Newsletter September

Dear reader,

We are already very close to the wiki freeze! We and other teams across the globe are hurrying along to finish our projects and prepare our presentations for the Giant Jamboree. However, we couldn't do so without keeping you guys in the loop! Want to find out more about yeast, or how DNA works? Then enjoy September's newsletter

Content

Crowdfunding

Maybe you have already noticed on our social media channels that we have started our crowdfunding! Do you want to make a difference to solve worldwide problems such as: climate change, plastic pollution, and the nitrogen crisis? Then please support our project and help us to make a difference! You can contribute and learn more about our project via this link: www.steunleiden.nl/dopllock

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Naturalis

This month we gave a microbiology workshop at the Naturalis Biodiversity Center. Visitors could participate and perform scientific experiments themselves. We showcased numerous microbes we cultivated in the lab on agar plates as well as our own genetically modified *E. coli* bacteria, which produce a jellyfish protein that makes them glow green. The audience was intrigued by seeing that microbes are all around us. We cultivated microbes living in the water, in the ground and even in the air. Visitors could grow microbes living on their skin at home in petri dishes we provided and see how washing hands kills microbes. Lastly, visitors isolated DNA from their own saliva! All their important questions about synthetic biology, genetically modifyied organisms and microbiology were discussed with our team members. It was a very fun and educational event on which we received good feedback!
Did you unfortunately miss this iGEM event? Do you want to do some microbiology experiments yourself or ask our iGEM team members your questions? Well then you're in luck! The 17th of October, we will give another workshop. This time at Rijksmuseum Boerhaave: https://rijksmuseumboerhaave.nl/te-zien-te-doen/doe-het-zelf-microbiologie/

Technasium KAJ Munk

iGEM includes more than just making a science project. A big part of what is expected of iGEM teams is to engage with the general public, in particular people who may not know much about synthetic biology to bring awareness to the field. To this end, we went to teach at a highschool and did some experiments with the students. We hope we inspired some of them to pursue an interest in biology. In any case, we were enthralled by the enthusiasm of some of the students and had plenty of fun organising these lessons. Check it out below!

One of the experiments we did was a Gram-staining. A Gram-staining is a technique in which you can identify whether bacteria are Gram-positive or Gram-negative (see the June newsletter, subsegment Microbe of the Month, to catch up on what that means!). You can stain the cells with different pigments, and depending on the structure of their outer cell wall, they will be colored differently. This was a lot of fun!

The other experiment we did was a Winogradsky column. These columns are a means of seperating bacteria by their trophic level: what do they eat and which conditions they need to live. The idea is that you fill a column (in our case a plastic bottle) with mud, mixed with egg yolk and shredded paper to provide nutrients for the cells. Then, you add water so all the mud is covered, but there is still a little air left and you leave it in the sun for several weeks. When you do this, the bacteria in the column will seperate based on what conditions they prefer: all the way on the top, there is oxygen in the air. This oxygen can be used by photosynthesising bacteria, but is hurtful to other bacteria. Below these, you will get bacteria that can deal with a little oxygen, but not too much. Then, non-sulphur-using photosynthetic bacteria and the list goes on. See below for what these types of columns can end up looking like! We hope they will be finished before the wiki freeze so we can put some pictures on our wiki!
Want an easy explanation how to do this? Go to https://tinyurl.com/6t4p2rs
Send us your own pictures if you make it!

source: https://joyfulmicrobe.com/winogradsky-column/ credit to Donato Giovanelli

GMO Discussion Evening

Marie-Louise Bilgin introducing herself on our discussion evening

Besides education, we also did something else to engage with the public. This month, we organised a discussion evening to hear from people that aren't involved in the project what their opinion is on the use of GMOs. We invited people from all kinds of different backgrounds, including non-scientists. We wanted to listen to what fears the general public has to find out if we are overlooking things in the design of our system. We also wanted to know if people would be comfortable with the release of GMOs in semi-contained settings. Besides our guests, we also invited an expert panel of scientists and policy advisors to give their unbiased advice and information to the public.
We want to thank everyone who came to the evening for participating! It was great to see how engaged everyone was with the discussion and were able to have a nice and nuanced discussion on the ethics and practicalities surrounding the release of GMOs into the environment.

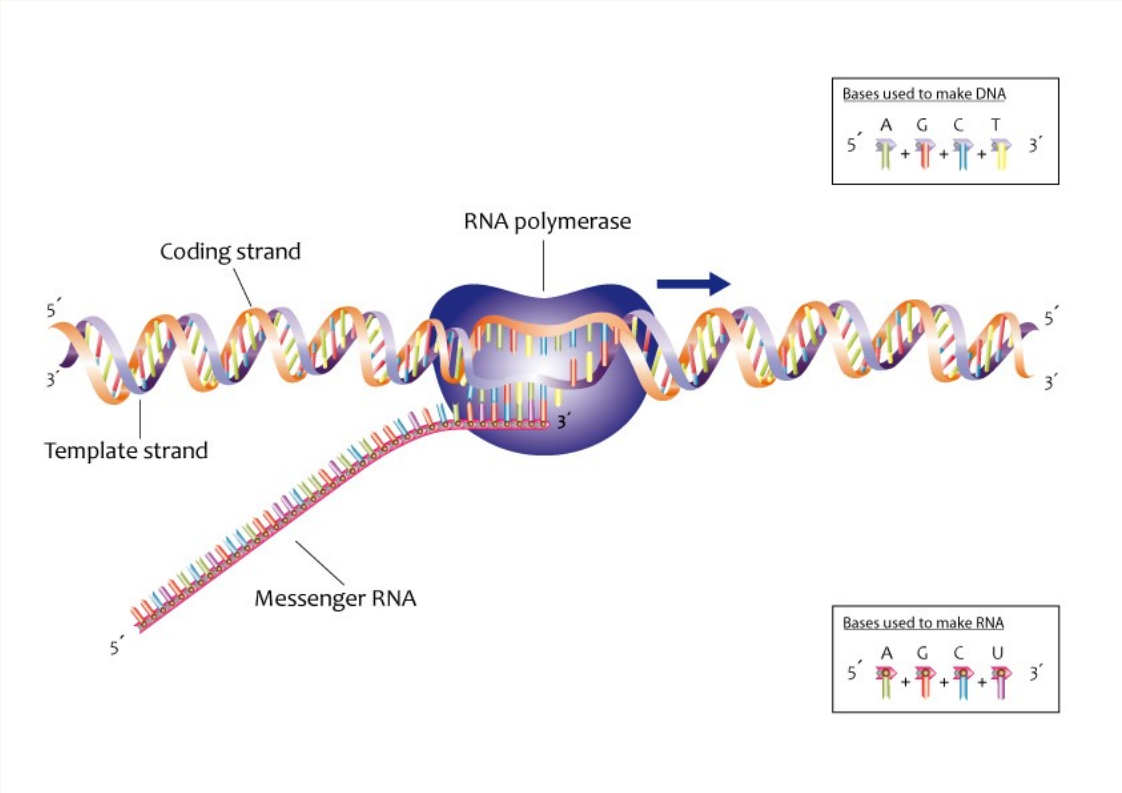
Wiki Freeze incomming!

We are getting incredibly close to the Wiki Freeze! At the moment we are working very

hard to finish all of our wiki pages in order to upload them in time. To this end, we are working very hard to write all the pages and do all the programming in time.
The wiki freeze will be in the early hours of October 22nd. By then, we will hopefully have finished building our website. We can't wait to see the results of our hard work!

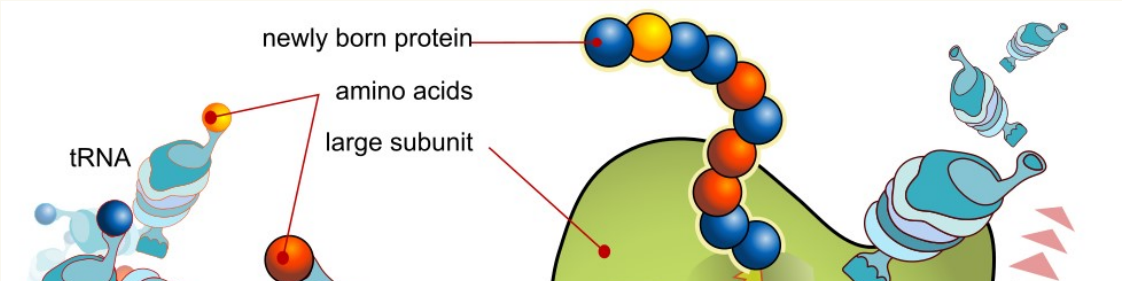
Transcription and translation

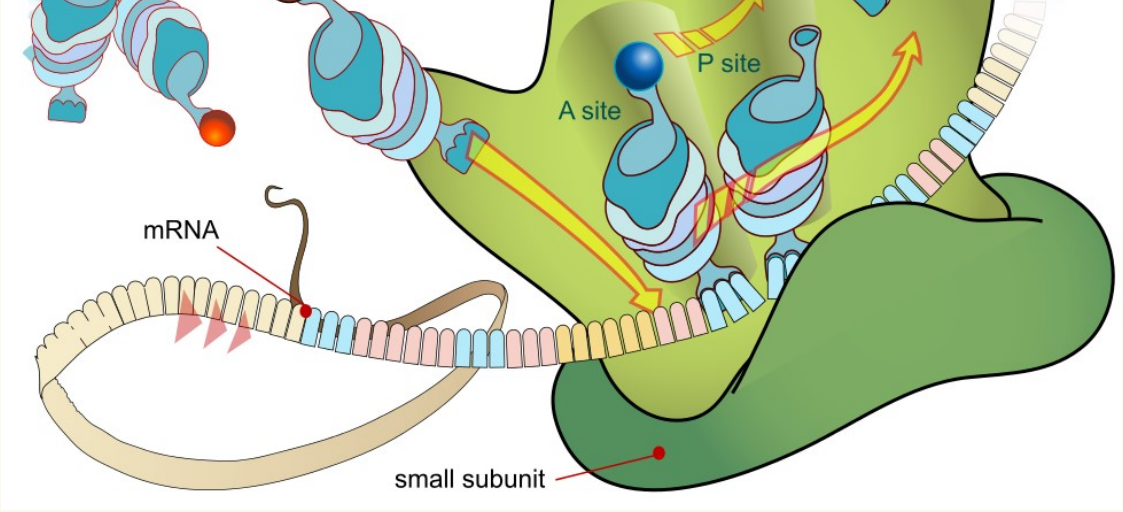
DNA is a molecule in the cell that encodes instructions for the cell how to behave. Transcription is the process by which cells turn their DNA into RNA. Translation in turn, is how cells turn RNA into proteins. Proteins are like small little machines that can perform certain functions for the cell, in the form of facilitating a specific chemical reaction.



source: NHS HEE Genomics Education Programme: www.genomicseducation.hee.nhs.uk

In the picture above, you can see a DNA strand that is currently being transcribed. The enzyme RNA polymerase will 'walk' along the DNA strand from the 5' (5 prime) direction into the 3' direction. As it does so, it will make a copy of the DNA, except it does so in RNA, which has slightly different chemical properties from DNA. In prokaryotes, like bacteria, the RNA, called a messenger RNA (mRNA) in this context, is then immediately ready to head to the ribosome, where it is turned into protein. In eukaryotes, like animals, plants and fungi, the mRNA is first modified before it exits the nucleus and heads to the ribosome.

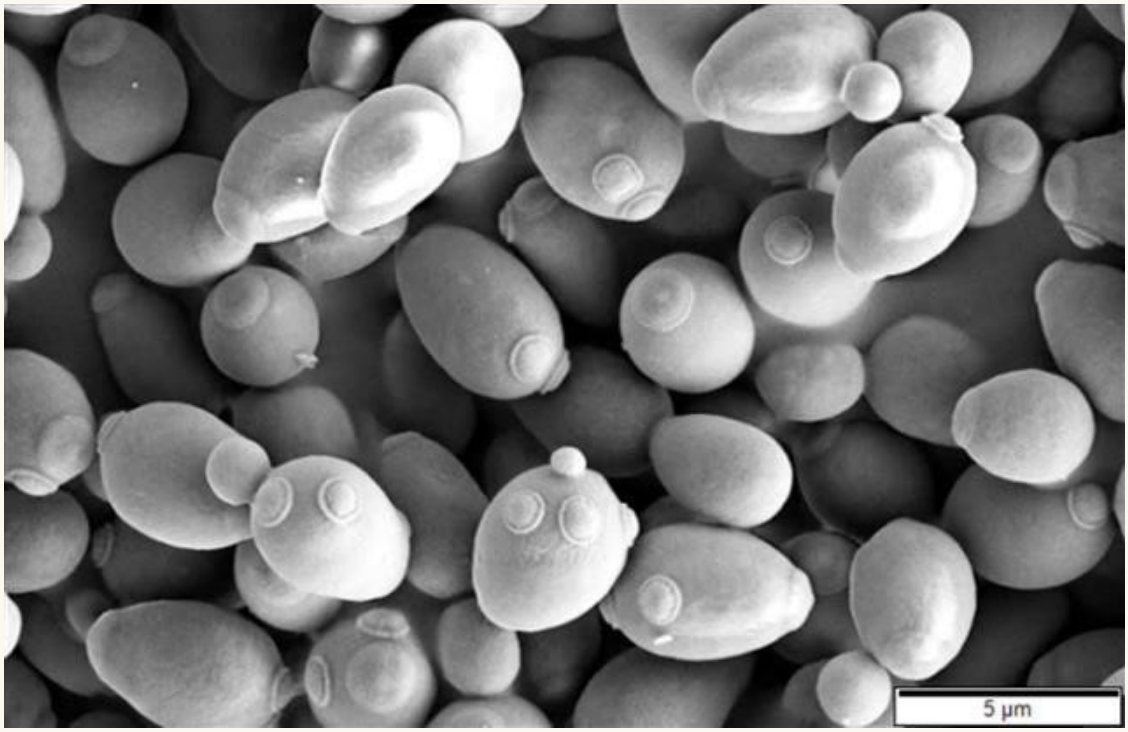




Source: 'LadyofHats', https://commons.wikimedia.org/wiki/User:LadyofHats

After transcription, the mRNA molecule heads to the ribosome. The ribosome is an organelle (an organ of a cell) that 'translates' the instructions encoded by the mRNA into a peptide. Peptides are series of aminoacids that are glued together. These then are twisted and turned into a specific shape to form proteins. The way this happens is that the RNA is divided into subunits of 3 basepairs (the 'letters' of DNA/RNA, ACGT and ACGU respectively). The combination of which different basepairs make up the codon determine which aminoacid will be incorporated into the peptide. This is how mutations in the DNA can change the proteins that are made by cells; if a letter changes into another letter, this will result in the change of a single aminoacid that is different. If however, some letters are deleted or added, this can mean that the entirety of the protein that follows this mutation has different aminoacids (except if a multiple of 3 basepairs are deleted or added; this will simply remove some aminoacids from the peptide)

Microbe of the Month: September

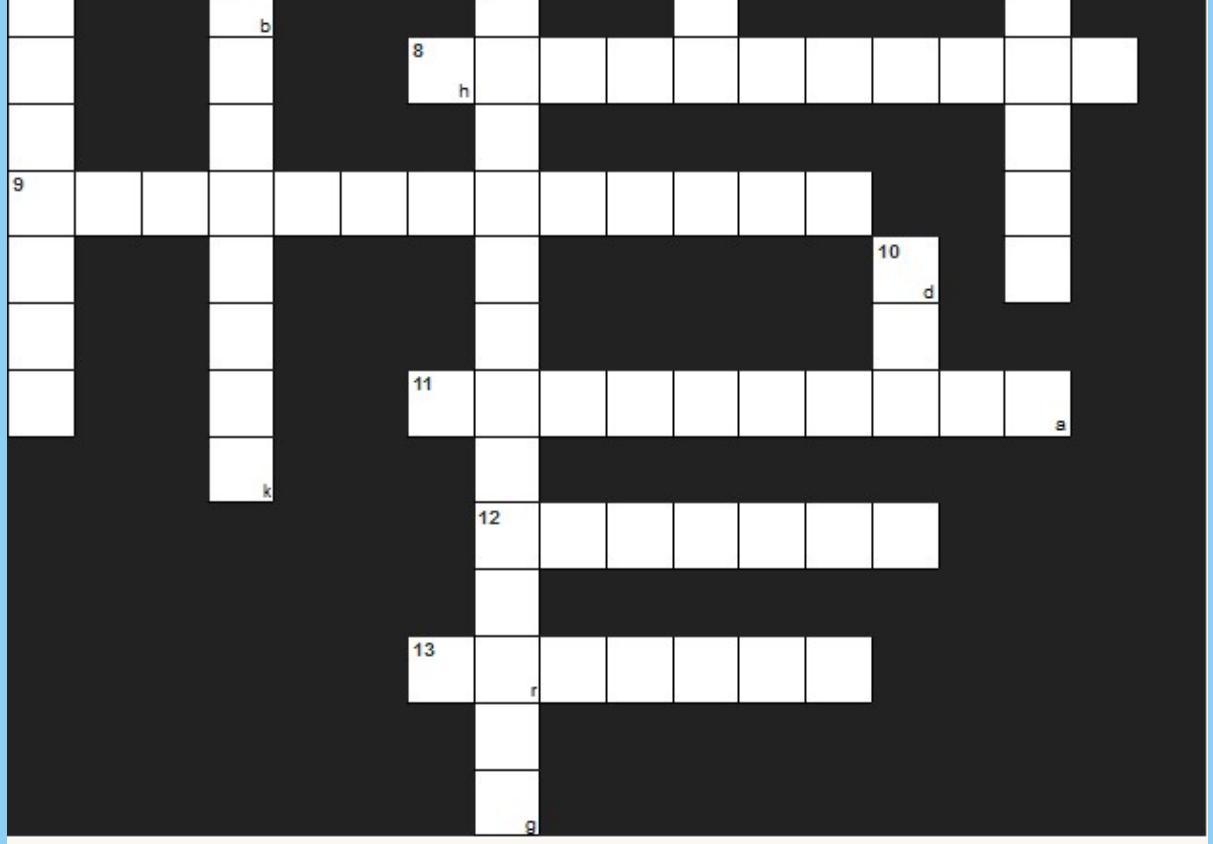


Baker's yeast through a scanning electron microscope, 'budding' - Das Murtey M, Ramasamy P. ISample Preparations for Scanning Electron Microscopy - Life Sciences. In: Janecek M, Kral R, editors. Modern Electron Microscopy in Physical and Life Sciences. Rijeka: IntechOpen; 2016. DOI: 10.5772/61720

The microbe of this month is possibly the microbe mankind is most familiar with: baker's yeast, or *Saccharomyces cerevisiae*.This is one of the microbes that is involved in the making of pretty much all breads and beers.
Above, you can see a beautiful picture of yeast that is in the process of 'budding'. This budding is the way yeast cells divide: rather than splitting down the middle like most cells do, yeasts replicate asymmetrically. Cell division in yeasts is extremely interesting! They are special because they differ from the norm in many ways. Yeasts are eukaryotes, just like animals are. They have two 'sexes', more properly known as mating types: a and α. Two haploid cells (this means that they contain one copy of every gene) of a different mating type can fuse to form a diploid cell (containing two copies of every gene, like people do: one from the father and one from the mother). These diploid cells then either divide through meiosis, sexual cell division, or mitosis - non-sexual cell division. If the cells go through meiosis, they will turn into haploid spores. They tend to do this when the growth conditions become too harsh for them to survive and they need to go into survival mode. The spore will start growing again when the conditions improve (like if you would put them into a dough with some water and sugar).
The cells in the picture above are dividing mitotically. These buds will be on the cell during their entire cell cycle in optimal growth conditions. In fact, the buds on a cell can get their own smaller buds when the cells are growing very quickly. This is like a baby being pregnant before it is out of the womb! Crazy!
Yeast has been very important for biotechnology too, like the other organisms discussed before, and therefore we decided to include it in the newsletter for this month. Not only are yeasts efficient cell factories to produce proteins, they have frequently been used in research. Topics that are often researched in yeast include the secretory pathways across eukaryotes, looking for differences in cellular physiology and cell senescence: the ageing of cells. People have been studying ageing in yeast for well over 60 years and this has helped us advance our knowledge on how we could try to make animals live longer too. One important finding has been that caloric restriction, the limiting of the amount of food for cells, can increase the life span of the cells. This has been replicated in mouse models too, so it is reasonable to assume that this is a characteristic all eukaryotes share.

Our website!

Quizzes



Horizontal

1 Alteration of DNA **2** Organelle, responsible for turning RNA into proteins **3** Adjective describing cells containing one copy of each gene **8** The process of turning RNA into peptides **9** Organelle, commonly known as the powerhouse of the cell **11** Organism that has free-floating DNA in the cell instead of a nucleus containing the DNA **12** Molecule made up of a sequence of amino acids with a 3D structure **13** Asexual cell division

Vertical

1 Sexual cell division **4** Circular pieces of DNA that can be transferred between cells deoxyribonucleicacid DNA **5** The nucleotide that is encoded by the letter C in DNA **6** The process of turning DNA into RNA **7** A subunit of a coding sequence that is turned into a single amino acid in a peptide **10** Organism that has had its genes intentionally changed in a specific way

Solution

D A G K H R B S

Sponsors

Our list of sponsors is growing! We are very lucky to be able to keep adding sponsors to our project. We are extremely grateful to all of those who have supported us and would like to give them a shout-out for making DOPL LOCK possible. Thank you very much!