



Committee for Oversight of Research Units

Annual Reporting for Faculty Supported Research Centres and Networks

All Centres (provisional Centres; McGill Centres), Research groups and Networks that receive funding from the Faculty of Medicine and Health Sciences (FMHS) are required to provide an annual report to the Committee for Oversight of Research Units ([CORU](#))

The reporting period is May 1, 2022 – April 30, 2023.

Please submit your report to the Research Office, Faculty of Medicine and Health Sciences (riac.med@mcgill.ca) before the following deadline:

May 15, 2023

Continued support from the Faculty is contingent on:

1. the receipt of the reporting documents on time,
2. the evaluation of reported activities by the Faculty's Committee for Oversight of Research Units (CORU),
3. the availability of Faculty funds.

Your strong engagement in the Faculty's mission for continued research excellence and financial stewardship is truly appreciated.

Annual Report of Activities and Outcomes

Name of the Unit: Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM)

Name of Unit leader & email address: Anmar Khadra and Frédéric Guichard

If the Unit is a **Senate-approved** McGill Research Centre, indicate date of approval: November 16, 2011

Mission statement of the Unit (~2 sentences):

The mission of CAMBAM is to take a national and international leadership role in promoting the applications of mathematical and computational sciences to study different aspects of physiological, biological and ecological systems, as well as foster collaborations *between the quantitative and experimental life scientists*. CAMBAM meets its objectives by promoting and fostering research, teaching and training in applications of quantitative life sciences at all levels ranging from the molecular/genetic through single cell and whole organ physiology and biology to population dynamics and broader ecological questions, at different time and special scales. CAMBAM accomplishes these goals through (i) establishing various training programs that are developed independently or in collaborations with other international and national centers, including workshops and summer schools that involve hands-on training and continuously evolving material that copes with recent advances made in the field; and (ii) building partnerships with industry that can provide internships for CAMBAM trainees. Such training opportunities assist CAMBAM PIs to develop the expertise of their trainees by bringing them up to speed with their research project and connect them with industry. CAMBAM also provides them with funding opportunities to reward exceptional trainees.

Total number of Unit members:

CAMBAM has 156 full members and 13 associate members (see **Appendix 1** for a list of members obtained from the listserv). The core members of CAMBAM include 23 faculty members.

Number of members affiliated with McGill's FMHS:

Close to 50% of CAMBAM members belong to FMHS.

Unit's website:

Please note the website needs to feature:

- all sources of funding support (including the FMHS logo),
- the list of Members and their institutional affiliation with appropriate links,
- the activities supported by the Unit,
- all previous Annual Reports.

Website address (URL): <http://www.crm.umontreal.ca/labo/cambam/en/>

Please respect the page limits, where indicated.

(minimum font size of 11 pts, use lay language)

1. Explain the significance of the Unit's mission at McGill and beyond (1/2 page max.)

- Maintain international leadership in the emerging field of quantitative biosciences. To accomplish this, CAMBAM has been a partner with an FQRNT-funded multi-center grant headed by the Centre de recherches mathématiques (CRM) since 2021.
- Connect researchers and students across faculties and institutions by creating interdisciplinary research teams and a framework for scientific and social interactions. That includes bridging complementary research programs together to establish multidisciplinary teams in the quantitative and life sciences. To accomplish this, we organize workshops and retreats and invite known speakers to the seminar series organized by CAMBAM in collaborations with other centers at McGill.
- Support and prepare students and postdoctoral trainees for the expanding career opportunities in quantitative biosciences in both industry and academia. Trainee members of CAMBAM regularly get email announcements about different academic and industry-based job opportunities.
- Establish stronger connections with industry. This is done through the industry partners of NSERC-CREATE in Complex Dynamics, a partner of CAMBAM since 2018. Several trainees in CAMBAM currently participate in internships with the industry partners of NSERC-CREATE.

2. Alignment with the [Faculty's Strategic Research Plan](#) (1/2 page max.)

CAMBAM contributes to the Faculty's research mission through its members' involvement in developing mathematical and computational tools for understanding how complex biological systems function - from molecular to organismal levels. CAMBAM's contribution was specifically mentioned in the 2017 McGill Faculties of Medicine and Dentistry Strategic Research Plan. In addition, CAMBAM had close ties with the Initiative in Computational Medicine (MiCM). In partnership with the MiCM, CAMBAM co-organized online workshops focused on mathematical and statistical methodologies. MiCM also provided seed funding to CAMBAM members with research focused on complex systems and machine learning (e.g., Anmar Khadra and Pouya Bashivan). CAMBAM also collaborates with the Quantitative Life Sciences Program in organizing a very successful seminar series in computational medicine. These activities will continue in the near future. Finally, CAMBAM is heavily involved in the QLS program with many CAMBAM members teaching in the QLS foundation course QLSC 600 (e.g., Anmar Khadra, Erik Cook, Dre Guichard, Leon Glass, Gil Bob) and (co-)supervising many QLS PhD students (e.g, Jonas Lehnert, Louis Richez, Niklas Brake).

Bioscience and health research is quickly expanding from being an exclusively data collection endeavor to one that embraces the development of new technologies and quantitative methods. For example, much of the field of genetics is now driven by statistical and computational algorithms. To meet these changing needs, our researchers actively prepare students for life in both academic research and industry with the goal of bridging the "training gap" that exists between students in bioscience and those from mathematics, physics and engineering. Importantly, CAMBAM's interdisciplinary mission directly supports McGill's Strategic Research Plan to create a "convergence of life sciences, natural sciences, and engineering".

During the next few years, CAMBAM will continue its leadership role in Quantitative Biology at McGill, within Quebec and internationally. CAMBAM has regularly organized summer schools on the applications of mathematical sciences to physiology and medicine and helped sponsor several workshops, one of which focused on infectious disease transmission, an urgent topic in this international health crisis of COVID-19 pandemic. We will continue to sponsor and promote interdisciplinary seminars, workshops, events and summer schools to bring together researchers from across faculties and institutions to solve critical problems in bioscience and medicine.

3. **Highlight the top-5 accomplishments of the Unit over the past 12 months** (1/2 page max., use bullets).

1. The organization of a very successful CAMBAM/QLS seminar series between Sept 2022-May 2023 (see **Appendix 2** for details). The list of invited speakers sponsored by CAMBAM includes Michael Frank (Stanford), Amy Goldberg (Duke), Peter Harrison (Cambridge), James Faeder (Pittsburgh), John Murray (Yale), Amber Smith (Tennessee), Daniela Witten (Washington), Bard Ermentrout (Pittsburgh), David Sussillo (Stanford), Byron Yu (Carnegie Mellon), Troy Day (Queen's) and Marina Sirota (UCSF). Please see **Appendix 2** for details. CAMBAM member Suresh Krishna co-organized it with the QLS.
2. The organization of a CAMBAM summer school, entitled “Summer School in Nonlinear Dynamics for the Life Sciences” between May 2022/05/30 – 2022/06/10 (see **Appendix 3** for details). The school was funded by NSERC-CREATE in Complex Dynamics (\$2,800) and CRM/CAMBAM (\$3,048.38). The summer school received ~100 applications; fifty of them were short-listed for the event (both Canadian and international). The two-week event covered different topics on the applications of nonlinear dynamics and computations to life sciences in immunology, molecular and cellular biology, neuroscience and ecology. The program included theory-based and application-based lectures taught by 23 internationally recognized researchers in the field including 14 CAMBAM members, as well as tutorial and computer labs that complemented the material covered in these lectures. There were also projects assigned to the participants to work on and supervised by the instructors. CAMBAM members Fred Guichard, Pouya Bashivan and Morgan Craig organized the event. Speakers were paid honorarium for participating. The IT team and TAs were also paid per hour.
3. Several members of CAMBAM have participated actively and successfully in establishing the Digital Health Network that WILL BE funded by the *Fonds de recherche du Québec* (FRQ). Several members of CAMBAM have been directly involved in establishing this network, including Anmar Khadra, Fred Guichard, Jacques Belair, Fahima Nekka and Morgan Craig. The network will receive \$1M per year in funding from FRQ and will consist of 4 independent axes: (1) Real-world data science; (2) Modeling and numerical methods; (3) Synthesis of evidence and digital interventions; (4) Digital transformation. Axis 2 is essentially an expansion of CAMBAM into the network. CAMBAM member Morgan Craig will be co-leading this axis, while Anmar Khadra will be co-leading Axis 3.
4. Several members of CAMBAM have actively participated in establishing a team in central Canada that submitted a proposal for the [Canadian Biomanufacturing Research Fund](#). This initiative will be of national scope with focus on the mathematical and statistical modeling of infectious diseases with the aim of establishing partnerships between academia and industry. CAMBAM members Anmar Khadra and Morgan Craig are both part of this initiative.
5. We invited CAMBAM trainees to submit proposals to organize online workshops whose themes are consistent with the scientific mission of CAMBAM. The call for proposals that was circulated by CAMBAM offered the organizers \$1,000 awards for full day workshops and \$500 for half-day workshops. We received three excellent proposals that were all approved by the CAMBAM board (see description of these workshops below). Two of these workshops will be 1-day events that will be held on June 16 and 28, while the third one will be a 2-day event that will be held on June 27 and 28). CAMBAM member Anmar Khadra took care of circulating the announcement and assisting the organizers with the setting up these workshops. CRM will post these workshops on the CAMBAM website.

4. **Major joint publications over the past 12 months** (including shared software, data repositories; with links). Please only feature the article co-authored by at least two PI members of the Unit:

As indicated earlier, CAMBAM has 156 full members and 13 associate members. These members are mostly researchers in the quantitative life sciences that pursue collaborations (fostered by CAMBAM) with experimental scientists. Collaborations are not typically expected to be formed between members of

CAMBAM. Nonetheless there are many publications that are co-authored by members of CAMBAM. Here is a sample of some of these publications (members of CAMBAM are underlined):

1. Thomas M Bury, Daniel Dylewsky, Chris T Bauch, Madhur Anand, Leon Glass, Alvin Shrier, Gil Bub. Predicting discrete-time bifurcations with deep learning. arXiv preprint arXiv:2303.09669, 2023.
2. Khady Diagne, Thomas M Bury, Marc W Deyell, Zachary Laksman, Alvin Shrier, Gil Bub, Leon Glass. Rhythms from two competing periodic sources embedded in an excitable medium. Physical Review Letters 130 (2), 028401, 2023.
3. Jean François Ndiaye, Fahima Nekka, Morgan Craig. Understanding the Mechanisms and Treatment of Heart Failure: Quantitative Systems Pharmacology Models with a Focus on SGLT2 Inhibitors and Sex-Specific Differences. Pharmaceutics 15 (3), 1002, 2023.
4. Tomáš Gedeon, Antony R Humphries, Michael C Mackey, Hans-Otto Walther, Zhao Wang. Operon dynamics with state dependent transcription and/or translation delays. Journal of Mathematical Biology 84 (1-2), 2022.
5. Amin Akhshi, Myriah Haggard, Mariana Marquez Machorro, Saeed Farjami, Maurice J Chacron, Anmar Khadra. Decoding the relative contributions of extrinsic and intrinsic mechanisms in mediating heterogeneous spiking activities of sensory neurons in vivo using computational modeling. bioRxiv, 2023.01. 03.521866, 2023.
6. Jonas Lehnert, Kuwook Cha, Kerry Yang, Daniel F Zheng, Anmar Khadra, Erik P Cook, Arjun Krishnaswamy. Probing visual sensitivity and attention in mice using reverse correlation. bioRxiv, 2022.09. 08.507101, 2022.
7. Ramesh Arumugam, Frithjof Lutscher, Frédéric Guichard. Tracking unstable states: ecosystem dynamics in a changing world. Oikos 130 (4), 525-540, 2021.
8. Jacques Bélair, Fahima Nekka, John G Milton. Introduction to Focus Issue: Dynamical disease: A translational approach. Chaos: An Interdisciplinary Journal of Nonlinear Science 31 (6), 060401, 2021.

5. **Major joint research projects funded over the past 12 months** (involving at least two PI members of the Unit):

1. NSERC-CREATE in Complex Dynamics (<https://cd-create.org/home>). PIs: Caroline Palmer (associate CAMBAM member) and Anmar Khadra (CAMBAM co-director).
2. Centre de Recherches Mathématiques (<http://www.crm.umontreal.ca/en/index.shtml>). PIs: Anmar Khadra (CAMBAM co-director) and Fred Guichard (CAMBAM co-director).
3. Digital Health Network-FRQ. PIs: Anmar Khadra, Fred Guichard, Jacques Belair, Fahima Nekka and Morgan Craig.
4. Several members of CAMBAM have actively participated in establishing a team in central Canada that submitted a proposal for the [Canadian Biomanufacturing Research Fund](#).

6. **Major outreach activities** (e.g., seminar series, general public events):

1. The organization of a very successful CAMBAM/QLS seminar series between Sept 2022-May 2023 (see **Appendix 2** for details). The list of invited speakers sponsored by CAMBAM includes Michael Frank (Stanford), Amy Goldberg (Duke), Peter Harrison (Cambridge), James Faeder (Pittsburgh), John Murray (Yale), Amber Smith (Tennessee), Daniela Witten (Washington), Bard Ermentrout (Pittsburgh), David Sussillo (Stanford), Byron Yu (Carnegie Mellon), Troy Day (Queen's) and Marina Sirota (UCSF). Please see **Appendix 2** for details. CAMBAM member Suresh Krishna co-organized it with the QLS.
2. The CAMBAM/QLS seminar series will continue in the academic year between Sept 2023-May 2024. A total of 12 talks will be allocated for CAMBAM. CAMBAM member Suresh Krishna will continue to co-organize it with the QLS.

3. CAMBAM has sponsored Dr. Daniël A. Pijnappels (Leiden University, Netherlands) to speak at the Graduate Research Day on May 10, organized by the Department of Physiology (McGill). CAMBAM suggested him as a speaker for the event and covered his travel expenses (see **Appendix 4**). Dr. Pijnappels will give a 1-hour talk and act as a poster judge during the event.

4. CAMBAM member Anmar Khadra and associate member Claire Guerrier are submitting a funding request to CRM to organize a one week symposium, entitled “Rhythms, Networks and slow-fast analysis in neural and endocrine systems”. The budget requested will be \$25,000 from CRM and \$15,000 from CAMBAM. A total of 25 national/international speakers and 10 local speakers will be invited (we will cover the travel and accommodation cost of out-of-town speakers) and the event will be made open for other participants, especially trainees, to attend. We aim to organize the event in the Summer 2024.

7. Major training activities (e.g., summer schools, co-supervision of trainees, practical workshops):

1. The organization of a CAMBAM summer school, entitled “Summer School in Nonlinear Dynamics for the Life Sciences” between May 2022/05/30 – 2022/06/10 (see **Appendix 3** for details). The school was funded by NSERC-CREATE in Complex Dynamics (\$2,800) and CRM/CAMBAM (\$3,048.38). The summer school received ~100 applications; fifty of them were short-listed for the event (both Canadian and international). The two-week event covered different topics on the applications of nonlinear dynamics and computations to life sciences in immunology, molecular and cellular biology, neuroscience and ecology. The program included theory-based and application-based lectures taught by 23 internationally recognized researchers in the field including 14 CAMBAM members, as well as tutorial and computer labs that complemented the material covered in these lectures. There were also projects assigned to the participants to work on and supervised by the instructors. CAMBAM members Fred Guichard, Pouya Bashivan and Morgan Craig organized the event. Speakers were paid honorarium for participating. The IT team and TAs were also paid per hour.

2. CAMBAM member Fred Guichard will be organizing a workshop, titled “*Avancées dans la théorie des réseaux écologiques: vers une intégrations des relations entre communautés et écosystèmes*” in Paris, France, between May 22-24, 2023 (see **Appendix 5**). The workshop will focus on ecological and evolutionary dynamics in networks using mathematical tools. CAMBAM is one of the sponsors of this event and will cover the travel expenses of three CAMBAM PhD trainees to attend this training event.

3. CAMBAM will be running three independent workshops that will be organized by CAMBAM trainees in the summer of 2023 (see **Appendices 6 and 7** of the email announcements). Each trainee will be paid \$1,000 for organizing these workshops. Here is the list of the three workshops.

I. Title: Exploring Single Neuron Excitability with Mathematical and Computational Models.

Organizer(s): Niklas Brake and Nils Koch (McGill).

Date: June 16, 2023

Duration: One full day

Description: Understanding the principles of neuronal excitability is fundamental for comprehending how neurons communicate with each other and perform computations. Computational models of neuronal excitability provide powerful tools to investigate the mechanisms underlying the generation and propagation of electrical signals in neurons. The Izhikevich model is a versatile model for studying neuronal excitability, which has been used in numerous studies to model a wide range of firing phenotypes. This workshop aims to provide participants with an understanding of the principles of computational modeling of neuronal excitability by focusing on the Izhikevich model as a case study. Through a hands-on approach, the workshop will guide participants through fitting the Izhikevich model to the qualitative firing features of neurons obtained from openly accessible data from the Allen Institute.

II. Title: Machine Learning Applications in Computational Neuroscience and Biology.

Organizer(s): Amin Akhshi (McGill).

Date: June 28, 2023

Duration: One full day

Description: The increasing availability of large neural datasets in recent years has necessitated the development of advanced data analysis methods. Machine learning (ML) models have shown great promise in this regard, providing powerful tools for understanding complex neural systems. This workshop aims to provide an introduction to machine learning techniques and their applications in computational neuroscience and biology. We will cover the basics of machine learning, including supervised and unsupervised learning, deep learning, and reinforcement learning, and explore their applications in neuroscience, such as neural decoding, brain-computer interfaces, and data-driven modeling.

III. Title: From Genome to Phenome: A Comprehensive Workshop on Genome-Wide Scans and Cutting-Edge Post-GWAS Techniques (1).

Organizer(s): Goodarz Koli Farhood, Sahel Jahangiri Esfahani (McGill).

Date: June 27 & 28, 2023

Duration: Two full days

Description: This workshop provides an introduction to Genome-Wide Association Studies (GWAS) and advanced post-GWAS analysis techniques for identifying genetic variants associated with complex diseases or traits. The workshop begins with a brief overview of GWAS methodology, including study design, quality control, data management, and statistical analysis. Participants will then learn how to use a machine learning tool (Regenie) to perform GWAS analysis, which accounts for population stratification, relatedness, and case-control imbalance to address potential biases in the detection of genetic associations. The workshop then covers the use of the FUMA platform for Functional Mapping and Annotation of Genome-Wide Association Studies. This tool integrates GWAS summary statistics with functional genomic data from a range of resources to identify functional genomic annotations indexed by GWAS signals. It also prioritizes candidate genes for further functional validation. Next, the workshop introduces the MAGMA gene-based analysis tool, which identifies genes that are enriched with genetic variants associated with a particular phenotype. MAGMA calculates gene-level p-values based on the association of a phenotype with genetic variants in and around each gene, accounting for gene size, LD structure, and SNP annotation.

4. In the summer of 2024, CAMBAM graduate and postdoctoral trainees will be offered awards to organize workshops similar to those that will be organized in June 2023. We expect to receive 5 proposals in total. CAMBAM member Anmar Khadra will take care of evaluating the suitability of these proposals.

5. CAMBAM will provide two competitive graduate fellowships, \$4,000 each in the upcoming academic year (~Dec 2023). The amount of the fellowship will be adjusted based on available funds. Interested applicants will be asked to submit transcripts, one reference letter from the supervisor, as well as a 1/2-page project description to be considered for the fellowship.

8. If applicable, **list new members** who joined the Unit in the past 12 months (indicate: Name, title, full/associate member, affiliation):

NA

9. If applicable, **list members who have left the Unit** in the past 12 months (indicate: Name, title, full/associate member, affiliation):

Kehinde Ajibade, Mr., member, Concordia University; Sofia Alfonso, Ms., member, McGill University
lfarley@CVLF.CA – unknow; Renato C. Calleja, Dr., member, Universidad Nacional Autónoma de México
Olivier LAFITTE, Dr., member, Université Sorbonne Paris Nord; Jesse Vincent-Herscovici, Mr., board member, MITACS; Darya Kryzskaya, Dr., member, McGill; Grigoris Kylafis, Mr., member, McGill

Financial report & forecast

Expenses	2022/23 report	2023/24 budget
Total salaries	\$0	\$0
Training	\$12,084.38	\$5,000
Stipends	\$0	\$8,000
Outreach	\$3,387.61	\$25,650.01
Publications	\$0	\$0
Other (detail in #10 below)	\$0	\$0
Total expenses	\$15,471.99	\$38,650.01

Revenues	2022/23 report	2023/24 budget
Carryover	\$0	\$11,589.01
FMHS	\$15,000	\$15,000
User fees	\$0	\$0
Other sources (detail in #10 below)	\$12,061	\$12,061
Total revenues	\$11,589.01	\$0

10. Budget justification and details (e.g., itemize if multiple salaries, detail other sources of funding):

Year 2022-2023: Unfortunately our budget was cut significantly this academic year compared to the previous one. As a result, we could not offer fellowships like to used to.

1. Training: CAMBAM sponsored 3 students to attend a workshop in Paris, France (\$5,000), paid for instructors, a TA and an administrator to help with the summer school (\$3,048.38), and will be paying 4 CAMBAM trainees to organize three workshops (\$4,000).
3. Outreach: CAMBAM paid for two speakers to give in-person talks at the CAMBAM/QLS seminar series (\$1,687.61) and at the Annual Graduate Research Day (\$1,700).

Year 2023-2024: Details are listed below.

1. Training: We have allocated \$5,000 to organize potentially 5 different workshops.
2. Outreach: (i) The CAMBAM symposium in the summer 2024 (\$15,000). (ii) Seminar series speakers. Eight out of town speakers will be invited to give talk in the joined CAMBAM/QLS seminar series (\$10,000 for the entire academic year). The other four CAMBAM speakers will be local.
3. Stipend: CAMBAM will provide two student fellowships to grad students, each worth \$4,000. The amount may vary depending on available funds.

Funding

The funding CAMBAM received this year came from several sources, including McGill Faculty of Medicine (\$15,000), McGill Faculty of Science (\$3,030), CRM/UdeM (\$1,637) and FRQNT/CRM (\$7,394).

11. Explain why continued support from the FMHS is crucial to Unit (½ page max):

FMHS support has allowed CAMBAM to pursue and achieve many of its current programs. Recognizing the fundamental importance of interdisciplinary research, CAMBAM has taken leadership role in promoting collaborations between members from across faculties and disciplines, and established track record of successful Canadian (Digital Health Network, R, NSERC-CREATE in Complex Dynamics) and international

partnerships (MBI, NIMBios and MIT). With FMHS funding, CAMBAM has accomplished all of its important objectives and maintains a level of activity (both local and international) that compares favorably with other McGill research centers. Continuing support from FMHS will promote our interdisciplinary support of quantitative bioscience at McGill as well as allow us to maintain our international presence and collaborations with other centers. It is important to emphasize that many CAMBAM members are also members in the Society for Mathematical Biology and took leadership roles in that activities of this society (for example, the annual meeting that took place in Montreal in 2019).

12. Provide suggestions about how the Faculty could do better to support the Unit and research efforts in general (**no page limit but please be specific and unleash your creativity!**)

At this point, CAMBAM has been running its operations without any administrative support. The CRM occasionally provides some help in that front when needed, but support is quite limited to certain activities. CAMBAM intentionally never spends any funding on administrative support and solely relies on the efforts of its co-directors to run all CAMBAM operations in order to save the very limited funding of \$15,000 received from FMHS to support the core activities of CAMBAM. Additional funding will come a long way in allowing CAMBAM to have the freedom to expand such programs and rely occasionally in administrative support if necessary. The number of workshops and symposia organized by CAMBAM will increase significantly if additional funds are provided.

Appendix 1



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<input type="checkbox"/>	caolan.kovach-orr@MAIL.MCGILL.CA Caolan Kovach-Orr	Regular	Mail	Post	6 Nov 2009
<input type="checkbox"/>	caroline.palmer@MCGILL.CA Caroline Palmer	Regular	Mail	Post	22 May 2020
<input type="checkbox"/>	celia.greenwood@MCGILL.CA Celia Greenwood	Regular	Mail	Post	20 Jul 2017
<input type="checkbox"/>	christopher.pack@MCGILL.CA Christopher Pack	Regular	Mail	Post	12 Feb 2018
<input type="checkbox"/>	claire.brown@MCGILL.CA Claire Brown, Dr.	Regular	Mail	Post	1 Sep 2015
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<input type="checkbox"/>	fahima.nekka@UMONTREAL.CA Fahima Nekka	Regular	Mail	Post	12 Feb 2018
<input type="checkbox"/>	felipe.dargent@MAIL.MCGILL.CA Felipe Dargent	Regular	Mail	Post	6 Nov 2009

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<input type="checkbox"/> grace.brooks@MAIL.MCGILL.CA Kyla Brooks	Regular	Mail	Post	22 Apr 2013	
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<input type="checkbox"/> jessica.brooks@MAIL.MCGILL.CA No Name Available	Regular	Mail	Post	6 Nov 2009	
<input type="checkbox"/> jessica.lyda@MAIL.MCGILL.CA Jessica Lyda	Regular	Mail	Post	8 Aug 2017	
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<input type="checkbox"/> lafitte@MATH.UNIV-PARIS13.FR No Name Available	Regular	Mail	Post	29 Apr 2020
<input type="checkbox"/> lajoie@DMS.UMONTREAL.CA Guillaume Lajoie	Regular	Mail	Post	19 Mar 2018
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<input type="checkbox"/> laurentiu.oprea@MAIL.MCGILL.CA Laurentiu Oprea	Regular	Mail	Post	8 Sep 2016
<input type="checkbox"/> lefebvre.gen@UQAM.CA Geneviève Lefebvre	Regular	Mail	Post	12 Feb 2018
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<input type="checkbox"/> michael.pedruski@MAIL.MCGILL.CA Michael Pedruski	Regular	Mail	Post	6 Nov 2009
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(<https://www.mcgill.ca>)

Appendix 2

Quantitative Life Sciences
(/qls/)

Quick Links ▾



McGill.CA (<https://www.mcgill.ca>) / QUANTITATIVE LIFE SCIENCES ([HTTPS://WWW.MCGILL.CA/QLS](https://www.mcgill.ca/qls)) / Seminars (</qls/seminars>)

QLS Seminar Series Fall 2022

QLS has joined efforts with the Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM), the McGill initiative in Computational Medicine (MiCM) and the Ludmer Center to offer weekly interdisciplinary seminars.

Seminars are held on Tuesdays from 12-1pm EST.

Zoom link: <https://mcgill.zoom.us/j/86855481591>
(<https://mcgill.zoom.us/j/86855481591>).

For recordings of the 2021-22 seminars please visit the [QLS YouTube Page](#)
(<https://www.youtube.com/playlist?list=PLCCQ0xdIWGLBz-kHpBctI5NWCWep86RO6>).

Fall 2022	Speaker	Topic
Sep. 13	Naeha Subramanian (University of Washington) Sponsored by QLS	<u>Innate immunity at the interface of host defense and immune disease</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-naeha-subramanian-341034)
Sep. 20	Michael Frank (Stanford) Sponsored by CAMBAM	<u>Bigger data about smaller people: Studying language learning at scale</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-michael-frank-341041)
Sep. 27	Amy Goldberg (Duke University) Sponsored by CAMBAM	<u>Evolutionary perspectives on malaria: humans, primates, and the parasites we share</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-amy-goldberg-341036).
Oct. 4	Michael Baym (Harvard University) Sponsored by QLS	<u>What other factors select on antibiotic resistance?</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-michael-baym-341761)
Oct. 11	Reading Week	Reading Week
Oct. 18	Satrajit Ghosh (MIT) Sponsored by QLS	<u>Unpacking the Speech Chain: A window of scientific and technological opportunities</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-satrajit-ghosh-342583).
Oct. 26 (Wednesday)	Fabian Theis (Helmholtz) Sponsored by QLS	<u>Learning Single Cell Atlases</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-fabian-theis-342769).

Fall 2022	Speaker	Topic
Nov. 1	Peter Harrison (Cambridge) Sponsored by CAMBAM	<u>Timbre and consonance</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-peter-harrison-342842).
Nov. 8	James Faeder (University of Pittsburgh) Sponsored by CAMBAM	<u>Computational Modeling of Intracellular Dynamics</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-james-faeder-343271).
Nov. 15	Sara Zapata- Marin (McGill University) Sponsored by QLS	<u>Understanding the spatio-temporal distribution of pollen in Toronto</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-sara-zapata-marin-343199).
Nov. 22	Laura Pollock (McGill University) Sponsored by QLS	<u>Promise and pitfalls in predicting biodiversity</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-laura-pollock-343445).
Nov. 29	John Murray (Yale University) Sponsored by CAMBAM	<u>Learning and Generalization through Neural Representations</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-john-murray-343832).
Dec. 6	Amber Smith (University of Tennessee) Sponsored by CAMBAM	<u>Modeling the Dynamics of Viral-Bacterial Coinfection</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-amber-smith-343607).


QLS would like to thank Dr. Jesse Shapiro, Dr. Suresh Krishna, and Dr. Celia Greenwood for their help with organizing the seminars.

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McGill Seminar Series in Quantitative Life Sciences and Medicine

QLS has joined efforts with the Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM), the McGill initiative in Computational Medicine (MiCM) and the Ludmer Center to offer weekly interdisciplinary seminars.

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(<https://www.youtube.com/playlist?list=PLCCQ0xdIWGLBz-kHpBctI5NWCWep86RO6>).

Winter 2023	Speaker	Topic
Jan. 10	Daniela Witten (University of Washington) Sponsored by CAMBAM	<u>Single-cell RNA-sequencing data analysis without double-dipping</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-daniela-witten-344255)
Jan. 17	Zeyu Bian (University of Miami) Sponsored by QLS	<u>Penalized doubly-robust estimation of adaptive treatment strategies</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-erica-moodie-344128)
Jan. 24	Meghan Azad (University of Manitoba) Sponsored by QLS	<u>Milk, Microbes and Models: Studying Human Milk and the Infant Microbiome as a Biological System</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-meghan-azad-344330)
Jan. 31	QLS Research Day	QLS Research Day Keynote Speaker: Leon Glass (McGill University) Tipping points, critical transitions and bifurcations in physiology: Can we predict the onset of pathological dynamics?
Feb. 7	Daniel Fortin (Laval University) Sponsored by QLS	<u>The use of ecological theory to predict animal distribution in changing environments</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-daniel-fortin-345540)
Feb. 14	Bard Ermentrout (University of Pittsburgh) Sponsored by CAMBAM	<u>Follow your nose: The dynamics of olfactory-guided search</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-bard-ermentrout-345928)

Winter 2023	Speaker	Topic
Feb. 21	David Sussillo (Stanford University) Sponsored by CAMBAM	<u>Neural dynamics shape task organization in multitask networks</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-david-sussillo-346055).
Feb. 28	Reading Week	No Seminar
Mar. 7	Byron Yu (Carnegie Mellon University) Sponsored by CAMBAM	<u>Brain-computer interfaces for basic science</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-byron-yu-346384).
Mar. 14	Alex Baldwin (McGill University) Sponsored by QLS	<u>Models of contrast summation in human vision</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-alexander-baldwin-346229).
Mar. 21	Sonia Kefi (University of Montpellier) Sponsored by QLS	<u>The multiplexity of ecological communities</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-sonia-kefi-346286).
Mar. 28	Lamin Juwara (McGill University) Sponsored by QLS	<u>Mitigating the impact of data bias through synthetic data generators</u> (//www.mcgill.ca/qls/channels/event/qls-seminar-series-lamin-juwara-346554).

Winter 2023	Speaker	Topic
Apr. 4	Fiona Brinkman (Simon Fraser University) Sponsored by QLS	<u>Disrupting disease, while promoting health: Bacterial Bioinformatics Battles</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-fiona-brinkman-347206).
Apr.11	Troy Day (Queen's University) Sponsored by CAMBAM	<u>The Epidemiology and Economics of Physical Distancing during Infectious Disease Outbreaks</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-troy-day-347402)
Apr. 18	Marina Sirota (UCSF) Sponsored by CAMBAM	<u>Leveraging Molecular and Clinical Data to Better Understand Alzheimer's Disease</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-marina-sirota-347817).
Apr. 25	Natalie Reznikov (McGill University) Sponsored by QLS	<u>Mapping of trabecular bone anisotropy in 3D: a tool to decipher the loading history of bones using microCT</u> (http://www.mcgill.ca/qls/channels/event/qls-seminar-series-natalie-reznikov-347488).

QLS would like to thank Dr. Jesse Shapiro, Dr. Suresh Krishna, and Dr. Celia Greenwood for their help with organizing the seminars.

Appendix 3

WELCOME REGISTER PROGRAM CONTACT **FRANÇAIS**

ORGANIZERS

Pouya Bashivan
(McGill University)

Morgan Craig
(CHU Sainte-Justine Research
Center & University of
Montreal)

Frédéric Guichard
(McGill University)

Overview

[Français]

GUEST SPEAKERS

[See the list](#)

Summer School in Nonlinear Dynamics for the Life Sciences (CAMBAM-CRM-CREATE) May 30-June 10, 2022 (online)

The summer school will cover a wide range of topics on the applications of nonlinear dynamics and computations to life sciences, ranging from the sub-cellular world to population dynamics. The program will include theoretical and practical courses taught by internationally renowned researchers in this field, as well as tutorials and computer labs that will complement the course content. The instructors will also supervise the group projects carried out by the participants.

The Center for Mathematics Applied to Biosciences and Medicine (CAMBAM), in collaboration with the Center for Mathematical Research (CRM) and with the support of the CRSNG-CREATE program in complex dynamics, is organizing an online summer course entitled "Summer School in Nonlinear Dynamics for the Life Sciences", from May 30 to June 10, 2022. This summer school is part of the long-standing biannual summer schools organized by CAMBAM as part of its training program

TH

ANNUAL PHYSIOLOGY GRADUATE RESEARCH DAY

9:30 a.m.
OPENING REMARKS

9:45 a.m. - 11:45 a.m.
Ph.D. ORAL PRESENTATIONS

12:00 p.m. - 1:30 p.m.
LUNCH

1:30 p.m. - 3:30 p.m.
POSTER PRESENTATIONS

3:30 p.m. - 4:30 p.m.
BIERMAN'S GUEST LECTURER:

Dr. Daniël A. Pijnappels

Professor of cellular electrophysiology & interdisciplinary translational cardiology, head of the Laboratory of Experimental Cardiology at the Leiden University Medical Center in the Netherlands

“Biological defibrillation”

4:30 p.m. - 5:00 p.m.
PRESENTATION OF PRIZES

5:00 p.m. - 6:00 p.m.
WINE & CHEESE

**FRIDAY
MAY 19, 2023**

The Ph.D. oral presentations will be held in the Palmer Howard Amphitheater, 6th Floor, McIntyre Medical Sciences Building. The poster sessions will be held on the 6th floor lobby.

INFORMATION

gradstudies.physiology@mcgill.ca



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Physiology

Appendix 5

‘Avancées dans la théorie des réseaux écologiques: vers une intégrations des relations entre communautés et écosystèmes’

Lundi 22 – Mercredi 24 Mai 2023

Institut d'Écologie et des Sciences de l'Environnement de Paris (iEES Paris)
Sorbonne Université, 4 place Jussieu
Salle 417, 4e étage, barre 44-45

Organisateurs : Jake Harvey, Brendon McGuinness, Frédéric Guichard
(Université McGill)

La théorie des réseaux appliquée à l'écologie permet la caractérisation des nombreuses interactions écologiques qui caractérisent la plupart des écosystèmes naturels. Les approches plus dynamiques, souvent contraintes à l'étude de motifs incluant un nombre restreint d'interactions, prédisent l'impact de ces interactions sur la stabilité des réseaux et permettent l'études d'interactions non trophiques qui échappent à une description classique des interactions écologiques. Plusieurs avancées, certaines récentes, ont démontré la possibilité d'intégrer approches dynamique et statistiques aux réseaux, avec l'intégration d'interactions non trophiques ('higher-order interactions') et de flux spatiaux.

L'objectifs de cet atelier sera de repousser davantage cette frontière grâce à des outils tels que les hypergraphes permettant de caractériser la topologie et l'étude dynamique des écosystèmes en tenant compte de l'ensemble d'interactions interspécifiques et écosystémiques reconnues comme cruciales au maintien de la diversité et des fonctions écosystémiques, telles que les relation trophiques, mais aussi le recyclage, les espèces ingénieuses, la plasticité et l'évolution des interactions, et les flux spatiaux (dispersion, flux de matière). Nous espérons profiter ce grand défi pour engager un dialogue entre spécialistes des approches statistique et dynamique à l'étude des réseaux, d'approfondir leur utilisation pour étudier la relation entre communautés et écosystèmes, et de faciliter leur application à des systèmes naturels.

Contactez Frédéric Guichard (frederic.guichard@mcgill.ca) pour toute information et pour confirmer votre participation.

Appendix 6

Anmar Khadra, Dr.

From: CAMBAM_Seminars - Department of Physiology
<CAMBAM_SEMINARS@LISTS.MCGILL.CA> on behalf of Anmar Khadra, Dr.
<anmar.khadra@mcgill.ca>
Sent: Wednesday, March 8, 2023 4:29 PM
To: CAMBAM_SEMINARS@LISTS.MCGILL.CA
Subject: [CAMBAM_SEMINARS] CAMBAM mini-workshops: Call for proposals

Call for proposals: CAMBAM Mini-workshops in Mathematical and Computational Biology, Summer-Fall 2020

This is a call for proposals to organize short (half-day or one-day) online workshops in mathematical and computational biology. The call is open to the trainees within the CAMBAM community, including postdocs, and graduate students.

Each workshop would focus on a methodology (mathematical, statistical, computational) to address biological problems.

Format

Each workshop would be run online (e.g. Zoom). Each workshop would be scheduled by the organizer(s), leaving enough time for approved workshops to be broadly advertised by CAMBAM and *Centre de recherches mathématiques* (CRM). Workshops should ideally be scheduled during the summer, but we will consider fall 2020 proposals.

Each workshop is expected to last half-day to a full day, but proposals could include a justification for longer events.

Workshop can be team-led and involve multiple speakers. They can involve combinations of a lecture and more interactive sessions with participants (break-out rooms, software tutorials, problem solving, discussions)

Financial support:

Organizers of a half (full) day workshop will receive \$500 (\$1,000) awarded directly to a graduate student or postdoc (co-)leading the event.

To apply, please send a short (1-2 page) proposal to Anmar Khadra (anmar.khadra@mcgill.ca) addressing the following points:

1. Title
2. Short scientific summary
3. Description of quantitative methodology to be covered
4. People involved including name of organizer(s) and of any additional speaker
5. List of activities (e.g. lecture, computer lab/demonstration, discussions). Describe any technical assistance/resources you might require.
6. Proposed timeline (tentative dates and length)

Proposals received by **April 17th 2023, 5:00 PM** will be given full consideration.

Anmar.

Anmar Khadra, Ph.D.

Associate Professor, Department of Physiology
Co-director, Centre for Applied Mathematics in Bioscience and Medicine (CAMBAM)
McGill University
McIntyre Medical Building, Room: 1120
Tel (Office): 514-398-1743
Tel (Lab): 514-398-3639
<http://www.medicine.mcgill.ca/physio/khadralab/>

Appendix 7

Anmar Khadra, Dr.

From: Anmar Khadra, Dr.
Sent: Monday, May 8, 2023 1:33 PM
To: CAMBAM_SEMINARS@LISTS.MCGILL.CA
Cc: Niklas Brake; 'Nils Koch'
Subject: CAMBAM Workshop - Exploring Single Neuron Excitability with Mathematical and Computational Models

Dear members,

CAMBAM is organizing the following online workshop on **June 16, 2023**.

Title: Exploring Single Neuron Excitability with Mathematical and Computational Models

Organizers: Niklas Brake and Nils Koch.

Description: Understanding the principles of neuronal excitability is fundamental for comprehending how neurons communicate with each other and perform computations. Computational models of neuronal excitability provide powerful tools to investigate the mechanisms underlying the generation and propagation of electrical signals in neurons. The Izhikevich model is a versatile model for studying neuronal excitability, which has been used in numerous studies to model a wide range of firing phenotypes. This workshop aims to provide participants with an understanding of the principles of computational modeling of neuronal excitability by focusing on the Izhikevich model as a case study. Through a hands-on approach, the workshop will guide participants through fitting the Izhikevich model to the qualitative firing features of neurons obtained from openly accessible data from the Allen Institute.

Quantitative Methodology to be Covered:

1. General overview of neuronal excitability and the various models available (Hodgkin-Huxley, Izhikevich, integrate and fire, etc.)
2. Deeper explanation of the Izhikevich model and its specific applications in neuroscience.
3. An overview of the Allen Institute's openly accessible data on neuronal excitability.
4. An introduction to the principles of model fitting and validation. Description of numerical integration and model fitting.

List of Activities:

1. Lecture: An introductory lecture on the principles of neuronal excitability and overview of the various models of excitability with an emphasis on the Izhikevich model. Theoretical description of numerical integration and parameter fitting algorithms.
2. Computer Lab/Demonstration: Participants will have the opportunity to apply the principles learned in the lecture by fitting the Izhikevich model to the qualitative firing features of neurons obtained from the Allen Institute's openly accessible data using Python. We will design interactive Jupyter Notebooks that the participants can build on to explore the practical challenges of modelling.
3. Discussion: Interactive discussions where participants can ask questions and share their experiences in breakout rooms.

To register in this event, please fill out the online form: <https://forms.office.com/r/3Hi9Q5G6qg>. The deadline for registration is June 12, 2023.

Kind regards,
Anmar Khadra.

Anmar Khadra, Dr.

From: Anmar Khadra, Dr.
Sent: Monday, May 8, 2023 1:47 PM
To: CAMBAM_SEMINARS@LISTS.MCGILL.CA
Cc: 'Sahel Jahangiri Esfahani'; Goodarz Koli Farhood
Subject: CAMBAM workshop - From Genome to Phenome: A Comprehensive Workshop on Genome-Wide Scans and Cutting-Edge Post-GWAS Techniques

Dear members,

CAMBAM is organizing the following online two-day workshop on **June 27 and 28, 2023**.

Title: From Genome to Phenome: A Comprehensive Workshop on Genome-Wide Scans and Cutting-Edge Post-GWAS Techniques

Organizers: Sahel Jahangiri Esfahani and Goodarz Koli Farhood.

Description: This workshop will provide an introduction to Genome-Wide Association Studies (GWAS) and advanced post-GWAS analysis techniques for identifying genetic variants associated with complex diseases or traits. The workshop will begin with a brief overview of GWAS methodology, including study design, quality control, data management, and statistical analysis. Participants will then learn how to use a machine learning tool (Regenie) to perform GWAS analysis, which accounts for population stratification, relatedness, and case-control imbalance to address potential biases in the detection of genetic associations. The workshop will cover the use of the FUMA platform for Functional Mapping and Annotation of Genome-Wide Association Studies. This tool integrates GWAS summary statistics with functional genomic data from a range of resources to identify functional genomic annotations indexed by GWAS signals. It also prioritizes candidate genes for further functional validation. Next, the workshop will introduce the MAGMA gene-based analysis tool, which identifies genes that are enriched with genetic variants associated with a particular phenotype. MAGMA calculates gene-level p-values based on the association of a phenotype with genetic variants in and around each gene, accounting for gene size, LD structure, and SNP annotation.

Quantitative methodology to be covered:

1. *Regenie*: a software tool used for GWAS analysis that aims to improve the detection of true genetic associations by accounting for population stratification and relatedness. It fits linear mixed models in two steps through applying linear/logistic ridge regressions on different blocks of single nucleotide polymorphisms (SNPs), separately, includes a polygenic background correction and a principal component analysis to control for population structure. This approach has been shown to increase power and reduce false-positive rates in GWAS studies, particularly in samples with complex family structures or cryptic relatedness.
2. *FUMA (Functional Mapping and Annotation of Genome-Wide Association Studies)*: An online platform that allows researchers to annotate, visualize, and interpret GWAS results. It integrates GWAS summary statistics with functional genomic data from a range of resources, including gene expression data, epigenetic marks, chromatin accessibility, and protein-protein interactions. FUMA can identify functional genomic annotations that are enriched with GWAS signals and prioritize candidate genes for further functional validation.
3. *MAGMA (Multi-marker Analysis of GenoMic Annotation)*: A gene-based analysis tool that tests for enrichment of genetic variants in gene regions. It calculates gene-level P values based on the association of a phenotype with genetic variants in and around each gene, while accounting for gene size, LD structure, and SNP annotation. MAGMA enables identification of genes that are significantly associated with a phenotype, as well as biological pathways (Gene-set) and tissue-specific expressions (Gene-property) that are enriched with these genes.

List of activities:

The workshop will include lectures as well as hands-on tutorials; practice data and a pipeline will be provided. Participants will need to have access to a LINUX server and have the introduced installed the software described here. Installation instructions will be provided.

To register in this event, please fill out the online [form](#). *The deadline for registration is June 20, 2023.*

Kind regards,
Anmar Khadra.

Anmar Khadra, Dr.

From: Anmar Khadra, Dr.
Sent: Monday, May 8, 2023 1:52 PM
To: CAMBAM_SEMINARS@LISTS.MCGILL.CA
Cc: Amin Akhshi
Subject: CAMBAM workshop - Machine Learning Applications in Computational Neuroscience and Biology

Dear members,

CAMBAM is organizing the following online workshop on **June 28, 2023**.

Title: Machine Learning Applications in Computational Neuroscience and Biology

Organizers: Amin Akhshi.

Description: The increasing availability of large neural datasets in recent years has necessitated the development of advanced data analysis methods. Machine learning (ML) models have shown great promise in this regard, providing powerful tools for understanding complex neural systems. This workshop aims to provide an introduction to machine learning techniques and their applications in computational neuroscience and biology. We will cover the basics of machine learning, including supervised and unsupervised learning, deep learning, and reinforcement learning, and explore their applications in neuroscience, such as neural decoding, brain-computer interfaces, and data-driven modeling.

Quantitative topics to be covered: During this workshop, we will focus on the following quantitative methodologies in the context of ML applications in neuroscience and biology.

1. Supervised Learning (Classification and Regression)
2. Unsupervised Learning (Clustering, Dimensionality Reduction)
3. Reinforcement Learning
4. Neural Networks (Deep Learning, Convolutional Neural Networks, Recurrent Neural Networks)

To register in this event, please fill out the online form: <https://forms.office.com/r/d7Y3RYgZtJ>. The deadline for registration is June 20, 2023.

Kind regards,
Anmar Khadra.