ACS SyntheticBiology

Introducing Our Authors

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CHRISTINA AGAPAKIS

Nick Seaver

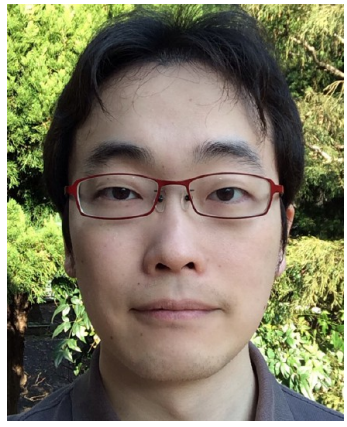
Current Position. Postdoctoral Scholar, UCLA. Advisor: Ann Hirsch

Education. Ph.D. Harvard Biological and Biomedical Sciences. Advisor: Dr. Pamela Silver. Undergraduate degree from Yale University in Molecular, Cellular, and Developmental Biology.

Nonscientific Interests. My nonscientific interests blend and overlap with my science, because I'm interested in art and design and how they intersect with science and technology. I've collaborated with artists, designers, and social scientists on projects that explore the aesthetic and cultural dimensions of biotechnology. Art and science both involve seeing the world in new ways, and working with art has helped me see my science from many different perspectives.

As a synthetic biologist, collaboration with designers and artists has really shaped how I understand the design and development of new technologies. Synthetic biology aims to design living things based on design principles from engineering, including the streamlining, abstraction, and decoupling of modular, standardized parts. However, while we frequently discuss the ethical, legal, and social issues involved in synthetic biology, we have few formalized principles for incorporating such concerns into our designs. Learning from and working with designers from a number of other fields can provide us with tools, methods, and visions for how to consider the social contexts of our work alongside the technical contexts. Indeed, what art, design, and social science can show us is how the social and the technical are always intertwined. (Read Agapakis' article; DOI: 10.1021/sb4001068).

KAZUAKI AMIKURA



Kazuaki Amikura

Current Position. Research Scientist, Earth-Life Science Institute, Tokyo Institute of Technology.

Education. Ph.D. Engineering, Tokyo Institute of Technology (2014). Advisor: Assoc. Prof. Daisuke Kiga. B.S. Biology, Kitasato University (2009).

Nonscientific Interests. Traveling, walking, reading.

I'm interested in evolution of ribozyme and protein. My Ph.D. work included developing simplified genetic codes which include less than 20 amino acid species. Those codes are an effective tool for resurrection of simplified proteins which governed the biochemical reactions in primitive cells. My current research is focused on the reconstruction of primitive biochemistry at the Earth-Life Science Institute (ELSI) in Tokyo Tech. ELSI has a grander aim of exploring both the origins of the Earth and life. Thus, ELSI's goal is to elucidate the origins of life in the context of early Earth conditions. What was the gene set of the first community of life like? This is also my motivation at ELSI. I hope to explore this fundamental question experimentally through interdisciplinary collaborations. (Read Amikura's article; DOI: 10.1021/sb400144h).

JAROSLAV BENDL

Tomas Volf

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Current Position. Ph.D. Candidate, Department of Information Systems, Brno University of Technology and Loschmidt Laboratories, Department of Experimental Biology, Masaryk University, Czech Republic. Advisors: Assoc. Prof. Jaroslav Zendulka and Prof. Jiri Damborsky.

Education. M.Sc. in Bioinformatics, Brno University of Technology, Czech Republic.

Nonscientific interests. Jogging, climbing, and spending time with family and friends.

My graduate research is devoted to the prediction of the effect of amino acid substitutions on protein function. During my doctoral studies in Loschmidt laboratories, I participated in the development of a general methodology for assessing the deleteriousness of protein mutations. The interdisciplinary focus of our laboratory let me also collaborate on engineering of a metabolic pathway for biodegradation of highly toxic 1,2,3-trichloropropane to harmless glycerol. Within this project, I have developed a universal software tool for the optimization of the ratio of three enzymes in the model pathway described by Michaelis–Menten equations. This software was consequently applied for studying the effect of catalytic efficiency and enantioselectivity of enzymes on glycerol production. Since my background lies in a computer science, the work on the project in field of synthetic biology provided me with an opportunity to explore new research directions. (Read Bendl's article; DOI: 10.1021/sb400147n).

FRANCESCA CERONI

Francesca Ceroni

Current Position. Research Associate, Centre for Synthetic Biology and Innovation (CSynBI) and the Department of Bioengineering, Imperial College London, London, U.K. Supervisors: Dr. Tom Ellis and Guy-Bart Stan.

Education. Ph.D. Bioengineering, University of Bologna, Italy. M.S. in Pharmaceutical Biotechnologies, University of Bologna, Italy. B.S. in Biotechnologies, University of Bologna, Italy.

Nonscientific Interests. Writing, music, reading, and outdoor activities.

My research is focused on examining the causes of physiological burden in *E. coli* when cells are transformed with foreign genetic devices, in order to understand how to design better synthetic systems for useful purposes. To understand this process in detail, it is useful to separate the contributions to gene expression that transcription and translation make. Thus, helping to develop the Spinach RNA aptamer as a characterization tool has been part of my research. (Read Ceroni's article; DOI: 10.1021/sb400089c).

PAVEL DVORAK

Pavel Dvorak

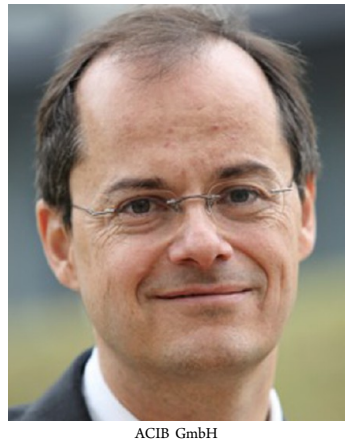
Current Position. Ph.D. Candidate, Loschmidt Laboratories, Department of Experimental Biology and Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic. Advisor: Prof. Jiri Damborsky.

Education. M.Sc. in Molecular Biology and Genetics, Masaryk University, Brno, Czech Republic.

Nonscientific Interests. My family and friends, sports, hiking, cooking, and movies.

My doctoral work has been focused on rational engineering of synthetic metabolic pathway for biodegradation of toxic anthropogenic pollutant 1,2,3-trichloropropane. We improved the system by protein engineering and studied its dynamic performance *in vitro* with purified enzymes and *in silico* by mathematical modeling. In our more recent work, we try to show that the knowledge collected during detailed *in vitro* and *in silico* studies of the pathway can be used together with selected genetic tools for rational engineering of the route in a heterologous host organism. Thanks to this project, I started to be deeply interested in the fields of metabolic engineering and synthetic biology and I plan to further develop my skills in that direction. (Read Dvorak's article; DOI: 10.1021/sb400147n).

ANTON GLIEDER



ACIB GmbH

Current Position. Prof. for Biotechnology at Graz University of Technology and CSO of Austrian Centre of Industrial Biotechnology (ACIB GmbH).

Education. Mag. in Biochemistry, University Vienna, Austria. Advisor: Prof. Dr. Erwin Heberle-Bors. Ph.D. in Microbiology,

University of Graz, Austria (Nov. 1993). Advisor: Prof. Dr. Gregor Högenaue.

Nonscientific Interests. Gardening and horticulture, forestry, family adventures, building houses, and skiing.

My research interests combine enzyme discovery and engineering for biocatalysis with R&D on new expression systems and technologies. A core interest is on engineered and synthetic promoters for yeast expression systems, mainly *Pichia pastoris*. More recently, this was extended from single enzymes to more complex enzyme systems including whole pathways. Thereby, we started to explore the potential of *Pichia pastoris* as a cell factory chassis for chemical production. (Read Glieder's article; DOI: 10.1021/sb400091p).

THOMAS GOROCHOWSKI

Thomas Gorochowski

Current Position. Marie Curie Fellow, DSM Biotechnology Center, Delft, The Netherlands. Advisors: Hans Roubos, Roel Bovenberg.

Education. Ph.D. Complexity Sciences, University of Bristol, U.K. Advisors: Mario di Bernardo, Claire Grierson. M.Res. Complexity Sciences, University of Bristol, U.K. M.Eng. Computer Science, University of Warwick, U.K.

Nonscientific Interests. I enjoy racket sports, sketching in my notepad, time spent far away from civilization in the great outdoors, and fly fishing on warm summers evening down by the river.

I am broadly interested in how natural and engineered complex systems generate useful functions and the ways that they adapt and evolve to meet new challenges. My current research focuses on studying how bacteria engineered to act as cellular factories respond to these production demands and stress. In this work we combined the use of new synthetic genetic expression parts with a microbioreactor platform to perform a detailed analysis of expression and growth for several strains of *E. coli* across different temperatures. This revealed complex contextual effects and changes in cell morphology during expression that related to protein production demands. Our findings highlight the potential for microbioreactors to support the growing need for broader characterization efforts in synthetic biology that more fully capture part performance under varying conditions. (Read Gorochowski's article; DOI: 10.1021/sb4001245).

HASEONG KIM

Haseong Kim

Current Position. Faculty scientist, Biochemicals and synthetic biology research center, Korea Research Institute of Bioscience and Biotechnology (KRIBB).

Education. Ph.D. Systems Biology, Imperial College London. Advisor: Prof. Erol Gelenbe. M.S. Bioinformatics, Seoul National University. Advisor: Prof. Taesung Park. B.S. Horticultural Science, Korea University.

Nonscientific Interests. Playing basketball, baseball, and watching football.

My research focused on theoretical study of dynamic biological systems such as gene regulatory networks. After finishing my Ph.D., I joined the Korea Research Institute of Bioscience and Biotechnology (KRIBB) and started to fill the gap between theory and real biological systems by learning wet lab techniques. In our lab, various flow cytometry and high throughput colony imaging analyses are coupled with single cell techniques with artificial genetic circuits to detect and regulate key compounds in the cell. Along with the high throughput engineering techniques, mathematical and statistical models are being developed for genetic circuits whose behavior can be predicted and applied to design a new genetic circuit. In this work, finding and engineering of industrially important enzymes, regulatory parts, and new metabolic pathways are challenged based on the single cell techniques, eventually to develop microbial cell factories for pharmaceutical and biochemical product syntheses. (Read Kim's article; DOI: 10.1021/sb400112u).

NAGENDRA PRASAD KURUMBANG

Nagendra Prasad Kurumbang

Current Position. Postdoctoral Fellow with Marie Curie Fellowship at Loschmidt Laboratories, Department of Experimental

Biology and Research Center for Toxic Compounds in the Environment, Faculty of Science, Masaryk University, Brno, Czech Republic. Advisor: Prof. Jiri Damborsky.

Education. Ph.D. in Biochemistry, Institute of Biomolecular Reconstruction, Department of Pharmaceutical Engineering, Sun Moon University, South Korea. Advisors: Prof. Kwangkyoung Liou and Prof. Jae Kyung Sohng.

Nonscientific Interests. Traveling, sports, music and movies, hanging out with friends and family.

My research interests lie in biosynthesis, metabolic engineering and synthetic biology. In this project, we identified the main bottlenecks of the synthetic pathway involved in transformation of toxic chemical 1,2,3-trichloropropane to the harmless product glycerol. We employed engineered proteins to resolve the problems of low activity and enantioselectivity; and metabolic pathway engineering to address the toxicity of the metabolites. A kinetic model was used for the prediction of the enzyme ratios as well as the enzymes properties required for more efficient flow of the flux toward the final product. I am eager to continue my research in synthetic biology for designing of the new systems and for understanding of the native ones. (Read Kurumbang's article; DOI: 10.1021/sb400147n).

KILKOANG KWON

Kilkoang Kwon

Current Position. Research student at Biochemicals and Synthetic Biology Research Center in Korea Research Institue of Bioscience & Biotechnolgy (KRIBB). Ph.D. Candidate, department of Chemical and Biomolecular Engineering at Korea Advanced Institue of Science and Technology (KAIST), Advisor: Dr. Seung-Goo Lee.

Education. BS/MS at the department of Microbial Engineering at Konkuk University in South Korea.

Nonscientific Interests. I play any sport except football, which is the only sport I love to watch.

My research interests are enzyme engineering and synthetic biology, especially applications of genetic circuits along with protein engineering for synthetic biology. In this work, we have developed the Genetic Enzyme Screening System (GESS) that enables the rapid mining of novel enzymes by flow cytometry techniques. The genetic circuit is highly useful for high-throughput enzyme screening from diverse microbial resources or designed mutant libraries. Currently, I am working on expanding the genetic circuit for various target enzymes. (Read Kwon's article; DOI: 10.1021/sb400112u).

JULIA PITZER

Marina Kotnik

Current Position. Ph.D. student at the Institute of Molecular Biotechnology, Graz University of Technology. Advisor: Dr. Anton Glieder.

Education. M.S. in Environmental System Sciences with major in Chemistry, University of Graz, Austria (March 2014). Advisors: Dr. Wolfgang Kroutil and Dr. Frances H. Arnold (California Institute of Technology, U.S.A.). M.S. in Biotechnology, Graz University of Technology, Austria. Advisors: Dr. Anton Glieder and Dr. Andrea Mattevi (University of Pavia, Italy). B.S. in Environmental System Sciences with major in Chemistry, University of Graz, Austria.

Nonscientific Interests. Traveling to new countries, reading books, and outdoor sports such as skiing, swimming, and hiking.

My Ph.D. research is focused on the identification and characterization of new regulatory transcriptional elements in three different yeast species. In the current work we describe the construction of synthetic promoters in the methylotrophic yeast *Pichia pastoris*. We show that functional promoters can be designed in a fully synthetic way and that a range of different expression levels can be obtained. My Ph.D. project is part of Chem21, a European cooperation between pharmaceutical companies and universities to develop a greener way of pharmaceutical production. My aim is to establish a versatile toolbox with different promoters and terminators that can be used for metabolic engineering. I'm especially interested in the application of this toolbox to design pathways for production of valuable pharmaceutical compounds in yeast. (Read Pitzer's article; DOI: 10.1021/sb400091p).

GEORGIOS POTHOULAKIS

Georgios Pothoulakis

Current Position. Ph.D. Candidate, Centre for Synthetic Biology and Innovation and Department of Bioengineering, Imperial College London, London, U.K. Advisor: Dr. Tom Ellis.

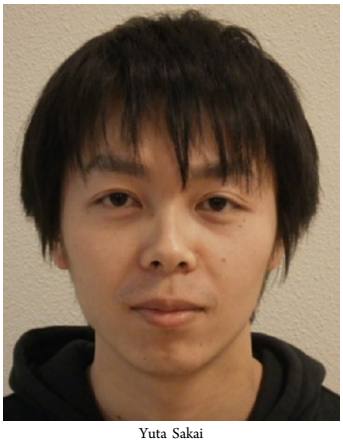
Education. M.Res. in Systems and Synthetic Biology, Imperial College London, U.K. B.S. in Biology, Aristotle University of Thessaloniki, Greece.

Nonscientific Interests. Movies, music, travel, and good food.

My current research is focused on developing a programmable biological system that generates useful structures that can be mathematically described and simulated. Through the combination of programmable circuits and genes that encode patterned structures we aim to produce cells which self-organize and construct ordered communities.

Before this, my Master's project was focused on the development of novel characterization tools for measuring transcription and translation in engineered *E. coli*. I developed an *in vivo* characterization system using the Spinach RNA aptamer and a fluorescent protein (mRFP1), enabling us to simultaneously but separately measure transcription and translation of mRNAs. Specifically, using flow cytometry, I evaluated the strength of certain promoters and ribosome binding sites, highlighting the different behaviors of transcription and translation. Through this process, we also investigated the limits of the Spinach RNA aptamer as a characterization tool. (Read Pothoulakis' article; DOI: 10.1021/sb400089c).

YUTA SAKAI



Yuta Sakai

Current Position. Ph.D. student, Department of Biotechnology and Life Science, Tokyo University of Agriculture and Technology. Advisor: Prof. Kazunori Ikebukuro.

Education. M.E. and B.E. in Department of Biotechnology and Life Science, Tokyo University of Agriculture and Technology. Advisor: Prof. Kazunori Ikebukuro.

Nonscientific Interests. Traveling and sports.

I am interested in engineering genetic tools to regulate the target gene expression and I am currently working on RNA-based tools and its application to regulate biological systems. In this paper, we improved the gene regulation abilities of small RNAs in *Escherichia coli*. We developed the strategy based on mimicking the mechanism of well characterized naturally occurring small RNAs and a rational mutational approach. The engineering strategy was applied against several small RNAs that regulate the target genes by different mechanisms. I hope the engineering strategy described in our paper will be valuable to engineer small RNAs that strongly regulate target gene expression. (Read Sakai's article; DOI: 10.1021/sb4000959).

SUVI SANTALA

Suvi Santala

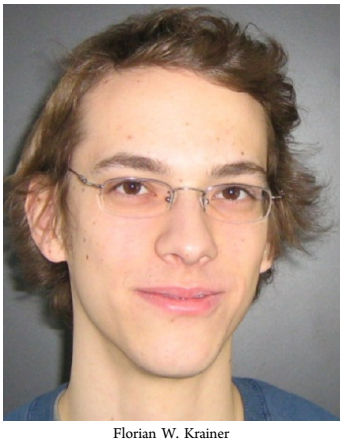
Current position. Ph.D. Student, Teaching Associate, Department of Chemistry and Bioengineering, Tampere University of Technology, Tampere, Finland. Advisors: Prof. Matti Karp and Adj. Prof. Ville Santala.

Education. MSc (Tech), Biotechnology, Tampere University of Technology.

Nonscientific Interests. I spend most of the spare time with my two kids. I also enjoy traveling, reading, hiking, and running.

The main focus in my research is on developing synthetic biology tools and model platforms for production of industrially relevant molecules exploiting a new model organism *Acinetobacter baylyi* ADP1. The exceptional competence for natural transformation enables straightforward genome engineering in an automated manner. Along the natural competence, the existing strong knowledge on ADP1 genome, and versatile metabolic features make ADP1 a convenient host for synthetic biology in a broad range of applications. Our recent studies have provided specific and sensitive *in vivo* tools for rapid detection of changes in intracellular metabolite levels related to long-chain hydrocarbon metabolism, and the near future work involves targeted proteomic analysis on ADP1. Previously, we have demonstrated the utilization of *A. baylyi* ADP1 as a model platform for enhanced production of triacylglycerols and wax esters. This paper describes a new approach to produce long chain hydrocarbons with well-characterized genetic components, enabling the production of customized bioproducts. Importantly, we aim at developing tools and methodologies that are universally applicable in other synthetic biology hosts and systems as well. (Read Santala' s article; DOI: 10.1021/sb4000788).

THOMAS VOGL



Florian W. Krainer

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Current Position. Ph.D. student at the Institute of Molecular Biotechnology, Graz/DK Molecular Enzymology, Graz. Advisor: Dr. Anton Glieder.

Education. M.S. in Molecular Microbiology at the University of Graz, Austria. Advisors: Dr. Harald Pichler and Dr. Helmut Schwab. B.S. in Molecular Biology at the Graz University of Technology, Austria.

Nonscientific Interests. Sports, music, movies.

My research is focused on synthetic promoters and regulatory circuits as tools for metabolic engineering applications and protein production. I am mainly working with the yeast *Pichia pastoris*, one of the most commonly used eukaryotic expression systems. A common problem of synthetic biology and high-yield protein production is the need for fine-tuning expression. Too strong expression of a synthetic regulator or a foreign protein may disturb the cellular machinery. In this paper, we created synthetic core promoters that can be used to fine-tune expression. These short parts span a range of expression levels and can easily be attached on a PCR primer. Looking forward, I hope to continue working in the intersection of basic research on transcriptional regulation and applications for biotechnology and synthetic biology. (Read Vogl's article; DOI: 10.1021/sb400091p).