) since it changes the reproductive cells. Even though HGGE comes with many medical chances, permanently changing the DNA of an unborn child, introduced a new broad spectrum of medical, ethical, and societal concerns. It remains controversial and illegal. The debate on HGGE gained further momentum in 2018, when Chinese biophysicist He Jiankui announced the first gene-edited babies[6]. He claimed to have introduced a mutation into the embryo´s genomes using CRISPR/Cas9, to make them HIV-resistant . He Jiankui received a three-year jail sentence[7]. The core fears and concerns around HGGE involve unpredictable health risks and societal hazards. Even though CRISPR/Cas9 is a very precise gene editing tool, non-targeted parts of the DNA can be mistakenly cut, bearing unpredictable outcomes. Side effects of HGGE concerning both the treated and subsequent generations are neither predictable nor satisfy the medical principles "first do no harm" and informed consent. For these reasons, HGGE currently remains limited to laboratory experiments, apart from the He Jiankui affair.

While great effort is put into overcoming potential impediments, such as undesirable off-targets[8], many early successes are emerging and contributing towards better health.

ANIMALS AND MONEY

This part of BioSReports unravels interesting relations between animals and the economy.

The economic value of a keystone predator: sea otters in North America

by Leonard Kurzweg

North America's kelp forests are habitat to many economically important species, sequester atmospheric carbon dioxide, nourish huge ocean areas and are hotspots for many species that attract tourists[1]. However, kelp forests are declining rapidly[2]. One of the most commonly mentioned reasons is kelp overgrazing by sea urchins[2,3,4]. In 2014, California's coastal bull kelp canopy was reduced by over 90% compared to the previous year, resulting in a replacement with unproductive sea urchin barrens[1]. One might see sea urchin overgrazing as a non-human damage, but it is not. Sea urchin populations started to rapidly increase after the near extinction of sea otters due to the maritime fur trade of the 18th and 19th centuries[5]. Sea otters are keystone predators that protect kelp forests by limiting populations of their main prey (sea urchins)[2]. One suggestion, therefore, is to re-establish sea otter populations to protect kelp forests[2,3]. Here I aim to elucidate the economic value of the sea otter (*Enhydra lutris*) dissenting from this ecological impact as a keystone predator.

Throughout the sea otters' North American range, kelp forests with sea otters stored 4.4 mio -8.7 mio tons more carbon than kelp forests without them[4]. Assuming prices of 47 US dollars (US$) per ton of Carbon (retrieved 2012) on the European Carbon Exchange (ECE) market, the total value of sea otter induced carbon fixation would be an estimated US$205 million- $408 million[4]. The authors also estimated a net primary productivity that was 243–875 g C m^{-2} yr^{-1} higher in sea-otter kelp forests compared to non-sea-otter ones. They considered that a fraction of this carbon is sedimented in the deep ocean where it can be stored for many centuries[4]. If only 1% of this carbon were to be stored annually, this amounted to an ECE value (retrieved 2012) of US$6 million- $21 million[4]. The economic value of otter-induced declines in invertebrates amounted to a 7.3 million Canadian dollars (CA$)/year (5.670.873,14 US$/year) worth of losses to invertebrate fisheries[5]. Simultaneously, sea otters lead to a 37% higher ecosystem biomass, which increased the value of finfish fishery by 9.4 million CA$/year[5] (7.301.553,28 US$/year). Finally, the potential growth in tourism revenue was estimated to be 41.5 million CA$/year (32.241.102,97 US$/year) for ecosystems with sea otters[5]. Overall, this study considered the economic increase of finfish fishery and tourism minus the loss to invertebrate fishery and thereby predicted a 43.6 million CA$ (33.87 million US$) higher economic value of ecosystems with, compared to ecosystems without sea otters[5].

The impact of kelp forests on climate change is hard to predict, and therefore the indirect economic impact by sea otters on climate change is too. However, stabilizing sea otters along shorelines are likely to improve kelp forests. This may have additional significant knock-on effects not mentioned so far, such as larger kelp forests reducing wave energy[2] and thereby protecting shorelines from erosion or the increase of herring populations that spawn on kelp[2]. It appears that the sea otter can bring significant benefits and resettlement projects are recommended.

EXCURSIONS AND OTHER NEWS

Service post for new BioS students – links and drinks

by Helen Rothfuß, Nele Kheim

As new BioS Master students will be starting their studies this October, we are providing a short overview of upcoming events, important dates and places to get more information. Although the courses and lectures start on 10th of October, the Biology Student Council (FSR) will be organizing introductory events for new master students in the week of 4th of October. On the 4th of October BioS welcome session will take place at 3pm in Andreas-Schubert-Building in hall 28. An official celebration of TU Dresden to start the semester will be on the 6th of October, you will find more details here. New BioS students can meet current BioS students at these events, who offer to become mentors and help with any university related issue new students might have in the future.

What courses, lectures and exams to sign up for and when to sign up will be announced closer to the beginning of the semester by the coordinating office. Finally, there are vast options for language courses and sport programs to select from. The beginning of the courses as well as the date to sign up will be announced once the semester has started. The TU Dresden website will offer a more detailed view of all mentioned events in case you are interested.

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