Prof. Merja Penttilä

Synthetic biology lecture course, spring 2023

**HOMEWORK: Presentation based on a scientific article**

**Form groups of about 4 persons (12 groups) and select one article** from the list below (that is not selected yet by somebody else). Please, read the article carefully to understand the main points of it well. Google also since short “layman” descriptions have been published on some of the articles. You may also see if any new publications exist that have referred to this article; these may bring interesting additions to the topic. Small details are not important, but the general concept is and some methods in order to understand what was achieved and how.

Provide a clear presentation; it should also contain enough explanations so that it is understandable as a stand-alone story. Use pictures and illustrations. Some articles may be demanding but discuss, find more information, and try to capture the essential. The presentation **should not exceed 17 min**. We will have 12 presentations total, 4 presentations each lecture time, with time for discussion. For **each article other persons not belonging to the presenting group are assigned to ask questions**, and you can choose the time point for your turn as well.

(All presentations will be included in the common study material.)

Please, send your presentations to merja.penttila@vtt.fi on the **previous Friday by noon**. You may be asked to alter the presentation in case there are errors.

It would be useful for everybody to familiarize themselves to the topic a bit before the lecture, not only the presenters!

Include the following to the presentation:

* Brief introduction to the topic
* Main aim, why was this done
* Methods and approaches
* What was achieved, were they successful, what did not work (if presented)
* Why and how is this important and path forward
* You can also list if there were major points you did not understand

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|  | Article | Persons in the group\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | Askers of questions\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 12.5 | Galanie, S. et al. (2015). **Complete biosynthesis of opiods in yeast.** Science 349, 1095-1100.  | Pinja Salminen, Katri Nieminen, Viivi Mäkelä, Linnea Hammarberg | Minna Myllymäki, Melissa Hendrén, Anni Lindfors, Hibiki Maruyama |
| 22.5 | Jensen,… M.C. Jewett & Michael Köpke. **Carbon-negative production of acetone and isopropanol by gas fermentation at industrial pilot scale**. Nature Biotechnology | VOL 40 | March 2022 | 335–344. <https://doi.org/10.1038/s41587-021-01195-w> | Minna Myllymäki,Eva Kaipia, Jussi Pietiläinen, Jimi Oikarinen, Martin Ahlberg | Pinja Salminen, Katri Nieminen, Viivi Mäkelä,Linnea Hammarberg |
| 32.5 | Pezhman Mohammadi et al. **Bioinspired Functionally Graded Composite Assembled Using Cellulose Nanocrystals and Genetically Engineered Proteins with Controlled Biomineralization**. Adv.Mater.2021, 33, 2102658 | Hanna Dahl, Noora Karvonen,Dinara Bozzhigitova, Oguzcan Ates | Joel Rouste, Juulia Mikkola, Klara Hamit, Elina Satova |
| 42.5 | Segall-Shapiro T.H., Sontag E.D., & Voigt C.A. (2018). [**Engineered promoters enable constant gene expression at any copy number in bacteria.**](https://www.nature.com/articles/nbt.4111) *Nature Biotechnology,* DOI: 10.1038/nbt.4111. | Melissa Hendrén, Anni Lindfors, Hibiki Maruyama, Elina Satova |  Anna Tervo, Martin Ahlberg, Ville Takio, Rita Ristimäki |
| 59.5 | [Daniel Solis-Escalante](https://www.ncbi.nlm.nih.gov/pubmed/?term=Solis-Escalante%20D%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), [Niels G. A. Kuijpers](https://www.ncbi.nlm.nih.gov/pubmed/?term=Kuijpers%20NG%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), [Nuria Barrajon-Simancas](https://www.ncbi.nlm.nih.gov/pubmed/?term=Barrajon-Simancas%20N%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), [Marcel van den Broek](https://www.ncbi.nlm.nih.gov/pubmed/?term=van%20den%20Broek%20M%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), [Jack T. Pronk](https://www.ncbi.nlm.nih.gov/pubmed/?term=Pronk%20JT%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), [Jean-Marc Daran](https://www.ncbi.nlm.nih.gov/pubmed/?term=Daran%20JM%5BAuthor%5D&cauthor=true&cauthor_uid=26071034), and [Pascale Daran-Lapujade](https://www.ncbi.nlm.nih.gov/pubmed/?term=Daran-Lapujade%20P%5BAuthor%5D&cauthor=true&cauthor_uid=26071034). **A Minimal Set of Glycolytic Genes Reveals Strong Redundancies in *Saccharomyces cerevisiae* Central Metabolism.** [Eukaryot Cell](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4519752/). 2015 Aug; 14(8): 804–816. doi:  [10.1128/EC.00064-15](https://dx.doi.org/10.1128/EC.00064-15).Kuipers et al. Pathway swapping: **Toward modular engineering of essential cellular processes.** [Proc Natl Acad Sci U S A](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5206561/). 2016 Dec 27; 113(52): 15060–15065. doi: [10.1073/pnas.1606701113](https://dx.doi.org/10.1073/pnas.1606701113) | Joel Rouste, Juulia Mikkola, Klara Hamit, Sarah Bluhm | Mikko Korkiakoski, Martin Ahlberg, Eva Kaipia, Jussi Pietiläinen, Jimi Oikarinen |
| 69.5 | [Katarzyna P. Adamala](https://www.nature.com/articles/nchem.2644#auth-1), [Daniel A. Martin-Alarcon](https://www.nature.com/articles/nchem.2644#auth-2), [Katriona R. Guthrie-Honea](https://www.nature.com/articles/nchem.2644#auth-3) & [Edward S. Boyden](https://www.nature.com/articles/nchem.2644#auth-4). **Engineering genetic circuit interactions within and between synthetic minimal cells.** *Nature Chemistry* volume 9, pages 431–439 (2017). doi:10.1038/nchem.2644 | Annikki Ollila, Amanda Lillberg, Jessika Katajainen, Aura Relander | Laura Kangas, Stefania Aspholm-Tsironi, Noora Keskinen, Elina Ahvenainen |
| 79.5 | [Drew S. Tack](https://www.nature.com/articles/s41598-018-21549-w#auth-1), [Austin C. Cole](https://www.nature.com/articles/s41598-018-21549-w#auth-2), [Raghav Shroff](https://www.nature.com/articles/s41598-018-21549-w#auth-3), [Barrett R. Morrow](https://www.nature.com/articles/s41598-018-21549-w#auth-4) & [Andrew D. Ellington](https://www.nature.com/articles/s41598-018-21549-w#auth-5). **Evolving Bacterial Fitness with an Expanded Genetic Code.** *Scientific Reports,* **volume 8**, Article number: 3288(2018). doi:10.1038/s41598-018-21549-w | Mikko Korkiakoski, Laura Kangas, Milla Tynkkynen, Ville Takio | Annikki Ollila, Amanda Lillberg, Jessika Katajainen, Aura Relander |
| 89.5 | Ryu et al. **Control of nitrogen fixation in bacteria that associate with cereals** [Nature Microbiology](https://www.nature.com/nmicrobiol) volume 5, pages 314–330 (2020).(Temme, K., Zhao, D., & C.A. Voigt (2012). [Refactoring the nitrogen fixation gene cluster from *Klebsiella oxytoca*.](http://www.pnas.org/content/109/18/7085.short) *Proc. Natl. Acad. Sci.*, 109(18): 7085-7090.) | Stefania Aspholm-Tsironi, Noora Keskinen, Elina Ahvenainen, Rita Ristimäki | Milla Tynkkynen, Thi Lam,Sarah Bluhm, Celma Mekki |
| 916.5 | Terrell et al. **Bioelectronic control of a microbial community using surface-assembled electrogenetic cells to route signals.** Nature Nanotechnol. (2021). <https://doi.org/10.1038/s41565-021-00878-4> | Emma Vaara, Susa Salminen, Lotta Rosenlöf, Jenni Klemola, Max Höglund | Nea Möttönen, Cecilia Maijala, Elizaveta Sidorova, Carl-Alfons Antson |
| 1016.5 | Wang et al. **A sustainable mouse karyotype created by programmed chromosome fusion.** Science 377, 967–975 (2022). | Anna Tervo, Salli Hannula, Eemil Ferrand, Thi Lam | Emma Vaara, Susa Salminen, Lotta Rosenlöf, Jenni Klemola |
| 1116.5 | Levin, I., Liu, M., Voigt, C.A. *et al.* **Merging enzymatic and synthetic chemistry with computational synthesis planning**. *Nat Commun* **13**, 7747 (2022). https://doi.org/10.1038/s41467-022-35422-y | Nea Möttönen, Cecilia Maijala, Elizaveta Sidorova, Carl-Alfons Antson | Julia Pham, Pihla Manninen,Franziska Schmitt, Max Höglund |
| 1216.5 | Gadella et al. **A brilliant monomeric red fluorescent protein combining high brightness and fast maturation**. *Nat Methods* **20**, 497–498 (2023). https://doi.org/10.1038/s41592-023-01810-5 | Julia Pham, Pihla Manninen,Saashtika Mohan, Franziska Schmitt, Clema Mekki | Salli Hannula, Eemil Ferrand,Hanna Dahl, Noora Karvonen, Dinara Bozzhigitova, Oguzcan Ates too many? |