

Elitesatsning Universitetet i Bergen – Bergens Forskningsstiftelse:
Scientific progress report 2018

Reporting period: 02/2016-02/2018

Publishable summary.

Dr. Koelsch has published numerous articles in peer-reviewed international high-quality journals, including high-impact factor journals (with IFs > 10). His h-index has risen to 41 (64 according to scholar google). Dr. Koelsch has acquired funding from the NFR for a project investigating the effects of a music intervention on the brain in patients with Alzheimer's disease (budget 17.9 Mio. NOK). The first team members for this project have been hired, the trial registration has been completed, and ethical approval has been obtained from REK. Thus, measurement of patients and music interventions will start soon. This project will investigate if singing (at home and in an Alzheimer choir) can slow down brain atrophy and cognitive decline, ameliorate depressive symptoms, and increase quality of life. If successful, our intervention will help to keep patients longer at home (instead of having to move to a nursing home), with enormous financial socio-economic benefits in the next decades. In addition to this project, Dr. Koelsch has acquired faculty funding with a PhD student investigating statistical learning in adults and in children with atypical language development. Beyond the objectives of these projects, Dr. Koelsch plans to further investigate neural correlates of emotion with music using functional neuroimaging, and in particular the potential of music to modulate aware and unaware thought. As outreach activities, he works on a popular science book on therapeutic effects of music, and expects substantial interest of the media in the Alzheimer project.

Publications.

In the last two years I have published 11 peer-reviewed articles in international high-quality scientific journals, and 2 (invited) articles are in preparation (all articles are listed below). Three of these articles are/will be published in high-impact factor journals (IFs according to ISI Web of Knowledge): *Trends in Cognitive Sciences* (IF = 15.4), *Behavioral and Brain Sciences* (IF = 14.2), *Neuron* (IF = 14). Moreover, one of the published articles (Pehrs et al., *Cerebral Cortex* 2017, IF = 6.6) is listed in ISI WoK as "highly cited article" (meaning that it is in the top 10% of its field). My *h-index* has risen to 41 according to ISI WoK (64 according to scholar-google).

1. Koelsch, S., Skouras, S., & Lohmann, G. (2018). The auditory cortex hosts network nodes influential for emotion processing: An fMRI study on music-evoked fear and joy. *PloS one*, 13(1), e0190057.
2. Hohmann, L., Bradt, J., Stegemann, T., & Koelsch, S. (2017). Effects of music therapy and music-based interventions in the treatment of substance use disorders: A systematic review. *PloS one*, 12(11), e0187363.
3. DePriest, J., Glushko, A., Steinhauer, K., & Koelsch, S. (2017). Language and music phrase boundary processing in Autism Spectrum Disorder: An ERP study. *Scientific reports*, 7(1), 14465.
4. Taruffi, L., Pehrs, C., Skouras, S., & Koelsch, S. (2017). Effects of sad and happy music on mind-wandering and the default mode network. *Scientific reports*, 7(1), 14396.
5. Wassiliwizky, E., Koelsch, S., Wagner, V., Jacobsen, T., & Menninghaus, W. (2017). The emotional power of poetry: Neural circuitry, psychophysiology and compositional principles. *Social*

Cognitive and Affective Neuroscience, 12(8), 1229-1240.

6. Menninghaus, W., Wagner, V., Hanich, J., Wassiliwizky, E., Jacobsen, T., & Koelsch, S. (2017). The distancing-embracing model of the enjoyment of negative emotions in art reception (target article). *Behavioral and Brain Sciences*, 40.
7. Pehrs, C., Zaki, J., Schlochtermeyer, L. H., Jacobs, A. M., Kuchinke, L., & Koelsch, S. (2017). The Temporal Pole Top-Down Modulates the Ventral Visual Stream During Social Cognition. *Cerebral Cortex*, 27(1), 777-792. IF = 8.7
8. Glushko, A., Steinhauer, K., DePriest, J., & Koelsch, S. (2016). Neurophysiological correlates of musical and prosodic phrasing: shared processing mechanisms and effects of musical expertise. *PLoS one*, 11(5), e0155300.
9. Koelsch, S., Boehlig, A., Hohenadel, M., Nitsche, I., Bauer, K., & Sack, U. (2016). The impact of acute stress on hormones and cytokines, and how their recovery is affected by music-evoked positive mood. *Scientific reports*, 6.
10. Koelsch, S., Busch, T., Jentschke, S., & Rohrmeier, M. (2016). Under the hood of statistical learning: A statistical MMN reflects the magnitude of transitional probabilities in auditory sequences. *Scientific reports*, 6.
11. Guo, S., & Koelsch, S. (2016). Effects of veridical expectations on syntax processing in music: Event-related potential evidence. *Scientific reports*, 6, 19064.

Articles in preparation:

Koelsch, S. (in prep.). The effects of music on the neural encoding of emotion. *Neuron* (invited review).

Koelsch, S., Friston, K., & Vuust, P. (submitted). Predictive processes and the peculiar case of music. *Trends in Cognitive Sciences* (invited review).

Grant applications & Project work performed.

1) In 2016 the NFR granted my proposal on "Effects of music instrument lessons on brain plasticity, mood, and quality of life in Alzheimer patients" ("ALMUTH"; Forskerprosjekt - BEDREHELSE, total budget 17.9 Mio. NOK). This project investigates if a singing intervention for patients with Alzheimer's disease in the early stages will have positive influence on brain degeneration (brains of patients will be scanned before and after the intervention with functional and structural magnetic resonance imaging), on depressive symptoms, cognitive functioning, and quality of life of the patients, as well as on the quality of life of the caregivers. The singing intervention spans one year, with a daily singing program, weekly singing lessons by a music therapist, and participation in an Alzheimer choir several times a month. This project has started in the summer of 2017, the first PhD student as well as a person working for the project at Bergen Kommune have been hired, two more PhD positions (and application deadline is over) and a Post-doctoral researcher position have been announced, the music materials have been developed, the trial registration has been completed, and ethics approval has been obtained from REK. Thus, we are now ready to test the first patients and start with the intervention.

2) Although another NFR application for the study on *Music as a tool for prevention of atypical language development in children* was not granted, I was successful in obtaining a faculty 4-year PhD position in 2017 for a project on "Neural Correlates of Statistical Learning in Adults and Children (SLAC)". The PhD student (Barbara Tsogli) was hired in 2017, and we have successfully developed an experimental paradigm for statistical learning (testing adults) of which we are confident that it can be used in different groups, including children (pre-school and elementary

school) and individuals with dyslexia. We have submitted a REK application for ethics approval for a project with pre-school children, and are currently finishing an electro-encephalographic (EEG) study using and testing this experimental paradigm with healthy adults. The investigation with children will bring us closer to my goal of using music as a tool for the early diagnosis and prevention of atypical development (and a tool to support typical development) in the areas language and socio-emotional personality development (as outlined in my last 2016 progress report).

Other grant proposals mentioned in my 2016 progress report were not funded. Other grant proposals submitted since 2016 include 2 NFR proposals and 1 Horizon 2020 proposal.

Keynote lectures and plenary lectures (selection).

I have been invited to prestigious international conferences in the fields of music therapy, music psychology, and neuroscience and music, e.g.:

European Music-Therapy Congress (July 2017 in Vienna, Austria) on "Music, Emotions, and the Brain: Implications for therapy" (plenary lecture and discussion)

NeuroMusic VI (June 2017 in Boston, USA) on "Musical predictions, and their impairment in children with atypical language development" (plenary lecture)

Further plans & objectives.

Research plans:

1) My current research priority is the ALMUTH project (i.e., a music intervention with Alzheimer's patients, see "Grant applications" above). This project will continue until 2021. In line with the original grant proposal, goals in the next project period include: Acquiring pre-, intermediate, and post-data (MRI, fMRI, psychological testing) from experimental (music) group and two control groups (n = ~135 patients in total). Performing the music intervention with the music group (neurocognitive music therapy), evaluation of empirical data, as well as health economics analysis and assessment, taking into account costs for music therapy, and cost savings due to amelioration of depression and prolonged time that patients can stay out of nursing homes. Finally, will also include dissemination, and -- given a positive outcome -- the implementation of the music therapy program (e.g., training of commune music therapists). Our vision is that our intervention will help to keep patients longer at home (instead of having to move to a nursing home), with enormous financial socio-economic benefits in the next decades.

2) My second research priority is the project on statistical learning (see "Grant applications" above), in particular investigating neural correlates of high- and low-probability local dependencies with EEG and fMRI in healthy adults, with EEG in pre-school children at risk for dyslexia and in individuals with dyslexia.

3) In addition, I plan to further investigate neural correlates of emotion with music using functional neuroimaging, and in particular the potential of music to modulate aware and unaware thought.

Outreach plans:

Within the ALMUTH project (see above) we expect massive interest from the media (radio and TV), with one documentary already in production (by film students of UiB). Moreover, I am

working on a popular science book on therapeutic effects of music, which will presumably also be published in Norwegian (published by Cappelen Damm).

Grant submission plans:

Late 2018: Submission of a EU-grant application for "Personalised coaching for well-being and care of people as they age"

2019: Submission of an ERC advanced grant.

Professor Michael R. Fellows: Second Annual Report to the Bergen Research Foundation, March 2018.

This report is organized as follows:

1. Publishable summary
2. Main project objectives and sub-goals
3. Work performed from the beginning of the project and main results achieved so far
4. Progress beyond state of the art and expected potential impact
5. Deviations - not applicable
6. Failure to achieve - not applicable
7. Outlook on scientific activities in 2018
8. Links With other projects
9. Major dissemination activities of the project so far
10. Grant application activities in the reporting period
11. Deviations - not applicable

1. Publishable Summary.

Professor Michael Fellows was recruited to the University of Bergen where he has longstanding collaborative ties, coming from Australia where he retains vibrant research connections, starting in January, 2016. His wife and major collaborative partner, Dr. (Prof.) Frances Rosamond was also recruited on a part-time basis, and they have happily moved to Bergen, bringing to UiB one of the most creative and impactful research teams in contemporary computer science.

In 2016 Professor Fellows was awarded Australias highest civilian honour: *Order of Australia, Companion to the Queen (AC)*, comparable to a UK Knighthood, the first time that a Computer Scientist has been so honored. Over the last forty years, approximately thirty scientists, over all fields, have received an AC, including seven Nobel Laureates. Professor Fellows received this award for two principal contributions of outstanding international impact:

(1) Fundamental mathematical research in founding the area of parameterized algorithms and complexity now often called multivariate algorithmics. (Exemplified by the foundational research monograph, *Parameterized Complexity* by Downey and Fellows, 530 pp., Springer, 1999, and by it's sequel *Fundamentals of Parameterized Complexity*, 790 pp., by R. Downey and M. Fellows, Springer, 2013.)

(2) Highly innovative approaches to communicating the basic mathematical ideas of computer science, especially for children. (Exemplified by the book *Computer Science Unplugged!* by Bell, Witten and Fellows, 1997, now translated into 25 languages and used in schools throughout the world.)

Professor Fellows was recruited to Bergen through the Elite Professorship Program of the Norwegian government, with matching funds from Bergens Forskningsstiftelse, with the mission to:

- Nucleate a research group at UiB to continue to contribute in these two ways.
- Act as a catalyst and mentor, especially in concert with the already strong research profile of UiB in multivariate algorithmics (currently the strongest in the world).
- Realize the goals articulated in the FPT II project proposal (on Professor Fellows website). These goals are primarily directed at bridging the gap between theory and practical applications of multivariate algorithmics.

Those research goals have been refined and further articulated in the proposal “Parameterized Complexity for Practical Computing (PCPC)” proposed to the Norwegian Research Foundation Toppforsk Program (this proposal can also be found on Professor Fellows’ website).

In February, 2018, we learned that this will be funded: up to NOK 24 884 000, over six years, one of three Toppforsk grants awarded to researchers at UiB. Recruitment of excellent new staff (postdocs and PhD students) is moving ahead rapidly on this good news.

The first year (2016) involved much activity in moving to Bergen and recruiting and initiating this research group that now includes:

- Dr. (Prof.) Frances Rosamond (assisting in all aspects)
- Dr. Mateus Oliveira de Oliveira (four year postdoctoral researcher)
- Mr. Lars Jaffke (four year PhD student)

Our group hosted numerous international research visitors in 2016 and 2017. A steady stream of international research visitors is planned for 2018.

There continues to be very high international demand for plenary talks, visits, short courses and workshop organization in regards the two principal creative themes.

2. Main Project Objectives and Sub-Goals.

The specific scientific objectives of the FPT II / PCPC Project can be summarized as consisting of two main exploratory pushes:

(A) New ways of deploying parameterization in the design of algorithms (including heuristic algorithms, the main workhorse of practical computing). Key opportunities targeted by the FPT II Project include:

- Parameterizing on the way that typical inputs to a computational problem arise: generative parameterization. This direction is being explored by the team also in collaboration with Prof. Jan Arne Telle, and Professor Kitty Meeks of the University of Glasgow, who visited the FPT II Team twice in 2016 and has since successfully landed a Scottish Research Council Young Researcher Grant (roughly comparable to an ERC Starting Grant).

- Working bottom-up with applied computing communities, rather than top-down. In the top-down approach that currently dominates research in algorithms, the mathematical scientist begins with an abstract model of the entire computational challenge (the computational problem) and attempts to find an efficient complete solution answerable to this abstract model of the computing situation in a worst-case analysis framework. In a bottom-up approach, one begins with what applied computing practitioners are actually doing (typically heuristics of some kind) and attempts to use FPT techniques to strengthen key subroutines (for example, greedy subroutines often play a key role in heuristics). In the period 2015–2017 the team has published pioneering papers on FPT-turbocharging greedy subroutines that have attracted substantial attention. This is a key theme of the ongoing Australian Research Council grant with collaborators in Sydney, Australia.

- Deconstructing real-number-based NP-hardness results. A general argument can be made that hardness results for computational problems legislated with real numbers are unrealistic, because the negative assessment of problem feasibility is in a framework of worst-case asymptotic complexity. Thus to credit such results one must believe that, e.g., costs measured to unlimited decimal accuracy meaningfully exist, which is absurd. More realistically, what we know or care about is much more approximative: for example, a job to be scheduled on a cpu is cool or pretty cool or kind of warm etc. on a scale that can be responsibly parameterized, leading to realistic and useful FPT results. A particular target is the well-known body of negative complexity results in algorithmic game theory.

(B) New domains of application of multivariate algorithmic techniques and perspectives. There are entire research communities where FPT methods could be quite useful, but where the subject has yet to penetrate. This is partly a sociological phenomenon, as communities tend to coalesce around a set of techniques and models, and do more of the same. To bring FPT methods and perspectives to new domain X, it really is necessary to join the X community, collaborate with established researchers there, and mentor the new possibilities that multivariate algorithmics offers. Some obvious important applied computing domains in this regard include:

- *Scheduling.* Here there are an abundance of natural parameters in small ranges, and many computational challenges having major practical impact. The FPT II / PCPC team has been in the forefront in regards the few efforts so far in this direction.

- *Machine Learning.* On the modelling side, this also includes relevance to cognitive science (e.g., the parameterized complexity of Bayesian models). In 2016 the FPT II / PCPC team interacted heavily with researchers in this application domain, hosting two substantial visits, giving a series of lectures at Bolzano University, and an opening plenary address at a cognitive science workshop in the Netherlands. Another new direction the team has been developing (partly in collaboration with the Sydney group) is in exploring the notion of prominent data from a parameterized point of view, for uses in training sets for neural nets.

- *Group Theory and Matrix Algebra.* The FPT II / PCPC team has had some initial results attempting to answer the question: *What is the analog of the notion of bounded treewidth*

for permutation groups? Progress in this area has the potential for speeding up backtracking by exploiting symmetries, backtracking being a workhorse of practical computing.

3. Activities and Results of the Project So Far.

2016

- Hosted visits by several potential postdocs and PhD students, and recruited one of each.
- Co-organization of the third in the series of the International Conference on Creative Mathematical Sciences Communication (CMSC), held in Lubeck, Germany, October 2016. One theme of the conference is to extend Computer Science Unplugged!. This initiative has been strongly supported by Google (more than USD 100,000 over the years). The first was held in Darwin, Australia, in 2013. The third will be in Wellington, New Zealand in 2018. The fourth is proposed to be in Bergen in 2020.
- Professor Fellows gave the opening plenary talk, a survey of multivariate algorithmics, at the Scottish Combinatorics Conference in Glasgow in April, 2016.
- Professor Fellows gave the opening plenary talk at the first Topics in Theoretical Computer Science (TTCS) conference in Tehran, Iran, July 2016. This was a survey of multivariate algorithmics. TTCS is intended to be an annual Iranian conference on theoretical computer science. Professor Fellows is on the Steering Committee.
- Professor Fellows was a co-organizer of a Lorentz Center Workshop on Parameterized Complexity in Computational Geometry and Topology, Leiden, Netherlands, April 48.
- Professor Fellows presented a series of introductory lectures on multivariate algorithmics at the University of Bozen-Bolzano in June 2016. Our host, Tarek Besold, is a collaborator in the area of multivariate algorithmics in cognitive science, and was a potential postdoc. We hosted him in a visit to Bergen in January, 2016.
- Professor Fellows was a co-organizer of a workshop on Parameterized Complexity and Computational Geometry at the University of Sydney in Australia in December, 2016. This was supported by the Australian Research Council. The subject of multivariate algorithmics is becoming well-known to the computational geometry research community, an example of one of the goals of the FPT II Project.
- A major initiative which began in 2015, headed by Professor Rosamond, who is the Chair of the Steering Committee, was to organize the highly successful Parameterized Algorithms and Computational Experiments Challenge (PACE). The results of the first PACE Challenge were reported at a special session of IPEC at Aarhus, Denmark, in August 2016.

Multivariate algorithmics has matured to the point where it is important to experimentally explore implementations. The first Challenge was a great success, and the results of the second Challenge were presented at IPEC 2017. This initiative directly engages one of the two key themes of the FPT II / PCPC Project.

2017

- Attendance at DD24 (Domain Decomposition), February 2017. The ultimate goal is to build some bridges to this research community, that is strongly represented at UiB. There are two main lines of opportunity: (1) Versions of the domain decomposition approach useful in combinatorial optimization. A classic example is the approach of Brenda Baker in designing EPTASs (an approximation form of FPT) for combinatorial optimization problems on graphs of bounded genus. (2) The possibility of FPT algorithms for central subroutines in matrix algebra that are used in DD approaches in numerical analysis.
- Attendance at the International Frontiers of Algorithmics Workshop (FAW) in Chengdu, China in June, 2017. Professor Rosamond is a Program Committee Co-Chair (one of two) for this well-established theoretical computer science meeting. Professor Fellows gave an invited plenary talk.
- Attendance at the IWOCA meeting in Newcastle, Australia, July, 2017. This IWOCA was in honor of its founder and our close collaborator in Australia, Mirka Miller, who recently passed away. Both Professor Fellows and Professor Rosamond were members of the IWOCA 2017 Program Committee.
- Attendance at the ALGO/IPEC meetings in Vienna, September, 2017. Professor Rosamond presented the IPEC Excellent Student Paper Award(s) and the IPEC Best Paper Award. IPEC is the annual premier specialist conference in multivariate algorithmics. Rosamond is the Editor of the FPT Newsletter (since 2004) and the Publicity Chair for IPEC.
- A key objective for 2017 was to follow up on discussions we had at the meeting in Tromsø of the Heads of Informatics Departments of Norwegian universities on the subject of Computer Science curriculum reform at the school level (ages 6 on up). At the Tromsø meeting Norway's Minister of Education pointed to the fact that Norway significantly lags most European and other developed countries in informatics curriculum reform at the school level. Our team has continued to seek to engage this issue at the Norwegian national level, modeled on the efforts of our close colleague Tim Bell in the similarly small and independent-minded country of New Zealand. A new initiative of 2017 and continuing into 2018 is to bring Norway into participation with the widely international BEBRAS program, which is focused on computational thinking in ways that are easy for schools to engage.
- Prof. Fellows was one of four proposers of the successful Australian Research Council grant: *Local Reoptimization for Turbocharging Heuristics*, 20152017. This is directly related to the FPT II / PCPC Project.

2018

- Prof. Fellows and Prof. Rosamond attended the Logical Foundations of Computer Science meeting in January 2018. Fellows gave the opening plenary invited talk.

4. Progress Beyond State of the Art and Expected Impact of the

Project So Far.

In addressing the topic of the progress beyond the state-of-the-art, so far, and the expected impact of the of the FPT II / PCPC project, both in terms of core mathematical science and computing, and in terms of social impact in Norway and the world, it is important to remember that there are two major themes of the project, as reflected at the beginning of this report:

(1) Core technologies / methodologies at the mathematical beating heart of computer science, algorithms and complexity. This is the realm of parameterized/multivariate algorithmics, and its mathematical empowerment of efficient algorithms.

(2) The communication of the core ideas in these tremendous advances, so important to all of science, social communication, commerce, and modern civilization in general — the core mathematical ideas, issues and horizons — to "Children of All Ages" as we the authors of *Computer Science Unplugged*, put it in our draft book, which was rejected by every major publisher in the world, and now translated into 25 languages and used throughout the world, and playing a major role in IT/CS education reform in the schools, to keep up with the amazing advances in computing and its impact on human life.

Our team is in the forefront, both in Norway in particular, and the world in general, with regards to (2), which is of major social impact. With respect to (1) the FPT II / PCPC project (which began before our relatively recent move to Bergen) is having a huge impact on the mathematical core of theoretical computer science. The numbers supporting this claim are very easy to check nowadays. Bergen is credibly regarded, on the numbers, as the world hotspot in algorithms and complexity innovation now. This may not last, but will reliably linger. In the mid-1980's Edinburgh was the hotspot for the nascent field of Artificial Intelligence. It is still strong.

What is going on is a shift from a one dimensional complexity theory, and accompanying algorithm design techniques and issues, to a multivariate approach, which is winning on all fronts, with implementations, on real data. The multidimensional approach is here to stay! What this means is more efficient algorithms all across-the-board, in all of the sciences, and in engineering, and in many areas of social choice, all across-the-board, because algorithmic science is the beating heart of computing.

5. Not applicable

6. Not applicable

7. Outlook on Scientific Activities in 2018

Activities from 2017 regarding PACE, IPEC, the Forskningsdagene, and interactions with Informatics and other departments will be continued. Editing and publication of the FPT Newsletter will be continued, as well as publicity/research dissemination via the wiki Website: <http://fpt.wikidot.com> and the community facebook page at "@MikeFellowsFPT".

A significant activity of 2018 will be recruiting and orienting team members (PhDs and post-docs) for the Toppforsk project. We have already identified some potential applicants and are moving forward on the advertising/hiring procedures.

Initiatives to renew education and disseminate information about informatics in primary and lower and upper secondary schools, primarily Norwegian schools will be engaged. *Bebras* and *Computer Science Unplugged!* are the most developed and international approaches. We will utilize these two agencies throughout Norway, with the Department of Informatics, UiB as the energizing Hub.

The 2018 Creative Mathematical Sciences Communication conference (www.cmsc.nz), July in Wellington, NZ, will work in parallel with *Bebras*. Many CS Unplugged tasks are already incorporated into *Bebras* tasks. Many logic problems that are used in the international mathematics competitions are similar to those in the *Bebras* tasks. We envision the Norwegian mathematics community, computer science community, children's coding, and the programming Olympiads all working together to create a strong IT educational infrastructure at every school level in Norway.

Research visitors already scheduled for 2018 include: Julien Baste (LIP6, France); Laurent Bulteau (Univ Lyon); Danny Hermelin (Ben-Gurion University of the Negev); G. Philip (CMI India) with possibly his student; Alexsander Andrade de Melo (University of Brazil), student of Ueverton Souza; Abhisekh Sankaran (IMSc Chennai).

Participation at conferences, workshops and schools will help innovate, develop and disseminate the research program of the FPT II / PCPC projects. We anticipate the following 2018 travels.

- 18th Logical Foundations of Computer Science Conference (LFCS) in Florida, USA, January 2018. The LFCS is a prominent conference series that was started in 1989. The conference honored Prof. Anil Nerode, a pioneer of logic and computing. Fellows was the opening plenary Invited Speaker on the origins and horizons of parameterized complexity.
- British Mathematics Colloquium at St. Andrews University in Scotland, April, 2018. Fellows is a plenary invited speaker.
- Fixed-Parameter Computational Geometry II, Leiden Workshop, Lorentz Center, May 2018. This follows up the Geometry I workshop of 2016. Fellows has been on both organizing committees.
- IWOCA 2018 in Singapore in July, 2018. This conference series was started by Mirka Miller (Univ. Newcastle, AU) and grew over 20 years. Fellows is an invited plenary Speaker.
- CMSC 2018 in Wellington, New Zealand in July 2018. This conference (mentioned above) follows IWOCA. Rosamond is the primary organizer of this conference. The big outcome will be activities used around the world and in Norway for IT enrichment.

- FPT Data Wrangling for Social Good workshop in Wellington in July 2018, immediately following the CMSC conference in Wellington, New Zealand. Rosamond is the primary organizer of this conference.
- International Congress of Mathematicians: ICM (which happens every four years), and the satellite LAWCLIQUES Workshop in August, 2018. Papers are being prepared by the team for this event. We will meet with co-authors Maise Dantas da Silva, Fabio Protti and Ueverton Souza. Ueverton's student Alexander has applied to the Brazilian government for funding to visit UiB for six months starting September 2018.
- ALGO/ESA/IPEC/PACE in Helsinki in August 2018. ALGO is an annual meeting combining the premier algorithmic conference European Symposium on Algorithms (ESA) and a number of other specialized conferences and workshops, all related to algorithms and their applications, including IPEC and PACE, making ALGO the major European event for researchers, students and practitioners in algorithms. The EATCS-IPEC Nerode Prize is awarded at ALGO. Rosamond is Chair of the Steering Committee of PACE and Publicity Director of IPEC.
- Dagstuhl Seminar 18421, *Algorithmic Enumeration: Output-sensitive, Input-Sensitive, Parameterized, Approximative* in October 2018. Organized by Henning Fernau (Universitt Trier, DE), Petr A. Golovach (University of Bergen, NO), Dieter Kratsch (University of Lorraine Metz, FR), Marie-France Sagot (University Claude Bernard, Lyon, FR). Fellows and Rosamond have some preliminary work with Marek Karpinsky (Bonn) to present at this seminar.

8. Links With Other Projects.

- The UiB FPT II / PCPC group maintains vigorous links with the Australian Research Council grant DP-150101134, *Local Reoptimization for Turbocharging Heuristics*, 20152017, with collaborators at the University of Sydney and the University of New South Wales, Australia. Associate Professor Serge Gaspers at UNSW, who was a postdoc at UiB, recently received a major award and promotion. This is directly related to the FPT II / PCPC Project. Some of the basic research themes were initiated in the ARC proposal.
- The *Excited: Center of Excellence in IT Education* is center at NTNU and Nord University. One of the Excited goals is more and better applicants to IT studies in Norway. The Excited project will be one of the members of the consortium we are building to bring Bebras to Norway. We are collaborating with the Bebras project (www.bebas.org)

9. Major Dissemination Activities of the Project So Far.

The major dissemination activities have been through peer-reviewed publications, talks and presentations and conference organizing, the *FPT Newsletter*, advising and mentoring, and other outreach activities. The publication list below includes output from the entire team.

9.1 Peer-Reviewed Publications

2016

Michael R. Fellows, Danny Hermelin, Frances A. Rosamond, Hadas Shachnai. Tractable Parameterizations for the Minimum Linear Arrangement Problem. *ACM Transactions on Computation Theory* 8(2): 112 (2016).

Frances A. Rosamond, Editing to Cliques: A Survey of FPT Results and Recent Applications in Analyzing Large Datasets. 6th Latin-American Workshop on Cliques in Graphs, Vol. 44 (2016).

Holger Dell, Thore Husfeldt, Bart M. P. Jansen, Petteri Kaski, Christian Komusiewicz, Frances Rosamond. The First Parameterized Algorithms and Computational Experiments Challenge. Published in the IPEC Proceedings for 2016, LIPI-CS series, Schloss Dagstuhl, 2016.

2016 Ground Reachability and Joinability in Linear Term Rewriting Systems are Fixed Parameter Tractable with Respect to Depth Mateus de Oliveira Oliveira Proc. of the 11th International Symposium on Parameterized and Exact Computation (IPEC 2016) Aarhus, Denmark , August 2016

Causality in Petri Nets is MSO Definable Mateus de Oliveira Oliveira Proc. of the 23rd Workshop on Logic, Language, Information and Computation (WoLLIC 2016) Puebla, Mexico, August 2016

Satisfiability via Smooth Pictures Mateus de Oliveira Oliveira Proc. of the 19th International Conference on Theory and Applications of Satisfiability Testing (SAT 2016) Bordeaux, France, July 2016

Size-Treewidth Tradeoffs for Circuits Computing the Element Distinctness Function Mateus de Oliveira Oliveira Proc. of the 33rd International Symposium on Theoretical Aspects of Computer Science (STACS 2016). Orleans, France, February 2016.

An Algorithmic Metatheorem for Directed Treewidth (arxiv) Mateus de Oliveira Oliveira Discrete Applied Mathematics, Vol. 204, Pages 49-76, 2016

2017

M. Fellows. Surfing With Rod. *Computability and Complexity*, 2017: 9–18.

Adam R. Day, Michael R. Fellows, Noam Greenberg, Bakhadyr Khoussainov, Alexander G. Melnikov, Frances A. Rosamond: *Computability and Complexity - Essays Dedicated to Rodney G. Downey on the Occasion of His 60th Birthday*. Lecture Notes in Computer Science 10010, Springer 2017, ISBN 978-3-319-50061-4.

Mingyu Xiao, Frances A. Rosamond: *Frontiers in Algorithmics - 11th International Workshop, FAW 2017, Chengdu, China, June 23-25, 2017, Proceedings*. Lecture Notes in Computer Science 10336, Springer 2017, ISBN 978-3-319-59604-4.

L. Jaffke, Hans L. Bodlaender, Pinar Heggenes, Jan Arne Telle. “Definability Equals Recognizability for k -Outerplanar Graphs and l -Chordal Partial k -Trees,” *European Journal of Combinatorics*, 66:191234, Elsevier, 2017.

L. Jaffke, Bart M. P. Jansen. “Fine-Grained Parameterized Complexity Analysis of Graph Coloring Problems,” in *Proceedings 10th International Conference on Algorithms and Complexity (CIAC 2017)*, volume 10236 of LNCS, pages 345-356, Springer, 2017. [Note: A full version has been submitted to a journal.]

L. Jaffke, O-joung Kwon, Jan Arne Telle. “Polynomial-time algorithms for the longest induced path and induced disjoint paths problems on graphs of bounded mim-width.” In *Proceedings 12th International Symposium on Parameterized and Exact Computation (IPEC 2017)*, volume 89 of LIPIcs, pages 21:1-21:13, Schloss Dagstuhl Publishing, 2017.

Mateus de Oliveira Oliveira. “Parameterized Provability in Equational Logic.” *Proc. of the 26th International Conference on Automated Reasoning with Analytic Tableaux and Related Methods (TABLEAUX 2017)*. Brasilia, Brazil, September 2017.

Mateus de Oliveira Oliveira. “On Supergraphs Satisfying CMSO Properties.” *Proc. of the 26th Annual Conference of the European Association for Computer Science Logic (CSL 2017)*. Stockholm, Sweden, August 2017.

Mateus de Oliveira Oliveira, Pavel Pudlk. “Representations of Monotone Boolean Functions by Linear Programs.” *Proc. of the 32nd Computational Complexity Conference (CCC 2017)*. Riga, Latvia, July 2017.

Christian Komusiewicz, Mateus de Oliveira Oliveira and Meirav Zehavi. “Revisiting the Parameterized Complexity of Maximum-Duo Preservation String Mapping Problem.” *Proc. of the 28th Annual Symposium on Combinatorial Pattern Matching (CPM 2017)* Warsaw, Poland, July 2017.

Appeared or to appear in 2018

M. R. Fellows, A. Kulik, F. Rosamond and H. Shachnai. “Parameterized Approximation via Fidelity Preserving Transformations,” *Journal of Computer and System Sciences* 93 (2018), 30-40.

L. Jaffke, O-joung Kwon, Jan Arne Telle. “A unified polynomial-time algorithm for Feedback Vertex Set on graphs of bounded mim-width.” In *Proceedings 35th Symposium on Theoretical Aspects in Computer Science (STACS 2018)*, volume 96 of LIPIcs, pages 42:1-42:14, Schloss Dagstuhl Publishing, 2018.

Mateus de Oliveira Oliveira. “A Near-Quadratic Lower Bound for the Size of Quantum Circuits of Constant Treewidth.” To appear in the *Proc. of the 29th ACM-SIAM Symposium on Discrete Algorithms (SODA 2018)*. New Orleans, Louisiana, USA.

Mateus de Oliveira Oliveira. “Size-Treewidth Tradeoffs for Circuits Computing the Element

Distinctness Function”. Accepted to *Theory of Computing Systems* (Journal).

Michael R. Fellows and Frances A. Rosamond: A brief history of Edward K. Blum and the Journal of Computer and System Sciences. *Journal of Computer and System Sciences* 94 (2018) 2?10.

Frances Rosamond: Computational Thinking Enrichment: Public-Key Cryptography. *Informatics in Education*. Accepted for publication 2018.

Maise Dantas da Silva, Michael R. Fellows, Fabio Protti, Frances A. Rosamond and Ueverton Souza: Algorithms, Kernels and Lower Bounds for the Flood-It Game Parameterized by the Vertex Cover Number. *Discrete Applied Mathematics*. Accepted for publication 2018.

In Review

L. Jaffke, Mateus de Oliveira Oliveira. “On Weak Isomorphism of Rooted Vertex-Colored Graphs.”

Mateus de Oliveira Oliveira, L. Jaffke, Hans Raj Tiwary. “Complexity Measures for Permutation Groups.”

L. Jaffke, O-joung Kwon, Torstein J. F. Strmme, Jan Arne Telle. “Generalized distance domination problems and their complexity on graphs of bounded mim-width.”

Michael R. Fellows, Lars Jaffke, Alz Izabella Kirly, Frances A. Rosamond and Mathias Weller. “What is known about vertex cover kernelization?”

Lars Jaffke, Mateus de Oliveira Oliveira. “Unconditional Lower Bounds for Circuit-Based Compressions.”

Daniel Lokshtanov, Mateus de Oliveira Oliveira, Saket Saurabh. “A Strongly-Uniform Slice-wise Polynomial Time Algorithm for the Embedded Planar Diameter Improvement Problem.”

Mateus de Oliveira Oliveira, Michael Wehar. “On the Fine Grained Complexity of Finite Automata Non-Emptiness of Intersection and Related Problems.”

Mateus de Oliveira Oliveira. “Unifying Partial Order Formalisms via Slice Languages.”

Mateus de Oliveira Oliveira. “Summing Graphs under Logical Constraints.”

Michael R. Fellows, Frances Rosamond, Ueverton S. Souza, and Maise D. Silva. A Survey on the Complexity of Flood-Filling Games.

7.2 Talks and Presentations

2016

SEN-National Symposium of Software Engineers in Amsterdam in January. Prof. Fellows gave an invited lecture. Rosamond collaborated with Prof. Joek van Montfort, principal of the company xota.com which teaches Scratch to children, who then became involved in the Creative Mathematical Sciences Communication (CMSC2016) conference that Rosamond helped organize in Luebeck in October.

Fixed-Parameter Computational Geometry I, Lorentz Center, Leiden in February hosted the Workshop to investigate intractable problems on spatial data. A positive result was closer collaboration with Prof. Benjamin Burton, Univ. Queensland. Rosamond became an external auditor of the PhD dissertation of one of his students. A second result was that the NetWorks group, sponsor of the workshop, became a sponsor of PACE. A third result was Bart Jansen's slide on the publication history of parameterized complexity that showcases the growth of the field.

Scottish Combinatorial Conference in Glasgow, with Fellows and Rosamond both invited speakers. There was also time for research collaboration with Kitty Meeks on a project of parameterized Nash Equilibrium. Meeks visited Bergen for two different weeks in 2016. Meeks and Jessica Enright are working on a project about networks of migration, to which Mike and I discussed possible parameterization.

Informatics Department Chairs and Ministry of Education of Norway, Tromso meeting. Fellows and Rosamond gave a presentation giving history and information about the recent curriculum changes in New Zealand, Australia and UK. They visited the Norwegian Centre for ICT in Education in Tromso and were informed about the Norwegian Centre's future projects.

Free University of Bozen-Bolzano, June to give a seminar and collaborate on AI and cognitive science discussions. Additional positive results included meeting Prof Sven Helmer who runs workshops Rails Girls, which originated in Finland. Helmer and several colleagues came to the CMSC conference in Luebeck in October.

ICALP in Rome, followed by the 7ECM, the Imaginary Conference, and the celebration of the birthday of Rolf Niedermeier (TU Berlin), all in Berlin in July. The International Colloquium on Automata, Languages and Programming (ICALP), is the main European conference in Theoretical Computer Science and the annual meeting of the European Association for Theoretical Computer Science (EATCS).

ALGO/ESA/IPEC/PACE in Aarhus. This an annual meeting combining the premier algorithmic conference European Symposium on Algorithms (ESA) and several other specialized conferences and workshops, all related to algorithms and their applications, making ALGO the major European event for researchers, students and practitioners in algorithms. Rosamond had several major roles at the 2016 IPEC. Rosamond is Chair of the Steering Committee of PACE, which held its first competition in 2016 and announced the winners at IPEC. She is the Publicity Director of IPEC, and reports at the business meeting.

Investiture of Professor Michael Fellows AC as Order of Australia, Companion to the Queen,

Canberra, Australia, September. This is Australia's highest civilian honour.

The 3rd Creative Mathematical Sciences Communication conference (CMSC2016) was held in Luebeck, Germany. Rosamond created this conference series starting in 2013 in Darwin, Australia, supported by Google, the Australian Mathematics Association, CDU and other sponsors. It was held again in Chennai in 2015, and now in Luebeck. The purpose of the conference is to gather researchers in CS education.

Luebeck FPT New Horizons Workshop. This workshop immediately follows CMSC.

Royal Society of New Zealand Fellows Day in Auckland, October. About 50 Fellows were in attendance. In 2014, Fellows was awarded as an Honorary Fellow of the Royal Society of New Zealand. Additional meeting was with Michael Dinneen, University of Auckland, who was one of Mike Fellows' PhD students at UVIC, Canada in the area of parameterized complexity.

2017

10th CIAC, Athens, Greece, 2017-05-24. Lars Jaffke presented paper: Fine-Grained Parameterized Complexity Analysis of Graph Coloring Problems.

12th IPEC, Vienna, Austria. 2017-09-08. Lars Jaffke presented paper: Polynomial-time algorithms for the longest induced path and induced disjoint paths problems on graphs of bounded mim-width.

GRASTA 2017: Workshop on Graph Theory Searching and Applications. Anogia, Crete. April. Mike presented. Discussions focused on complexity of games. We have much original material in preparation for a book on this topic.

BEBRAS Workshop, Brescia Italy 27/05/17 to 02/06/17. The purpose of this trip was to learn how the competition problems are developed, compare Bebras to Computer Science Unplugged, and determine its potential benefits for use in Norway.

Birthday celebration for Mike Fellows. June 14 - 15, UiB. Researchers from around the world came to celebrate Mike at the two-day Birthday Party in his honour.

FAW2017 took place in Chengdu in June. Fellows and Rosamond were both speakers. Rosamond was Co-Chair with Mingyu Xiao. Several days after the conference tutoring students.

IWOCA: Fellows and Rosamond were members of the Program Committee for the 28th International Workshop on Combinational Algorithms (IWOCA) that took place in Newcastle, Australia July 17-21, 2017. This IWOCA was in honour of its founder Professor Mirka Miller, Univ Newcastle, who was a dear colleague for many years. Mirka passed away from cancer last year.

ALGO/ESA/IPEC/PACE: September in Vienna. Rosamond give the Publicity Report at

the Business Meeting. She presented PACE, Excellent Student Paper and Best Paper awards.

IMSc-Chennai / IIT-Gandhinagar: October/November. Fellows and Rosamond visited the Institute of Mathematical Sciences, Chennai. Fellows gave a workshop. A teacher workshop was scheduled but was canceled due to the monsoon. Visit was made to IIT-Gandhinagar in Gujarat to visit Neeldhara Misra, now professor there. Rosamond and Fellows both gave talks. They also gave a Computer Science Unplugged workshop to 120 middle school students at a military base.

2018

35th STACS, Caen, France. 2018-03-03. Lars Jaffke presented a paper: A unified polynomial-time algorithm for Feedback Vertex Set on graphs of bounded mim-width.

18th Logical Foundations of Computer Science Conference (LFCS) in Florida, USA, January 2018. The LFCS is a prominent conference series that was started in 1989. The conference honored Prof. Anil Nerode, a pioneer of logic and computing, on his 85th birthday. Anil was Rosamond's PhD advisor at Cornell. Both Rosamond and Fellows were special invitees. Fellows was the opening plenary Invited Speaker on the origins and horizons of parameterized complexity.

7.3 Other Publications and Publicity

FPT News: The Parameterized Complexity Newsletter, Editor: Frances Rosamond. Vol. 12(1) May 2016 and Vol. 12(2) November 2016. Vol. 13(1) February 2017, Vol. 13(2) June 2017, and Vol. 13(3) November 2017. Vol 14(1) February 2018. ISSN 2203-109X. Website: <http://fpt.wikidot.com/fptnews>: the-parameterized-complexity-newsletter. See also the Parameterized Complexity wiki at Website: <http://fpt.wikidot.com> and the community facebook page at "@MikeFellowsFPT".

7.4 Outreach Activities

The *Research Days (Forskningsdagene)* held in Bergen are an annual festival dedicated to research. It is a European-wide event held on the 23 September annually. During this event, research and learning institutions of Bergen present their activities to a broad audience including children and adults, laymen and experts. Rosamond organized *Computer Science Unplugged!* activities for more than ten schools and almost 500 students, with their teachers. Similar activities were presented to adults at the *Research Night at the Historic Museum*, which lasted past midnight. 2016 and 2017.

Advising and mentoring is done by every member of the team. For examples, PhD student Lars Jaffke supervised visiting Erasmus Bachelor student Aliz Kiraly, working on paper [8] (2017). Post-Doc researcher Mateus de Oliveira Oliveira has organized a team with Masters students to compete in the PACE competition 2018.

The project hosts many research visitors who give Department Seminars, participate in

Winter/Summer Schools, and otherwise contribute to research and to dissemination.

10. Grant Application Activities.

The proposal entitled *Parameterized Complexity for Practical Computing*, was made to the Norwegian Research Council Toppforsk Program, and approved for funding up to NOK 24,884,000 over a period of five years, beginning in 2018 and ending in 2023.

Nordplus Horizontal 2018. Project title: *Culturally Diverse Approaches to Learning Mathematics and Computational Thinking*. Project number NPHZ-2018/10063. Our project aim is to build on and promote innovative and interactive learning Mathematics and Computational Thinking through the systematic exchange of experience for different cultures. The coordinating institution is Vilnius University. UiB is a Partner Institution with contact person Frances Rosamond. Submitted 2017.

Elitesatsning Universitetet i Bergen – Bergens Forskningsstiftelse:
Scientific progress report 2017

Reporting period: 01/01/2017-31/12/2017

DIAFORCAST: DIabetes prognosis FOR risk of development and progression to Complications And Stratified Therapy

1) Publishable summary:

Diabetes mellitus is a lifelong, incapacitating disease affecting 416 million people in 2015, and there will be 642 million diabetic patients in 2040, with 60% attributable to the developing countries. Diabetes management and treatment account for about 12-15% of direct health care costs in most European countries (about 5,000€patient with complications a year). Chronic hyperglycemia leads to a damage of macro- and microvascular vessels in the heart, kidney, eye and nerves. Diabetes is the leading cause of renal failure and acquired blindness worldwide. In particular, little is known about adequate means for prevention and treatment of microvascular complications in populations with history of poor living conditions. Despite decades of research, the mechanisms underlying vascular damage in patients with diabetes are far from clear. There is a lack of specific modalities for the treatment of microvascular diabetic complications. Therefore, DIAFORCAST focuses on identification of causal molecular underpinnings underlying risk or protection from diabetes complications that will support the design of novel strategies for therapy and prevention of diabetes progression and more efficient clinical trials.

2) Main project objectives and sub-goals:

Main objective. To unravel genetic and non-genetic markers associated with diabetes macro- and microvascular complications.

Specific sub-goals.

1. To unravel novel factors which promote protective mechanisms from diabetes associated complications in populations exposed to extreme stress or famine situations.
2. To identify and characterize a panel of genetic, epigenetic and blood markers in adults which can be used to differentiate different subtypes of diabetes associated complications.
3. To validate in longitudinal studies identified prognostic value of genetic and non-genetic markers as early indicators for intervention strategies to prevention of diabetes progression.

3) Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far:

This report covers 1½ year period from 01.09.2016-31.12.2017.

New clinical studies in populations with extreme exposures

Until now most of the existing clinical studies with although limited but available information on vascular complications in diabetes have mainly been focusing on identification of risk factors. Due to the heterogeneous nature of diabetes, studies on risk factors for diabetes complications has been a difficult task with limited progress. DIAFORCAST research framework is built on a concept of a new study designs focusing on identification of protective factors despite extreme environmental exposures and thereby representing more homogenous populations. We believe that this approach will grossly help to identify molecular mechanisms responsible for maintenance of complication-free survival in patients with diabetes. We have therefore launched collection of patients in two studies,

one in long-term patients with type 1 diabetes (PROLONG) and one in patients exposed to perinatal starvation who developed type 2 diabetes in adulthood (DOLCE) to identify protective factors from vascular complications. We have applied a multi-omics approach including metabolomics, large-scale genetic and whole genome transcriptomics analyses, and functional in vitro modelling.

To progress to data generation, processing and established integrated data analyses, the following actions have been taken:

-Recruitment of 4 new researchers with 100% employment to the group: 1 research analyst focusing on metabolomics analyses in the PROLONG study, one PhD student focusing on functional analyses of the key processes in the PROLONG study, one PhD student focusing on large scale genetic analyses in the DOLCE study, and one postdoctoral fellow focusing on large scale transcriptomics analyses in the PROLONG and DOLCE studies.

- To join forces and increased sample size in our studies, we have initiated a collaboration with similar DIALONG study conducted at UiO (Prof. Tore Julsrug Berg).

-To improve power in epidemiological analyses in the DOLCE study we have initiated collaboration with National Academy of Medical Sciences in Ukraine and obtained data on 400,000 patients with diabetes from the Ukraine national diabetes registry.

-We have completed analyses of targeted metabolites in the PROLONG and DIALONG studies in the collaboration with Lund and Umea Universities, Sweden.

-We have completed large-scale genome-wide association genotyping of approximately 500 000 markers in 4000 patients with type 2 diabetes from the DOLCE study.

-To provide sustainability of data access and maintenance of the collected data, we established a collaboration with Lund University Diabetes Center and management plan how the data for data storage and accession. Our newly employed researchers were trained in large-scale genomic analyses within the frame of this agreement.

In order to characterize genetic and non-genetic markers underlying susceptibility of diabetes progression, we have implemented procedures for procurement and analyses of peripheral blood lymphocytes isolated from PROLONG patients and embryonic retinal cultures. Specifically, we have:

-Established two panels for profiling and characterization of immune markers in type 1 diabetes which are responsible for diabetes progression to vascular complications

-Established an in vitro mice model of embryonic retinal cultures to study short and long-term effects of starvation exposure in collaboration with Lund University. We have also initiated establishment of similar model using human embryonic retinal cultures. This model has been used for investigation of short-term and long-term changes of gene expression after starvation exposure.

-Initiated studies on morphological, immunohistochemical and genomic analyses of changes which take place in retinal morphology caused by starvation exposure. Samples have also been stored for more sophisticated analyses in the future.

Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far):

The major advances during the first year, and which clearly go beyond state of the art are as follows:

- Effective recruitment of 4 researchers with professional qualifications that allowed efficient integration of data analyses and processing of different parts of the project
- The almost completion of the large-scale metabolomics and genotyping analyses, and successful establishment of an in vitro validation model.
- The quality control analysis of biological samples from the clinical studies in order to generate candidate biomarkers using key “omics” resources; metabolomics, genetics, transcriptomics and functional models. This represents an important improvement as many of these analyses previously were lacking required discovery, validation and confirmation pipeline stages.
- The almost completion of the integrated discovery and in vitro validation analyses. First data have already resulted in a novel research findings on the key mechanisms leading to diabetes retinopathy which being prepared in the manuscript for submission to a high impact New England Journal of Medicine journal.
- The identification of novel candidate biomarkers involved in the pathogenesis of diabetes retinopathy and neurodegenerative diseases that may lead to development of drugs with common beneficial therapeutic potential on preventing retinopathy and Alzheimer disease co-morbidity in patients with type 2 diabetes. This will represent a research data resource for diabetes researchers with a tremendous potential impact on both science and clinic.

4) Reasons for deviations from the original work plan and their impact on the work and resources. Propose corrective actions. (if applicable):

Targeted metabolomics analyses in DIALONG samples were planned to be analyzed at Lund University using the same metabolomics platform as PROLONG samples. Accidentally, during the sample processing the GC/MS instrument got out of the order and technical failure could not be repaired. We analyzed samples using a different HILAC instrument, however, the coverage of metabolites was different and did not allow a direct comparison of the metabolites between PROLONG and DIALONG studies. We therefore made an agreement with Umea University that has identical GC/MS metabolomics platform to run targeted metabolic analyses in DIALONG samples. The completion of the analyses was very successful, although it resulted in delay in statistical processing of the data.

No other deviations occurred.

5) Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on the work and resources. Propose corrective actions. (if applicable):

The project is on target and on schedule.

6) Outlook on scientific activities 2018:

Competition of ongoing integrative genomic analyses and submission of publications.

Functional follow-up of key findings in in vitro models.

Submission and approval of applications to the ethical committee for patient recruitment for follow-up studies and recruitment by genotype studies.

Preparation of protocols for physiological investigations in patients for follow-up studies and recruitment by genotype studies.

Initiation of national collaboration for validation of genetic discoveries. We will initiate large scale genome wide association genotyping of Norwegian Child Diabetes Registry and perform biomarker assessment of the longitudinal effects of biomarkers on progression of type 1 diabetes.

Initiation of collaborations with pharmaceutical industries for possible validation of the genetic findings in clinical trial settings.

Organization of scientific workshop between collaborative LUDC, UiO for bridging scientific discoveries in diabetes.

Participation in the two H2020 calls.

7) Links with other projects:

We are part of the EU consortia Rhapsody “Assessing risk and progression of pre-diabetes and type 2 diabetes to enable disease modification”. Within this consortium we participate with DOLCE study in diabetes re-classification analyses.

We are part of the EU consortia BEAt-DKD “Biomarker enterprise to attack diabetes kidney disease”. Within this consortium we participate with both DOLCE and PROLONG studies to assess protective markers for diabetes kidney disease.

8) Major dissemination activities (peer-reviewed publications, other publications, oral presentations, posters, media presentation, outreach etc.):

Peer-reviewed publications

1. Sandholm N, Van Zuydam N, Ahlqvist E, Juliusdottir T, Deshmukh HA, Rayner NW, Di Camillo B, Forsblom C, Fadista J, Ziemek D, Salem RM, Hiraki LT, Pezzolesi M, Trégouët D, Dahlström E, Valo E, Oskolkov N, Ladenvall C, Marcovecchio ML, Cooper J, Sambo F, Malovini A, Manfrini M, McKnight AJ, Lajer M, Harjutsalo V, Gordin D, Parkkonen M; FinnDiane Study Group, Jaakko Tuomilehto., **Lyssenko V**, McKeigue PM, Rich SS, Brosnan MJ, Fauman E, Bellazzi R, Rossing P, Hadjadj S, Krolewski A, Paterson AD; DCCT/EDIC Study Group, Jose C. Florez., Hirschhorn JN, Maxwell AP; GENIE Consortium, David Dunger., Cobelli C, Colhoun HM, Groop L, McCarthy MI, Groop PH; SUMMIT Consortium. The Genetic Landscape of Renal Complications in Type 1 Diabetes. *Journal of American Society for Nephrology*. 2017 Feb;28(2):557-574.
2. Olesen K, Jensen TM, Diaz LJ, Møller ACL, Willaing I, Lyssenko V. Sense of Coherence is associated with LDL-cholesterol in patients with type 1 diabetes - The PROLONG-Steno study. *J Clin Transl Endocrinology*. 2017 Feb 11;8:1-5.
3. Wheeler E, Leong A, Liu CT, Hivert MF, .. Rotter JI, Langenberg C, Barroso I, Meigs JB. Impact of common genetic determinants of Hemoglobin A1c on type 2 diabetes risk and diagnosis in ancestrally diverse populations: A transethnic genome-wide meta-analysis. *PLoS Medicine*. 2017 Sep 12;14(9):e1002383.
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Poster presentations

2017, San-Diego 91-3 June, the 76th American Diabetes Association - poster

Invited lectures

- 2017 Invited lecture, “Genetic factors underlying Type 2 diabetes”/DORI symposium, SS Cedars-Sinai Diabetes and Obesity symposium, LA/USA
- 2017 Invited lecture, workshop “Developing novel approaches for identifying heterogeneity in early T2DM pathophysiology” / NIH/ Washington/ USA
- 2017 Invited lecture “Diabetes genetics, clinical implications” Norwegian Endocrine Society/ Bergen/ Norway
- 2017 Lecturer “*Genetics of diabetes*”/ Biomedical master course on Glucose homeostasis/ Lund University / Sweden
- 2017 Lecturer “Diabetes pathogenesis - one disease, many faces”/ Bergen Research School of Inflammation/ Voss/ Norway
- 2017 Teaching, lecture “Typ 2-diabetes: patogener, glukossänkande behandling, genetik”/ medical students, termin 8/ UiB/ Norway
- 2017 Invited lecture “How to unravel protective factors from diabetes progression”/ Tübingen/ Germany
- 2016 Invited lecture Famine workshop on *Long-term Impact of Ukrainian famine of 1932-1933*/ Leiden/ Netherlands
- 2016 Keynote lecture “*Contemporary views on genetic of diabetes – the new kids on the block?*”/ Jacobaeus symposium Genomics of Diabetes – What’s next?/ Bergen/ Norway
- 2016 Invited lecture “*Diabetes forecast from a genetic landscape*”/ LUDC: Ten years of progress “From heterogeneity to personalized treatment/ Lund University/ Sweden
- 2016 Teaching, lecture “*Genetics of diabetes*”/ Biomedical master course on Glucose homeostasis/ Lund University/ Sweden

Teaching

2016 - 2017 - Medical students, termin 8/ UiB/ Norway

2016 – 2017 - Biomedical master course on Glucose homeostasis/ Lund University/ Sweden

Commission of Trust

- 2017 Expert evaluator for EU FP7 commission PREVIEW consortia
- 2016-2017 Scientific review board/ Diabetes Wellness foundation
- 2016-2019 Scientific review board/ Swedish Research Council/ B1.Endocrinology, Metabolic diseases including Reproduction and Gastrointestinal diseases

- 2016 Scientific evaluation postdoctoral committee, KG Jebsen center for diabetes research/ University of Bergen/ Norway
- 2017 Chairmen, Scientific review board/ South-East Regional Health Authority/ Norway
- 2016 Scientific review board/ South-East Regional Health Authority/ Norway

Type of publication/activities – please choose: peer-reviewed publication, other publication, organisation of conference, organisation of workshop, websites/applications, press release, flyer, article in popular press, videos, media briefings, oral presentation to a wider public, oral presentation to a scientific event, exhibition, thesis (MSC or PhD), interview, film, TV-clip, poster. ****Type of audience – please choose:** Scientific, Industry, Civil society, Policy makers, Medias

Date dd/mm/ yyyy	Type of publication/ activities	Reference, title, and URL if applicable	Type of audience**	Size of audience	Countries addressed

See above

9) Grant application activities in the reporting period:

A grant to the European Association Study for Diabetes (4,000,000 NOK), but unfortunately this was not taken further.

Meltzer foundation for organizing conferences, University of Bergen – awaiting decision.

10) Explanations on deviations of the use of resources between actual and planned use of resources (supplement to financial report):

In 2017 two postdoctoral fellows were planned to be recruited but qualified only one. The second postdoctoral fellow is planned to be recruited in 2018.

Elitesatsning Universitetet i Bergen – Bergens Forskningsstiftelse:
Scientific progress report 2017

Reporting period: 01/01/2017-31/12/2017

1) Publishable summary:

'Frontlines of Value' is an innovative class-driven research project on global capitalism and inequality in the 21st century. It seeks to occupy the open space between Piketty's 'Capital' (2013) and Graeber's 'Debt' (2011) – landmark studies in the current intellectual climate. It does so from the vantage point of 'Anthropological Political Economy'. The team, working in several world-regional locations, will develop the notion of the 'frontlines of value' by elaborating an ethnographically driven, multi-scalar methodology that seeks to simultaneously universalize, compare, and specify among cases and thus develop both a global vision and a set of outstanding case studies.

2) Main project objectives and sub-goals:

Main objective: Working out the notion of 'Frontlines of Value', develop an appropriate multiscalar approach, and realize a set of case studies as well as a more integrative narrative of class relationships within 21st century global capitalism.

3) Work performed from the beginning of the project to the end of the period covered by the report and main results achieved so far:

The PI has spent a considerable part of his time in 2017 recruiting a team of researchers – as well as leading an expert committee for an associate professor hire in the Department of Social Anthropology. Contracts were signed in the fall with two postdocs and six researchers (which will commence in 2018, see below). Also a research assistant was hired who has been working on a bibliography on value (provisionally completed in March 2018).

Notable actions: On the invitation of David Harvey, the PI has given a series of four lectures at the Graduate Center, City University of New York (November) - a global centre for the study of inequalities (Branko Milanovic, Paul Krugman, Joe Stiglitz, David Harvey are all there). He was also invited by the Fudan Institute for Advanced Study, Shanghai, for a talk on populism (22 November).

In June 2017, a PhD course with the title "The Capitalism Workshop" was offered at UiB. The workshop was given by six researchers from the Max Planck Institute for Social Anthropology plus the Director, Prof. Chris Hann; three researchers from the Barcelona based "Real Economics" project, including the PI Prof. Susana Narotzky, plus three invited researchers who will be affiliated with the Frontlines project in the next years (Dr. Luisa Steur; University of Amsterdam; Dr. Patrick Neveling, SOAS, London; Dr. Theodoros Rakopoulos, University of Oslo). 8 PhDs from Bergen and Oslo attended the course, 7 submitted final papers.

4) Progress beyond the state of the art and expected potential impact (including the socio-economic impact and the wider societal implications of the project so far):

The PI and researchers associated with the Frontlines program are instrumental in helping to produce a visible shift in the discourse of anthropology (and the social sciences) worldwide. Class, capitalism, inequality are becoming far more central to the disciplinary (and interdisciplinary) agenda, as evidenced by sessions at the American Anthropological Association, Washington DC, December 2017, and accepted sessions at the European Association of Social Anthropologists to be held in Stockholm, August 2018.

Public outreach: The PI was invited to give the “Amsterdam Lecture” at the University of Amsterdam on “The Future of the World Society” (April 2017); and, also in the Netherlands, to serve as expert on populism in Eastern and Western Europe in a TV program by the VPRO broadcaster on Dutch television (April 2017). This, after a page long interview in the leading Dutch newspaper NRC Handelsblad (<https://www.nrc.nl/nieuws/2017/05/08/het-oosten-van-het-oosten-is-woedend-8721910-a1557602>)

5) Reasons for deviations from the original work plan and their impact on the work and resources. Propose corrective actions. (if applicable):

Two modifications.

Of the three four year postdoc positions in the original work plan 1,5 have been transformed into researcher positions. The advantage: reduced vulnerability for the project and a wider spread of projects/better use of resources. Postdocs need to be active on the international labor market, creating a danger for any project that consists solely of postdoc positions that one or two will leave early, certainly with the top international researchers that Frontlines has tried to recruit. One postdoc is on a two year contract rather than a four year contract but will continue his affiliation/research with Frontlines after the two years. He was offered a tenured position in Singapore. I recommended him to take that position and negotiate a two year buy out on behalf of his participation in Frontlines. The 6 recruited researchers are all bought out from incumbent positions to implement (fieldwork) projects within the frame of Frontlines for periods from one semester to 1,5 years. They will be actively affiliated with Frontlines for the whole period until 2022.

Postdocs and researchers (with one exception) were only available from September 2018. So there is a slight delay in implementation of the project. This does not have any material repercussions.

6) Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on the work and resources. Propose corrective actions. (if applicable):

See under 5

7) Outlook on scientific activities 2018:

PI: fieldwork until summer holiday. First urban case study on creative classes/creative cities, Cluj, Romania (two further cases will follow, one in Northwestern Europe, one in Southern Europe).

Whole team of 10 scholars plus affiliated researchers assembling for a workshop in Bergen in September 2018.

PI plus postdocs in Bergen during the fall semester for intensive collaborative work, theoretical vision, and preparation for further fieldwork.

8) Links with other projects:

Egalitarianism Program, UiB/social anthropology, led by Prof. Bruce Kapferer.

Financialization project, Max Planck Institute for Social Anthropology, Halle, led by Prof. Chris Hann and Prof Don Kalb.

9) Major dissemination activities (peer-reviewed publications, other publications, oral presentations, posters, media presentation, outreach etc.):

Type of publication/activities – please choose: peer-reviewed publication, other publication, organisation of conference, organisation of workshop, websites/applications, press release, flyer, article in popular press, videos, media briefings, oral presentation to a wider public, oral presentation to a scientific event, exhibition, thesis (MSC or PhD), interview, film, TV-clip, poster. ****Type of audience – please choose:** Scientific, Industry, Civil society, Policy makers, Medias

Date dd/mm/ yyyy	Type of publication/ activities	Reference, title, and URL if applicable	Type of audience**	Size of audience	Countries addressed
2017	peer reviewed article	“Afterword: After the Commons – Commoning!”. In: Focaal – journal of global and historical anthropology, no. 76: 67-73	academic		Worldwide
31/03/2017	blog	“The EU at 60: The Treaty of Rome is a Smoke Screen”. In: Focaalblog 31 March.	academic/civil society/media		Worldwide and Europe in particular
31/03/2017	blog	“Anthropologists on the EU at 60”. Moderation of blog series	academic/civil society/media		Worldwide and Europe in particular
10-12/01/2017	workshop contribution	“Populism workshop”, Barcelona, Autonomous University of Barcelona.	academic	40	Worldwide, Europe, Eastern Europe
28-29/03/2017	Workshop contribution	Contribution on populism to “CEU – Berkeley Symposium”, Budapest	academic/civil society/media	60	Worldwide, Europe, Eastern Europe
31/4/2017	Workshop contribution	New York University, French Institute, “Class, Populism and the French Elections”	Academic/civil society/media	200	France, Europe, 'the West'

01.04.2017	Economic Anthropology Conference	Society for Economic Anthropology annual conference, Iowa City, "Finance and the capitalist transition debate".	Academic	100	World, Europe
21.04.2017	Workshop organization	Utrecht University, Sovereignty and social contestation	Academic	80	World
08.05.2017	Interview popular press	NRC Handelsblad https://www.nrc.nl/nieuws/2017/05/08/het-oosten-van-het-oosten-is-woedend-8721910-a1557602	Media		World
2-6/5/2017	Conference contribution	Canadian Association for Social Anthropology	Academic	100	World
18-21/5/2017	Conference contribution	Kiev Polytechnic, Political science dept, talk on populism	Academic/Civil society/media	150	World, Europe, Ukraine
4-6/6/2017	Lecture	Bristol Institute for Advanced Study, Eastern Europe and populism	Academic	20	Europe, Eastern Europe
9-10/6/2017	Workshop contribution	Regensburg, Graduate School in Eastern Europe studies	Academic	60	Europe, Eastern Europe, 'the West'.

25-27/6/2017	Workshop organization/ Phd course	“Capitalism for anthropologists”, University of Bergen	Academic	25	World
28-29/9/2017	Keynote	Romanian Anthropological Society, Bucharest, conference on ‘class’.	Academic	50	Eastern Europe
25.10.2017	Phd defense	Central European University, Budapest	Academic	20	Serbia
27-28/10/2017	Workshop contribution	University of Vienna, Anthropology dept, European Association of Social Anthropologists, “Deservingnes”	Academic	20	world
nov.2017	Public Lecture series (4)	Graduate Center, City University of New York, Center for Place, Power, Culture and Anthropology department	Academic, Civil Society, Media	50	World, Europe
23-25/11/2017	Workshop contribution	Shanghai, Fudan Institute for Advanced Study, Populism and modernity	Academic	30	World
29-11/3-12/2017	Panel contribution	American Anthropological Association Conference, Invited Panel, Populism	Academic, Civil Society, Media	100	World

10) Grant application activities in the reporting period:

None

11) Explanations on deviations of the use of resources between actual and planned use of resources (supplement to financial report):

Planned resources:

2017 Budget	UiB-part	BFS-part	Total
Payroll and indirect expenses	929 000	1 026 000	1 955 000
Procurement of R&D services			
Operating expenses	112 000	150 000	262 000
Equipment			
Total	1 041 000	1 176 000	2 217 000

Actual costs:

2017 Accounts	UiB-part	BFS-part	Total
Payroll and indirect expenses	189 606	893 080	1 082 686
Procurement of R&D services			
Operating expenses		144 866	144 866
Equipment			
Sum	189 606	1 037 946	1 227 552

Payroll and indirect expenses

UiB part

Planned resources: Postdoc/postdoc-level researcher and research assistant

Actual costs: Research assistant, employed 50% 1/1-31/5 2017, 60% 1/11-31/12 2017, total kr. 189 606

The difference between the planned and actual costs for UiB Payroll and indirect expenses is due to the start of the employment contracts for the postdoc and postdoc-level researcher. The start was originally planned and budgeted for 2017, but since the best candidates for the positions are available from September (postdoc)/October 2018 (postdoc-level researcher), the employment contracts commence in September/October 2018. The remaining budget for 2017 is transferred to 2018-2021.

BFS part

Planned resources: Project Investigator

Actual costs: Project Investigator 50% 1/1-31/7 2017, 100% from 1/8 2017

The difference between the planned and actual costs for BFS Payroll and indirect expenses (kr. 132 920) is due to lower actual salary costs of the Project Investigator who was employed 50% in the first half of 2017. The remaining budget for 2018 is transferred to 2018-2021.

Operating expenses

UiB part

Planned resources: visiting researchers and operating expenses for postdoc

Actual costs: 0

Due to the start of employment contracts in 2018 instead of in 2017, the budget for operating expenses for postdoc is transferred to 2018. The visiting researchers' stay will take place in 2018, after the above team members will join the project, and the budget for the 2017 is transferred to 2018.

Frances Rosamond, Ph.D.

Institutt for Informatikk

Company #916332165: Rosamond Computer Science Research and Education

Report January – December 2017

This report summarizes my activities and outcomes for the January – December 2017 year, and describes plans and goals for 2018. It is organized according to the following plan.

- I. Algorithmic activities
- II. Education / Outreach activities
- III. Publications
- IV. Travels and Presentations
- V. Outlook on Scientific Activities in 2018

I. Algorithmic Activities

- The Toppforsk proposal, “Parameterized Complexity for Practical Computing” was the primary initiative of 2017. The reviews were excellent and the university chose our proposal. We are very happy with this success and are already finding PhD and postdoc applicants.
- The second *Parameterized Algorithms and Computational Experiments Challenge* (PACE), a parameterized complexity programming competition continues to be a success. The challenge was first implemented in 2016 with 14 teams from 5 countries competing. This year there were 17 teams from 11 countries. Winners and future directions were announced at a Special Session of the *International Symposium of Parameterized and Exact Computation* (IPEC) co-located with ALGO/ESA in Vienna, Austria, in August 2017. The session was chosen so that it immediately followed the IPEC business meeting and was in the same auditorium. This meant that an even wider community was informed about the programming involved in implementation. Two winners gave brief details about their winning strategies. (Website: <https://pacechallenge.wordpress.com>).

We have secured 5 years of sponsorship of 4000 Euros each year from NETWORKS, Netherlands a consortium of 50 researchers from 4 institutions with the aim to address the pressing challenges posed by large-scale networks using stochastics and algorithms. In 2017, I was also able to convince a department to fund the participation of one of its student winners to attend IPEC/PACE. I have been the Steering Committee Chair from the start of PACE and have been involved in every aspect of this project, including designing, making and handing out the awards and getting the information on the ALGO website. We had to argue to have our reports about PACE included in the *LNCS IPEC Proceedings*.

An important outcome of PACE was a serious discussion about reviewing held at the Business Meeting. The IPEC Call for Papers says it welcomes practical results. The IPEC reviewers stated that they do not know how to review a practical paper, and always favor a

theoretical paper first. Implementers said they do not want to submit papers to IPEC because they feel they are unfairly reviewed. The result was that for the first time, an expert in implementation (a winner of the PACE competition) was appointed to the IPEC Program Committee (for 2018).

- The IPEC *Excellent Student Paper Awards* and the IPEC *Best Paper Awards* came about partly due to my insistence. The papers undergo normal review process and are chosen by the IPEC Program Committee co-chairs with some input from me. I create the award documents and donate \$100 for each paper. (Website: <https://algo2017.ac.tuwien.ac.at/ipec/>)
- I am the Publicity Director of IPEC, which is actually publicity director for the parameterized complexity community. I write/edit the Parameterized Complexity Newsletter, the wiki and the facebook page. I advertise the Nerode Prize, IPEC and other workshops/conferences, jobs and awards. The mailing list has over 1500 names/emails. Copies of the 2017 newsletters are attached. (Website: www.fpt.wikidot.com)
- I co-edited the Festschrift for Rodney Downey (Victoria University of Wellington, NZ) *Computability and Complexity: Essays Dedicated to Rodney G. Downey on the Occasion of His 60th Birthday*. There are 45 essays and an estimated 750 pages. I invited authors, wrote the Preface and the information on front and back covers, sourced the cover sketch, and handled the organization details including obtaining copyright forms from authors and making sure all the tex files compile. The book was published by Springer in January 2017.
- I was Program Co-chair for FAW, the *International Frontiers of Algorithmics Workshop* which has run successfully for about a decade as an international conference in theoretical computer science held in China. FAW was held in Chengdu, China, from June 23 to 25, 2017. The proceedings are Springer LNCS. I am guest co-editor (with co-PC chair Mingyu Xiao) of a special FAW issue of the journal *Theoretical Computer Science*.
- The FPT workshop: *FPT Data Wrangling for Social Good* is scheduled for July 2018 immediately following the CMSC conference in Wellington, New Zealand (see more below) has been arranged by me. The timing has a benefit in that FPT researchers also interested in outreach can attend both.
- A new Inter-institutional Erasmus Agreement 2017—2021 between Vilnius University and UiB has been arranged. Separately, I helped orient and mentor Erasmus student Aliz Kiraly who visited for three months from University of Szeged, Hungary.
- I provided letters of recommendation or faculty evaluations for the School of Engineering and Advanced Technology, Massey University, New Zealand; for Charles Darwin University; Pädagogische Hochschule Zürich, others.
- Served on department appointment committees:
 1. Postdoctoral Fellow in Informatics – Chair: Professor Pinar Heggernes, Dept. Informatics.
 2. Researcher within Type Theory – Chair: Professor Bjorn Ian Dundas, Department of Mathematics.

3. Postdoctoral Fellow in Informatics – Chair: Professor Fedor Fomin
4. Machine Learning candidates – Evaluation (99 candidates)

Reviewed papers for FCT, IWOCA, FAW,

Attended Seminars of the Algorithms Group, Department Seminars, MedViz and Visualization Seminars. Attended Winter School.

II Education / Outreach activities

A key objective is to follow up on discussions we had at the meeting in Tromsø of the Heads of Informatics Departments of Norwegian universities on the subject of Computer Science curriculum reform at the school level (ages 6 on up). At the Tromsø meeting Norway's Minister of Education pointed to the fact that Norway lags most European and other developed countries in informatics curriculum reform at the school level.

- **BEBRAS.** I am creating a consortium to bring Bebras to Norway. I met Prof. dr. Valentina Dagienė, Vilnius University Institute of Mathematics and Informatics, when she came to UiB to help with the programming competition. Valentina is the originator of Bebras, a computational thinking competition for schools, grades 1–12. Schools in over 55 countries participate in the Bebras competitions, including New Zealand and Australia. Every teacher that I have spoken with about Bebras has been enthusiastic. Members of the consortium will include: Renate Jensen (Bergen Kommune) who is working with the Ministry of Education to make changes in the math and CS school curriculum. Herdis Moldøyen (Oslo) is the project leader of LKK (volunteer organisation to teach kids coding). Herdis has connections with the Department of Education who may be interested in supporting Bebras in some way. Prof. Line Kolås, a Project Director of “Excited – Center of Excellence in IT Education” (a center at NTNU and Nord University) will collaborate. Faculty from UiB, hvl and others are involved. A mailing list and minutes of the last meeting are attached. Our target is a trial competition in October 2018. (www.bebras.org)
- **GRANT PROPOSAL:** Nordplus Horizontal 2018. Project title: Culturally Diverse Approaches to Learning Mathematics and Computational Thinking. Project number NPHZ-2018/10063. Our project aim is to build on and promote innovative and interactive learning Mathematics and Computational Thinking through the systematic exchange of experience for different cultures. The coordinating institution is Vilnius University. Partner institutions are UiB, FI-University of Turku, SE-KTH Royal Institute of Technology, LT-Klaipeda Gedminu progymnasium, and FI-Nummenpakan primary school.
- **4th Creative Mathematical Sciences Communication conference (CMSC 2018)** which takes place July 2018 in Wellington, New Zealand. The purpose of the conference is to unite scientists, researchers, teachers, and artists in developing new ways of communicating mathematical and computational thinking, and to create new Computer Science Unplugged type activities. I started the series in 2013 in Darwin with support from Google, the Australian Mathematical Sciences Institute, Australian Council of Deans of ICT, and Charles

Darwin University. The second CMSC was held at IMSc in Chennai in 2015, and the third in 2016 at the University of Lübeck. I have done most of the organization including the website, media announcements and collaborating with participants. We would like to plan the 5th CMSC in Bergen in 2020. See the website: www.cmssc.nz and the announcement *CMSC 2018: 4th Creative Mathematical Sciences Communication Conference* by Frances Rosamond. Online Journal of Humanistic Mathematics, Vol 8 Issue 1 (January 2018) 38 downloads as of 12 March. (<http://scholarship.claremont.edu/jhm/>)

- A successful “Mini-Workshop on Math, Computational Thinking, Writing & Story” was held in October. Over 50 people came and they stayed the entire three hours. Fredrik Manne welcomed everyone. Speakers included Ian Roberts who was visiting from Charles Darwin University, Australia and Nancy Casey who was visiting from USA and had worked with Mike on MEGA-Math. Torstein Stromme described Bebras. Mike and I both gave presentations. Attendees included teacher trainers from hvl including Rune Herheim, Gert Hana, and Inge Hauge and their students. Sven-Olai Høyland from computer science hvl came, as well as the students from our UiB teacher preparation course. Renate Jensen and Morten Fahlvik from Bergen Kommune schools attended. From our Institute, there were attendees from the Algorithms Group, Security and Crypto, and Visualization. I also invited the Mathematics Department, and the Art and Design Institute. Several participants have followed up to learn more about the curricular reform in New Zealand, about Computer Science Unplugged, and about Bebras.
- The Research Days (Forskningsdagene) held in Bergen are an annual festival dedicated to research. It is a European-wide event held on the 23 September annually. During this event, research and learning institutions of Bergen present their activities to a broad audience including children and adults, laymen and experts. With Pina Kingman, we had constructed four huge tents in the park. Over ten schools and almost 500 students experienced various Sorting Networks and other algorithmic activities. We received the following email:
Thank you so much for participating at the science week. I know that the sorting tarps were a favourite amongst the children.
All the best,
Silje Vik Pedersen, Leder
Forskningsdagene i Bergen
- We presented several activities at Research Night at the Historic Museum. Our activities had more visitors come to our event and stay longer than at any other exhibit (even past midnight).
- Gave a workshop at the Bergen High School.
- Co-taught with Professor Petter Bjorstad and Prof. Mike Fellows a class for students preparing to become high school teachers of Informatics and mathematics.

III Publications

Adam R. Day, Michael R. Fellows, Noam Greenberg, Bakhadyr Khoussainov, Alexander G. Melnikov, Frances A. Rosamond: *Computability and Complexity - Essays Dedicated to Rodney G. Downey on the Occasion of His 60th Birthday*. Lecture Notes in Computer Science 10010, Springer 2017, ISBN 978-3-319-50061-4

Mingyu Xiao, Frances A. Rosamond: *Frontiers in Algorithmics - 11th International Workshop, FAW 2017, Chengdu, China, June 23-25, 2017, Proceedings*. Lecture Notes in Computer Science 10336, Springer 2017, ISBN 978-3-319-59604-4

Michael R. Fellows, Ariel Kulik, Frances A. Rosamond, Hadas Shachnai: *Parameterized approximation via fidelity preserving transformations*. *J. Comput. Syst. Sci.* 93: 30-40 (2018). Online version was available November 2017.

Frances A. Rosamond (Editor) *FPT News: The Parameterized Complexity Newsletter*, Vol. 13(1) March 2017, Vol.13(2) June 2017, and Vol. 13(3) October 2017. ISSN 2203-109X. Moderator of the Parameterized Complexity wiki. (Website: <http://fpt.wikidot.com/fptnews:the-parameterized-complexity-newsletter>).

Michael R. Fellows and Frances A. Rosamond: *A brief history of Edward K. Blum and the Journal of Computer and System Sciences*. *Journal of Computer and System Sciences* 94 (2018) 2–10.

M. R. Fellows, A. Kulik, F. Rosamond and H. Shachnai: *Parameterized Approximation via Fidelity Preserving Transformations*. *Journal of Computer and System Sciences* 93 (2018), 30-40.

Frances Rosamond: *Computational Thinking Enrichment: Public-Key Cryptography*. *Informatics in Education*. Accepted for publication 2018.

Maise Dantas da Silva, Michael R. Fellows, Fábio Protti, Frances A. Rosamond and Ueverton Souza: *Algorithms, Kernels and Lower Bounds for the Flood-It Game Parameterized by the Vertex Cover Number*. *Discrete Applied Mathematics*. Accepted for publication 2018.

Michael R. Fellows, Frances Rosamond, Uéverton S. Souza, and Maise D. Silva. *A Survey on the Complexity of Flood-Filling Games*. In Review.

Michael R. Fellows, Lars Jafke, Alz Izabella Kirly, Frances A. Rosamond and MathiasWeller: *What is known about vertex cover kernelization?* In Review.

IV Travels and Presentations

I collaborate with Prof Michael Fellows on talks that he gives and I make all the powerpoints for him as well as for my talks. Additionally, I am the “travel agent” for these trips and for the travel of Prof

Michael Fellows, which includes sourcing accommodation, arranging air/train/auto transport, and managing the conference registrations. Finally, it includes recording all expenses/receipts and coordinating with Tor.

DD24 Attendance at DD24 (Domain Decomposition), Svalbard, February 2017. The ultimate goal is to build some bridges to this research community that is strongly represented at UiB. There are two main lines of opportunity: (1) Versions of the domain decomposition approach useful in combinatorial optimization. A classic example is the approach of Brenda Baker in designing EPTASs (an approximation form of FPT) for combinatorial optimization problems on graphs of bounded genus. (2) The possibility of FPT algorithms for central subroutines in matrix algebra that are used in DD approaches in numerical analysis.

GRASTA 2017: Workshop on Graph Theory Searching and Applications. Anogia, Crete. April. Mike presented. Discussions focused on complexity of games. We have much original material in preparation for a book on this topic.

BEBRAS Workshop, Brescia Italy 27/05/17 – 02/06/17. The purpose of this trip was to learn how the competition problems are developed, compare Bebras to *Computer Science Unplugged*, and determine its potential benefits for use in Norway.

Birthday celebration for Mike. June 14 - 15, UiB. Researchers from around the world came to celebrate Mike at the two-day Birthday Party in his honour. I gave a laudation. The Happy Birthday song in Norwegian is different from American.

FAW2017 took place in Chengdu in June. Mike and I were both speakers. I was Co-Chair with Mingyu Xiao. We stayed several days after the conference tutoring students.

IWOCA: I was a member of the Program Committee for the *28th International Workshop on Combinatorial Algorithms (IWOCA)* that took place in Newcastle, Australia July 17–21, 2017. This IWOCA was in honour of its founder Professor Mirka Miller, Univ Newcastle, who was a dear colleague for many years. Mirka passed away from cancer last year.

ALGO/ESA/IPEC/PACE: September in Vienna. My activities are discussed above. I give the Publicity Report at the Business Meeting. Present PACE, Excellent Student Paper and Best Paper awards.

LONDON, October: We took a weekend to London to see our neighbor Thorbjørn Reuter Christiansen perform his father's "180 Hammerblows Against the War Monkeys", his mother Ursula's 1972 film *The Executioner*, and his brother's SuperFlex installation at the Tate Turbine Hall. We met with Univ Newcastle colleagues Pablo Moscato and Regina Berretta. We spent a day with Gregory Gutin (Royal Holloway).

IMSc-Chennai / IIT-Gandhinagar: October/November. We visited the Institute of Mathematical Sciences, Chennai where even the cooks remember us. Mike spoke. A teacher workshop was scheduled but was canceled due to monsoon. We visited at IIT-Gandhinagar in Gujarat to visit Neeldhara Misra, now professor there. Mike and Fran both gave talks. We also gave a Computer Science Unplugged workshop to 120 middle school students at a military school.

V Outlook on Scientific Activities in 2018

Activities from 2017 regarding PACE, IPEC, the Forskningsdagene, and interactions with Informatics and other departments will be continued. Editing and publication of the FPT Newsletter will be continued, as well as publicity/research dissemination via the wiki (www.fpt.wikidot.com) and facebook (www.MikeFellows@FPT). Research in theoretical computer science will be conducted, and resulting papers will be published.

A significant activity of 2018 will be **recruiting and orienting team members** (PhDs and post-docs) for the Toppforsk project. We have already identified some potential applicants and are moving forward with Linda on the advertising/hiring procedures.

Initiatives to renew education and disseminate information about **informatics in primary and lower and upper secondary schools**, primarily Norwegian schools will be engaged. *Bebras* and *Computer Science Unplugged!* are the most developed and international approaches. We will utilize these two agencies throughout Norway, with the Department of Informatics, UiB as the energizing Hub. A check-list of tasks to be accomplished has been developed. These include:

1. Engage and fund a supporter to attend the Bebras Workshop in Cyprus in May.
2. Hire a Website Supervisor to build and coordinate our website with our Netherlands collaborators Christian and Kim.
3. Translate Bebras into Norwegian for the website and other promotional materials.
4. Enlist teachers and schools for the trial competition, targeted for October 2018.
5. Prepare for a big informational and enlisting splash at NKUL in May 2019.
6. Identify and enlist sponsors.

The **2018 Creative Mathematical Sciences Communication** conference (www.cmsc.nz), July in Wellington, NZ, will work in parallel with Bebras. Many CS Unplugged tasks are already incorporated into Bebras tasks. Many logic problems that are used in the international mathematics competitions are similar to those in the Bebras tasks. I envision the Norwegian mathematics community, computer science community, children's coding, and the programming Olympiads all working together to create a strong IT infrastructure at every school level.

Research visitors already scheduled for 2018 include:

Julien Baste, LIP6, France

Laurent Bulteau, Univ Lyon

Danny Hermelin, Ben-Gurion University of the Negev

G. Philip, CMI India with possibly his student

Alexsander Andrade de Melo, University of Brazil, student of Ueverton Souza

Abhisekh Sankaran, IMSc Chennai

Participation at conferences, workshops and schools will help innovate, develop and disseminate the research program of the Toppforsk and other visionary projects. We anticipate the following 2018 travels.

- 18th Logical Foundations of Computer Science Conference (LFCS) in Florida, USA, January 2018. The LFCS is a prominent conference series that was started in 1989. The

conference honored Prof. Anil Nerode, a pioneer of logic and computing. Anil was Fran's PhD advisor at Cornell. Both Fran and Mike were especial invitees. Mike was the opening plenary Invited Speaker on the origins and horizons of parameterized complexity.

- British Mathematics Colloquium at St. Andrews University in Scotland, April, 2018. We are invited by Kitty Meeks, who has visited here in Bergen. Her area has a focus on parameterized counting. We used an example from her work in our grant proposal. Mike is a plenary invited speaker.
- Fixed-Parameter Computational Geometry II, Leiden Workshop, Lorentz Center, May 2018. This follows up the Geometry I workshop of 2016. Mike gave a talk at the Geometry I and it so interested Lars Jafke that he joined the team. Australian colleagues (Ben Burton) are also on the organizing committee.
- IWOCA 2018 in Singapore in July, 2018. This conference series was started by Mirka Miller (Univ. Newcastle, AU) and grew over 20 years. Mike will be a plenary Invited Speaker.
- CMSC 2018 in Wellington, New Zealand in July 2018. This conference (mentioned above) follows IWOCA. I am the primary organizer of every detail of this conference. The big outcome will be activities used around the world for IT enrichment.
- FPT Data Wrangling for Social Good workshop in Wellington in July 2018, immediately following the CMSC conference in Wellington, New Zealand. Two colleagues from Massey Univ has agreed to be the co-hosts.
- International Congress of Mathematicians: ICM (which happens every four years), and the satellite LAWCLIQUES Workshop in August, 2018. Papers are being prepared by Mike, Fran, Mateus and Lars for this event. We will meet with co-authors Maise Dantas da Silva, Fábio Protti and Ueverton Souza. Ueverton's student Alexander has applied to the Brazilian government to visit UiB for six months starting September 2018.
- ALGO/ESA/IPEC/PACE in Helsinki in August 2018. ALGO is an annual meeting combining the premier algorithmic conference European Symposium on Algorithms (ESA) and a number of other specialized conferences and workshops, all related to algorithms and their applications, including IPEC and PACE, making ALGO the major European event for researchers, students and practitioners in algorithms. The EATCS-IPEC Nerode Prize is award at ALGO. Fran is Steering Committee of PACE and Publicity Director of IPEC.
- Dagstuhl Seminar 18421. Algorithmic Enumeration: Output-sensitive, Input-Sensitive, Parameterized, Approximative in October 2018. Organized by Henning Fernau (Universität Trier, DE), Petr A. Golovach (University of Bergen, NO), Dieter Kratsch (University of Lorraine Metz, FR), Marie-France Sagot (University Claude Bernard – Lyon, FR). Mike and Fran have some preliminary work with Marek Karpinsky (Bonn).