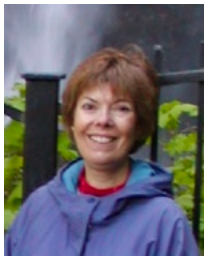
ICIAM Dianoia. Volume 12, Issue 2 April 2024



Welcome to the Spring/Autumn edition of ICIAM Dianoia. We have important ICIAM news of meetings, opportunities and new officers. In addition there is news from the International Science Council, and the introduction of an ambitious venture, the International Decade of Science for Sustainable Development. And this is the year to celebrate probability in prestigious international prizes.

Newsletter Content

1. Letter from the ICIAM President Wil Schilders, April 2024
2. Call for Proposals to Organize the 2025 ICIAM Board Meeting
3. ICIAM Reminders: April 2024
4. From the ICIAM Secretary, April 2024
5. Introducing ICIAM's New Officer-at-Large Kenji Kajiwara
6. Introducing ICIAM's New Officer-at-Large Yvonne Stokes
7. International Decade of Science for Sustainable Development
8. Review of the ISC report "Protecting Science in Times of Crisis"
9. News and Opportunities from the International Science Council
10. Michel Talagrand Wins the 2024 Abel Prize
11. Avi Wigderson Receives ACM A.M. Turing Award for Groundbreaking Insights on Randomness
12. Mathematical Congress of the Americas 2025: Deadline for Special Session Proposals Extended

Letter from the ICIAM President Wil Schilders, April 2024

Dear ICIAM colleagues and friends,

2024 is well underway, and since my New Year's message quite a few things have happened. First and foremost, the organisers of our next ICIAM Congress in The Hague, July 12-17, 2027 (note the dates in your agenda!), are doing very well with regards to the preparations for this important event. They are also benefitting from the experiences of past organisers, most prominently Valencia and Tokyo. We have great confidence in the team, including also the Scientific Program Committee, and I hope we will have another successful congress attracting many thousands of participants from all over the world. You can remain updated by regularly visiting https://iciam2027.org/ (https://iciam2027.org/).

As mentioned in January, the theme of the 2027 ICIAM Congress complies very well with the theme of the ''International Decade of Sciences for Sustainable Development'' (IDSSD) which is a follow-action of the ''International Year of Basic Sciences for Sustainable Development (IYBSSD 2022-2023). These initiatives have been put forward to UNESCO by the International Science Foundation (ISC), of which ICIAM is a full member. The ISC committee within ICIAM, led by past president Maria Esteban, and with members Liliane Basso Barichello, Yvonne Stokes (both officers-at-large) and Barbara Keyfitz (past president), is quite busy with all ISC related matters: a change of statutes that caused many discussions, the start of IDSSD and many other issues. Sustainability is also attracting the attention of many mathematicians, see for example the UNESCO publication, *Mathematics for* (https://www.unesco.org/en/articles/mathematics-action-

supporting-science-based-decision-making)*Action (https://www.unesco.org/en/articles/mathematics-action-supporting-science-based-decision-making),* a booklet addressing the role of mathematics with respect to the 17 sustainable development goals of UNESCO.

In the meantime, the two newly elected officers-at-large, Yvonne Stokes and Kenji Kajiwara, have been fully immersed in the activities of the ICIAM officers, and we are very happy to have them on board. In view of this, I would like to remind you that we are still looking for 2 additional officers-at-large that will be elected formally during this year's board meeting on June 17 (online). Please see the official reminder in this newsletter. The same holds for pre-bids concerning the ICIAM 2031 congress, these can still be sent to us. And we are still soliciting suggestions for the 2025 ICIAM Board meeting (plus associated workshop), an in person event. So if you would like to organise this, please contact us.

One of our officers, ICIAM secretary Suzanne Shontz, is featuring in a video made especially for the ''Mathematics and Statistic Awareness month'', and this is announced in the most recent version of ''SIAM Unwrapped'', April 2024. I hope many of you will have a look at the video (https://sinews.siam.org/Details-Page/celebrating-mathematics-and-statistics-awareness-month).

In my New Year's message, I mentioned quite a few conferences organised by member organisations of ICIAM all over the world. Right now, I would like to raise your attention for a conference on industrial and applied mathematics that will be held in Cape Town, September 30 till October 5. The organisers are very busy organising this event, and are planning to officially launch an African organisation for industrial and applied mathematics. Hence, I would like to ask all of you to consider attending this important event for African mathematics. More information can be found on the webpage https://aciam.co (https://aciam.co/).

End of May, I will be present during the annual Abel prize ceremony in Oslo. This year's winner, Michel Talagrand, will receive the Abel prize from the king of Norway, and many mathematicians will be there to celebrate this very special occasion. You can read more on the official web page of the Abel prize (https://abelprize.no/). It is really great that the Norwegian Parliament (The Storting) has installed this ''Nobelprize for mathematics'' in 2002, on the occasion of the 200th anniversary of Abel's birth.

This year's Board meeting will be held, for the first time online, on June 17. This will enable many more member societies to attend, and I hope many will be present. We decided to only have physical Board meetings in the odd years, from now on. The location for 2025 will be announced after the Board meeting.

Another activity that took place in recent months is concerned with the finances of ICIAM. Our treasurer, Heike Fassbender, set up a small committee that regularly discusses the finances of ICIAM, launching ideas for increasing the funds available to us and carrying out additional activities. We will report on this briefly during the Board meeting.

The officers are also busy speaking to member societies from their own continent, to see how things are going in these member societies and also whether any help can potentially be given. ICIAM is a global organisation and may be able to help individual societies. Together with Luis Vega, responsible for membership issues, there are also intensive discussions with African mathematicians, to see if we can increase the number of member associations on this continent. ICIAM strives to be a global organisation, and we welcome members from all continents of the world.

I hope we can continue to count on your support in all of these activities. Don't hesitate to share your opinions, ideas or suggestions with us. We can learn a lot from each other, and being together will make mathematics, especially in applications and industry, much stronger and more visible. This is our joint mission!

Wil Schilders, president

Wil Schilders

ICIAM President Wil Schilders is emeritus professor, Eindhoven University of Technology and director of the Dutch Platform for Mathematics. Previously he worked at Philips Research and NXP Semiconductors. He was founder and President of EU-MATHS-IN.

Call for Proposals to Organize the 2025 ICIAM Board Meeting

For the Board meeting in 2025, which will be in-person, we are soliciting expressions of interest to organize this meeting. Usually, these Board meetings take place on Saturday, with a 2-day technical workshop preceding it. If your society is interested in organizing the 2025 meeting, please send e-mail to Wil Schilders (president@iciam.org (mailto:president@iciam.org)) before May 31, 2024.

ICIAM Reminders: April 2024

Members are reminded to update their Society's information.

ICIAM maintains a self-service membership directory (http://www.iciam.org/members). Please take this opportunity to check your membership information, and update it if appropriate.

Instructions on how to update your entry or to add new information can be found in our membership FAQ (http://www.iciam.org/faq-members). Note that updates can only be done by a person designated as the "Editor" for that society. If you do not have that information, then send e-mail to the ICIAM Secretary (mailto:secretary@iciam.org) (secretary@iciam.org (mailto:secretary@iciam.org)) to name a new editor.

Here's a reminder that you can download a PDF file of any issue of ICIAM Dianoia (as long as the ICIAM Dianoia editor has remembered to set it up). Clicking on the "Downloads" button at the top of the browser view of the newsletter will bring up a screen that offers you a choice of A4 or US Letter to fit your printer.

From the ICIAM Secretary, April 2024

The following are details of some upcoming deadlines.

Pre-bids ICIAM 2031:

Following current rules, the online 2024 ICIAM Board meeting will be the place to present and discuss the pre-bids for ICIAM 2031. Only pre-bids approved and selected by the Board will be allowed to present a complete bid, to be discussed in the 2025 Board meeting, where the final decision will be made about who will organize ICIAM 2031. If your society plans to bid, please read the document (https://iciam.org/news/24/1/13/call-pre-bids-hosting-and-organising-iciam-2031-congress)describing how to prepare a bid. Note that in a pre-bid, details have to be given to the Board about location, organising group, some plans about financial issues, the scientific program committee (SPC), etc., but the pre-bid document does not need to contain the precise and complete information that a final bid contains. As written in the rules (see website), **pre-bids should be sent to the president (mailto:president@iciam.org?subject=ICIAM%202031%20Prebid) (president@iciam.org** (mailto:president@iciam.org)**) no later than April 30, 2024**, and it is possible to submit the document by email.

Nominations for ICIAM officer-at-large:

Based on the decisions made at the 2022 Board meeting, ICIAM will elect two more Officers-at-Large at our next board meeting, which will be held online on June 17, 2024. The term in office is 4 years and is renewable once. Remember that at the 2023 Board meeting in Tokyo, the Board already elected two additional Officers-at-Large. With the additional two Officers-at-Large being elected at the June meeting, we will have a total of 6 Officers-at-Large (besides the President, Past President, Secretary and Treasurer), as decided in 2022. I am therefore asking you to nominate candidates for the position of Officer-at-Large. (List of current officers (https://iciam.org/iciam-officers)).

The duties of an ICIAM Officer-at-Large include attendance of the monthly online meetings of the officers, as well as a possible face-to-face meeting of the officers and the annual Board meeting (online in even years). ICIAM has funds to cover travel expenses, in case they are needed. In addition, it is expected that the Officer-at-Large actively contributes to ICIAM business, e.g. by participating in one of our committees (https://iciam.org/iciam-committees), and other tasks defined in the meetings of the officers. Diversity and geographical spread are important criteria, besides that we encourage nominations of candidates with technical skills in maintaining websites and/or experience in managing social media.

Nominations by member societies should be sent to president@iciam.org (mailto:president@iciam.org) **and** secretary@iciam.org (mailto:secretary@iciam.org) **by April 30, 2024.**

ICIAM Conference Support (https://iciam.org/iciam-conference-support-applied-and-industrial-mathematics-developing-countries) for Applied and Industrial Mathematics in Developing Countries:

The International Council for Industrial and Applied Mathematics (ICIAM) has adopted the policy that in non-Congress years it will give support to existing conferences (typically to three conferences per year), with the support used to fund a number of ICIAM Fellowships for participants from developing countries and regions.

The following principles will govern this support:

1. Applications should be submitted a year in advance by email (secretary@iciam.org (mailto:secretary@iciam.org)) to the ICIAM Secretary. There is no prescribed form for the application. Applicants should give details of the conference, the organising body, and the plans for the use of ICIAM funds (including the plans for support through ICIAM Fellowships).

2. Each year there will be two rolling deadlines on 30 April and 31 October each year. The decision on which conferences to support, if any, will be made by the ICIAM Officers within one month of each of the deadlines. The Officers' decision will be final.

3. The level of support will be up to USD 3,500 per conference: a proportion of these funds is normally paid upfront when the application has been approved, and the remaining funds are paid after the conference has taken place and the report has been received and approved by the ICIAM Officers.

4. The ICIAM funds are expected to be used to fund a number of ICIAM Fellowships for selected delegates from developing countries and regions.

5. The selection of the ICIAM Fellowship recipients and the determination of their level of support will be the responsibility of the conference organisers.

6. The existence of the ICIAM Fellowships should be advertised under that name on the conference web site, and the support of ICIAM acknowledged in an appropriate way on that web site and in printed materials for the conference.

7. Within six months of the end of the Conference a report should be submitted to the ICIAM Secretary, secretary@iciam.org (mailto:secretary@iciam.org). The report should briefly describe the scientific achievements of the conference, list the recipients of the ICIAM Fellowships and where they travelled from, and indicate the funds expended through each ICIAM Fellowship.

8. Unexpended funds must be returned to the ICIAM Treasurer.

9. Other things being equal, preference will be given to conferences held in developing countries.

Please send proposals for ICIAM conference support to the secretary (secretary@iciam.org (mailto:secretary@iciam.org)**) by no later than April 30, 2024.**

Introducing ICIAM's New Officer-at-Large Kenji Kajiwara

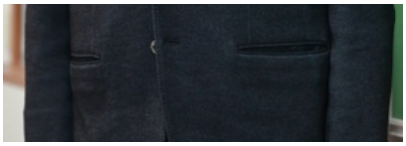
Brief History

I graduated from the Department of Mathematical Engineering at The University of Tokyo, Japan, in 1989, obtained a Master of Engineering and then a Ph.D. (Engineering) at the Department of Applied Physics at The University of Tokyo in 1994. Then, I was employed by Doshisha University, a private university in Kyoto, as a Lecturer and then an Associate Professor at the Department of Electrical Engineering (1994-2001). I moved to the Faculty of Mathematics, Kyushu University, in 2001 as an Associated Professor, then became a Professor in 2009. I moved to the Institute of Mathematics for Industry (IMI) in 2011 upon its inauguration, then I served as Deputy Director (2019-2022) and Director (2022-). I was awarded by JST one of the prestigious grants of CREST (250,000,000 JPY, 2019-2025) as PI and leading an interdisciplinary research project of mathematics, architecture, industrial design, and computational geometry. I am a member of the Japan SIAM, Australian Mathematical Society, and SIAM. I am also a member of the Asia Pacific Consortium of Mathematics for Industry and serving as Secretary since 2021. In JSIAM, I served as a Board Member (2012-2014, 2022-) and a Vice President (2020-2022), then I was elected as a Fellow in 2023. I took the role of a JSIAM Delegate to ICIAM (2020-2023), and then I contributed to ICIAM2023 in Tokyo as a member of the Organizing Committee and the Executive Committee.

Research Description

My background is mathematical physics, particularly the theory of integrable systems. My interest lies in discrete objects, such as differential-difference, difference, and so-called ultra-discrete equations. I have been studying the (discrete) Painlevé equations and their generalizations, with a particular focus on the particular solutions (hypergeometric type solutions and algebraic/rational solutions) and underlying algebraic and geometric structures [1]. I shifted my main research to integrable (discrete) differential geometry on the occasion of moving to IMI, with an expectation of interdisciplinary activities and possible joint research with industry. My recent work, done during the task of the Director, is on the characterization of “aesthetic” curves and surfaces used for industrial design and architecture [2]. It arises from a rediscovery of similarity geometry, a Klein geometry associated with the similarity transformation group (Euclidean motion + scale change), and collaboration with integrable systems, with the new light of motivation from industrial design. I think that this is a small but typical example of “Mathematics for Industry”.

Developing “Mathematics for Industry”



Mathematics for Industry (MfI) is an idea of a new area of research in mathematics that serves as a foundation for future technologies and which as well is valuable as mathematics in itself. It is formed through the challenge of responding to the demands of society and industry by reorganizing and merging pure and applied mathematics into flexible and versatile forms. The IMI was founded in 2011 as the first research institute of industrial and applied mathematics in Japan, with the mission of sharing the idea and developing MfI. Since its inauguration, we have been making a lot of efforts in:

1. Promotion of research and collaboration with industry and diverse scientific fields.
2. Management of Joint Use Research Center.
3. Human Resource Development.
4. International Collaborations.

As a Faculty Member, I have contributed mainly to (2) and (4). In particular, I have organized and managed the IMI Australia Branch at La Trobe University in Melbourne since 2015. As Director, I have been making those activities more systematic on a larger scale with extensive support and collaborations from the government and industry. One such challenge is “Mathematics for Industry Platform,” a network of 17 mathematical institutes spread over Japan that started in October 2023. I hope to have a chance to report on our activities and the current status of industrial and applied mathematics in Japan.

1. Kenji Kajiwara, Masatoshi Noumi and Yasuhiko Yamada, Geometric aspects of Painlevé equations, J. Phys. A: Math. Theor. 50(7)(2017) 073001. doi:10.1088/1751-8121/50/7/073001
2. Jun-ichi Inoguchi, Kenji Kajiwara, Kenjiro T. Miura, Yoshiki Jikumaru and Wolfgang K. Schief, Log-aesthetic curves: similarity geometry, integrable discretization and variational principles, Comput. Aided Geom. Design 105(2023) 102233. doi:10.1016/j.cagd.2023.102233

Kenji Kajiwara

Kenji Kajiwara is Director of the Institute for Mathematics in Industry, Kyushu University and Officer at Large of ICIAM. He obtained his PhD from the University of Tokyo. His research is in integrable systems and, more recently, in geometric design.

ICIAM

Introducing ICIAM's New Officer-at-Large Yvonne Stokes

I am an applied mathematician at The University of Adelaide, Australia. In 2023 I was elected as an Officer-at-large on the International Council of Industrial and Applied Mathematics (ICIAM). I also represent Australian and New Zealand Industrial and Applied Mathematics (ANZIAM), a division of the Australian Mathematics Society, on the ICIAM Board. I have a keen interest in applied mathematics and developing a better understanding of its value in the general population. I joined the ICIAM Board to both contribute to and learn about applied mathematics on the international scene and have become a member of ICIAM’s International Science Council Committee.

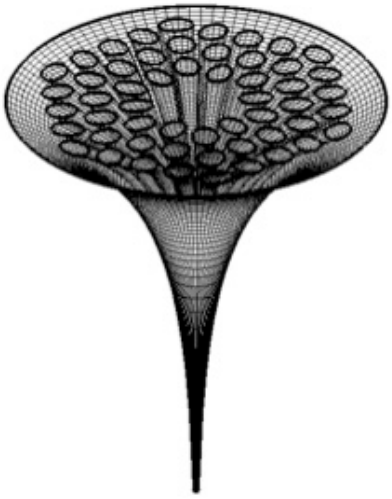
Brief Biography

I obtained a BSc from Murdoch University, Australia, and a BSc(Hons) and PhD from the University of Adelaide, Australia. Over my academic career, commenced in 1999 as an Assistant Lecturer at the University of Adelaide, I have held an Australian Research Council Postdoctoral Fellowship (2000-

2002) and an Australian Research Council Future Fellowship (2017-2021). My research and contributions to applied mathematics have been recognised by two ANZIAM medals: the J.H. Michell Medal in 2007 which recognises outstanding new researchers, and the E.O. Tuck Medal in 2018 for outstanding research and distinguished service to the field of Applied Mathematics. Since 2012 I have been a Member of the Australian Academy of Sciences National Committee for Mechanical and Engineering Sciences. I am also a member of the ANZIAM Executive Committee. I have 70 peer reviewed journal and conference papers and have been awarded five highly competitive ARC Discovery Project grants. I have also been awarded three ARC Linkage Project grants which include an industry partner.

Research

I enjoy using mathematics to solve real-world problems and have made significant contributions in the fields of fluid dynamics and mathematical biology. I develop physically grounded and elegant mathematical models using a range of sophisticated and inventive mathematics to obtain insightful and predictive results. These results provide fundamental understanding of complex processes. My models are important design tools for improving scientific understanding and developing new industrial processes across diverse areas including optical fibre fabrication, isolation of specific particles from others in a fluid, manufacture of novel components for mass-spectrometry, and assisted reproduction technologies.



My research on the drawing of optical fibres illustrates the type of research I enjoy. Thin optical fibres, ranging from axisymmetric tubes through to complex non-axisymmetric geometries with many air channels, have many uses in modern technologies, including communications systems, and biological, chemical and physical sensing. Accurate fabrication, by making an initial preform and pulling this to a fibre with the desired geometry, is crucial. But geometrical changes during fabrication make this very challenging. Predictive tools to replace costly experimental iteration are of significant value. 3D numerical simulation is not a viable option because of the number of free boundaries in even a quite simple fibre. I and my team, including applied mathematicians and experimentalists, have made ground-breaking contributions to provide such tools. With novel use of a variable transformation we solved a 30-year-old problem to show that extensional flow theory gives a semi-explicit solution for the change in geometry in drawing a preform to fibre for an arbitrary cross-sectional geometry (see figure, taken from reference [2]). The solution agrees well with experiments. Its form enables determining preform geometry and draw parameters to give a desired final fibre geometry. We showed that the same fibre will be obtained for a given pulling tension, regardless of the temperature profile, where the preform and other parameters are the same, a finding of enormous practical benefit because knowledge of the temperature is not needed provided furnace temperature can be adjusted to achieve the tension required for a desired fibre. From this the importance of equipping fibre-draw towers with tension measuring devices has been recognised. Our experimentally-validated mathematical models [1-5] provide highly-efficient, practically-useful, predictive tools with accuracy and power far exceeding what has gone before. More recent work has answered long-standing open questions on the effect of surface tension and an arbitrary number of internal holes on the stability of fibre drawing [6].

1. Y.M. Stokes, P. Buchak, D.G. Crowdy and H. Ebendorff-Heidepriem (2014) Drawing of micro-structured fibres: circular and non-circular tubes. J. Fluid Mech. 755, 176-203. doi:10.1017/jfm.2014.408
2. P. Buchak, D.G. Crowdy, Y.M. Stokes and H. Ebendorff-Heidepriem (2015) Elliptical pore regularisation of the inverse problem for microstructured optical fibre fabrication, J. Fluid Mech. 778, 5-38. doi:10.1017/jfm.2015.337
3. M.J. Chen, Y.M. Stokes, P. Buchak, D.G. Crowdy and H. Ebendorff-Heidepriem (2015) Microstructured optical fibre drawing with active pressurisation. J. Fluid Mech. 783, 137–165. doi:10.1017/jfm.2015.570
4. M. Chen, Y.M. Stokes, P. Buchak, D.G. Crowdy and H. Ebendorff-Heidepriem (2016) Asymptotic modelling of a six-hole MOF. J. Lightwave Technol. 34, 5651–5656. doi:10.1109/JLT.2016.2628438
5. M.J. Chen, Y.M. Stokes, P. Buchak, D.G. Crowdy, H.T.C. Foo, A. Dowler and H. Ebendorff-Heidepriem (2016) Drawing tubular fibres: experiments versus mathematical modelling. Optical Mater. Express 6, 166–180. doi:10.1364/OME.6.000166
6. Y.M. Stokes, J.J. Wylie, M.J. Chen (2019). Coupled fluid and energy flow in fabrication of microstructured optical fibres. J. Fluid Mech. 874, 548–572. doi:10. 1017/jfm.2019.466
7. J.J. Wylie, N.N. Papri, Y.M. Stokes, D. He (2023). Stability of drawing of microstructured optical fibres. J. Fluid

Mech. 962, A12 (30pp). doi:10.1017/jfm. 2023.267

Yvonne Stokes

Yvonne Stokes is Professor of Mathematics at the University of Adelaide, Australia. She is a member of the Executive Committee of ANZIAM, and became an Officer-at-Large of ICIAM in 2003. Her research areas are fluid dynamics and mathematical biology.

IDSSD

International Decade of Science for Sustainable Development

The *International Year of Basic Science for Sustainable Development* (IYBSSD) has ended, and its successor, the *International Decade of Science for Sustainable Development* (IDSSD) has begun. This article provides some background on this ambitious venture, which ICIAM is considering to support. (The January 2022 issue of ICIAM Dianoia profiled IYBSSD. You will also find much information on their site, https://www.iybssd2022.org/en/about-us/ (https://www.iybssd2022.org/en/about-us/)) The role of mathematics, specifically among the sciences, in sustainability is eloquently explained in the UNESCO publication, *Mathematics for Action: Supporting Science-Based Decision-Making* https://www.unesco.org/en/articles/mathematics-action-supporting-science-based-decision-making (https://urldefense.com/v3/__https:/www.unesco.org/en/articles/mathematics-action-supporting-science-based-decision-making__;!!KGKeukY!1SYBoai_BgyuhWLLBZQLn2i91-4q-iUhjLA6N11ZuE_67CgZw1TZsyu3FzIgIvG2bwCOC9lpcttXdt-opVeNTmoqki-xhhp3po4Q_g$)

The Inaugural Meeting on Zoom

I attended the inaugural meeting of IDSSD, which took place over Zoom on February 9. The meeting was chaired by **Michel Spiro**, who is President of the International Union of Pure and Applied Physics (IUPAP), another member union of the International Science Council. (A representative from ISC attended the meeting, but the IDSSD initiative is not an ISC project - it is completely independent.) I was impressed by the way the meeting was conducted: the chair began by asking all the participants to introduce themseves. This took a long time, but made it clear that we are all sharing something, not merely observing. I can't list all the participants, but Christiane Rousseau (from Mathematics of Planet Earth) was there, along with Monika Bauer from IIASA (I am now on their Scientific Advisory Committee), Vanessa McBride from ISC, Lidia Arthur Brito (and several others) from UNESCO, and Christoph Sorger from IMU. There were people from CNRS and from NSERC (government funding agencies for science in France and Canada respectively), from institutions like ICTP, and many other scientific unions.

The order of business was first an outline by Spiro of how the decade structure will be (or may be - there are still decisions to be made) organized. It will operate under the aegis of UNESCO, there will be working groups and a steering committee. The most important objective of the inaugural meeting was to ask organizations to commit to signing a Memorandum of Understanding (MOU), which I'll describe later in this report. The organizations that sign become the managers of IDSSD. This is an ambitious project, that will require substantial fundraising (more on this later). The project designers hope UNESCO will make a commitment. Their support (mainly non-financial) will make it possible to raise money from other sources. The organization will ask someone from UNESCO to be on the governing board. Among the initial steps will be preparing a program of activities. Members will not be passive. There is a need to enlarge the General Assembly (that is to say, the membership list), and especially to include the social sciences (which were not part of IYBSSD), and to engage NGO's.

Lidia Brito from UNESCO then explained how UNESCO manages its 'decades': their sponsorship gives the organization a decade to enact transformation. In this case, the idea is to bring science to the center of the sustainable development agenda.

A decade is not a 'thing' - not a legal organization that can operate projects, collect money, organize staff and volunteers, and so on. An organization called the *Earth-Humanity Coalition* (EHC) has been formed, and is pursuing tax-exempt legal status in France. In the meantime, IUPAP is serving as the headquarters, until EHC is established in 2025. The projected *Earth-Humanity Coalition* was presented by Carlos Alvarez Pereira, Secretary-General of the Club of Rome[1] (applewebdata://BED0CFFA-2AFE-4AEA-AE3D-BB99923F6713#_ftn1). They have formulated a 'Strategic Framework for the Decade and Plan for 2024'. Pereira laid out *Goals*, *Phases*, and *Principles* for the decade. The draft document that was circulated is too long and detailed to be printed in *ICIAM Dianoia*, but a final version should be available on the organization's website, earth-humanity.org, when that is in operation (not yet). Pereira's presentation also gave a somewhat jaw-dropping list of financial needs: 1 million Euros/year for the 2-year *activation* phase, 5-10 million per year for the 3-year *mobilization* phase, and 'billions' for the 5 years of *expansion and consolidation*. The draft document outlines their ideas about goals, strategic guidelines and organization. I cannot summarize it here, but some of the flavor is conveyed by the aphorism, "We aim to change the value proposition so that a person's well-being is not measured by the size of their ecological footprint."

This presentation was followed by a long discussion period. A representative from the Belmont Forum was concerned about overlap with existing structures which are already stretched thin - for example, Belmont, FutureEarth. The response was that what exists today is not sufficient. There was a question about the role of CERN or similar organizations. Someone pointed to a recent ISC report, *Flipping the Science Model* (available at the ISC website). I was glad to see a crucial point raised in the discussion: What is the role of industry in this? What engagement is envisaged? Pereira admitted that the question was relevant, but said the approach was not clear. As an organization (the only one in the group) that has 'industrial' in its name, ICIAM might have a role here. In fact, I was a bit disappointed to see that the EHC seems quite naive about the role of industry in influencing the direction of change in the world.

Supporting IDSSD: The Memo of Understanding and Beyond

After the discussion, Spiro took over to discuss the MoU. For 2024, IUPAP will be in charge of IDSSD, in the sense of being the legal organization under which IDSSD operates. During the year the new legal organization EHC will be formed to replace IUPAP as the enabling organization of IDSSD. Groups that want to be involved with IDSSD are being asked to sign a MoU that is just for 2024. Signing the MoU requires a contribution of 1,000 Euros for 2024. The officers of ICIAM have decided that making this commitment for one year is justified, a decision with which I concur, and they will be asking the Board for this commitment at the upcoming Board meeting in June. Meanwhile, ICIAM has named a representative to EHC (or IDSSD, which is the same thing): Mary Lou Zeeman, who is the R. Wells Johnson Professor of Mathematics at Bowdoin College in Maine. Mary Lou Zeeman has had a long involvement with climate modeling, sustainability and resilience and is an ideal person to represent ICIAM in this project.

[1] (applewebdata://BED0CFFA-2AFE-4AEA-AE3D-BB99923F6713#_ftnref1) A compact history of The Club of Rome (www.clubofrome.org (http://www.clubofrome.org)) is given in Wikipedia, along with an outline of their signature publication, *The Limits to Growth*, in 1972.

Barbara Lee Keyfitz

Barbara Lee Keyfitz is Emeritus Professor of Mathematics at The Ohio State University. She has a PhD from New York University, and works in partial differential equations. She is a former President of ICIAM, and Editor-in-Chief of ICIAM Dianoia.

Review of the ISC report "Protecting Science in Times of Crisis"

The Centre for Science Futures of the International Science Council (ISC) has recently issued an interesting report, Protecting Science in Times of Crisis (https://council.science/publications/protecting-science-in-times-of-crisis/?utm_source=International+Science+Council&utm_campaign=5d12d452b7-February+2024&utm_medium=email&utm_term=0_6e20810dfd-5d12d452b7-202267793&mc_cid=5d12d452b7&mc_eid=9194c71a6e), about how to protect science, higher education, research and scientists in times of crisis (natural disasters, wars, geopolitical conflicts, and so on). The report focuses on how to build resilience for science.

The analysis of past crises shows that science and scientists usually pay a high price in those situations: scientists lose their jobs or their ability to work, or have simply to leave. Scientific research and higher education become disorganized and unable to function in a good manner. The aim of preparing this report has been to establish a resilient global scientific community capable of withstanding crises and recovering from them in a better way than in the past.

There are a number of institutions and initiatives that function permanently or when necessary to help scientists displaced or in exile. There are also efforts to help educational institutions to continue their work or to rebuild after the end of a crisis, or in case of war. But there is not a shared or good understanding of how to prepare to deal with crises before they happen, or while they are unleashing their destructive power. And unfortunately there is no theory for the coordination of efforts in such situations. We all know that science and higher education are necessary for a healthy and efficient society, and so their protection is of the highest importance.

This report contains recommendations that could help to deal with disaster and wars in the future concerning the work of the scientific community. For that, it is necessary to think ahead, to prepare, to work with scenarios and to work in coordination with the global and national institutions that can help.

The report has been prepared based on several activities: first a long list of publications has been scrutinized in order to learn from what researchers or politicians or journalists have written in the past about particular events or situations, or in general. The list of references at the end of the report is quite comprehensive, useful and interesting. Next, a series of past disasters have been chosen, to see how science, scientists and high educations fared in those cases. Three kinds of events have been chosen:

- Violent conflict: (1) Russian invasion of Ukraine (2022–present); (2) Islamic State of Iraq and Syria (ISIS) occupation of Mosul University, Iraq (2014–2017);
- Disasters: (3) Cape Town University library fire, South Africa (2021); (4) Natural Science Museum fire, Brazil (2018); (5) The Fukushima nuclear disaster, Japan (2011);
- Crisis recovery: (6) war in the Balkans (1991–1999); (7) Japan after World War Two (1945).

And finally, interviews were scheduled with experts in disaster risk management or people who were directly involved in the events.

The report is centered about three steps to protect science in times of crisis: prevent and prepare; protect; and rebuild. And with respect to these three different phases, it presents first some *key findings*, which naturally lead towards some *suggested ways forward* and concrete recommendations.

This report in of interest for a large audience, and especially for scientists who are interested in understanding how our community can be more supportive.

Maria J. Esteban

Maria J. Esteban is a senior researcher at CNRS and works at the University Paris-Dauphine. Her research area includes nonlinear partial differential equations, especially variational methods. Her term as President of ICIAM ended October 1, 2019.

News and Opportunities from the International Science Council

Some of these reports, activities and opportunities could certainly be of interest to members of ICIAM or to their individual members. If you feel that people in your networks could be interested, you can circulate the information.

1) Global Call to co-design and embark on Pilot Science Missions for Sustainability.

The ISC has launched its Global Call on Science Missions for Sustainability! This is an exciting opportunity for innovative, collaborative, and diverse consortia to co-design and pioneer groundbreaking Science Missions to tackle complex sustainability challenges head-on. #SDGs

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Information sessions
Virtual Q&A sessions will be held on

- **25 April, 13:00 – 14:00 UTC**
- **26 April, 07:00 – 08:00 UTC**

if you are interested, please register for your preferred session at https://council.science/events/mission-science-information-sessions/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Flink.council.science%2Fclick%2F1rp58qwSRpoO2q.jgeRjzsM1UceG%2Ft2lm4-dz%2F3s%2Fcouncil.science%2Fevents%2Fmission-science-information-sessions%2F%3Futm_source%3DMembershipUpdate%26utm_medium%3Demail%26utm_campaign%3D20240326MU&data=05%

2) Publication of the discussion paper "Science organizations in the digital age", which synthesizes findings from a survey, interviews, and case studies involving ISC Members. It serves as both a current reflection of the digital status in the science community and a guide for organizations embarking on their digital transition journeys: https://council.science/current/blog/how-are-science-organizations-faring-in-the-digital-age/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Flink.council.science%2Fclick%2F1rsS_lmPgomp1w.Dk9xD3-DIz8pm%2Fxo0_6Fvw%2F3s%2Fcouncil.science%2Fcurrent%2Fblog%2Fhow-are-science-organizations-faring-in-the-digital-age%2F%3Futm_source%3DMembershipUpdate%26utm_medium%3Demail%26utm_campaign%3D20240404MU&data=05%7C0

3) The ISC Centre for Science Futures has secured a grant by the International Development Research Centre (IDRC) of Canada worth over one million dollars to explore **the impacts of AI on science systems in the Global South**. The funds will serve to develop first-hand knowledge on transformations of STI systems propelled by AI and other new technologies, and to explore with key science organizations, particularly in the Global South, how to enhance their visibility, build strong coalitions and take advantage of technological advancements: https://council.science/current/news/idrc-grant-science-global-south/ (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Flink.council.science%2Fclick%2F1rII6Z9EuEiu1F.F2BXF_clH41BZ%2FrUJyXjVm%2F3s%2Fcouncil.science%grant-science-global-south%2F%3Futm_source%3DMembershipUpdate%26utm_medium%3Demail%26utm_campaign%3D20240411MU&data=05%7C

Fo those interested, there will be a related Zoom session on **30 April at 12:00 pm UTC**, brought to you by the ISC Early and Mid-Career Researchers Forum, to discuss the recent reports *"Preparing National Research Ecosystems for AI: Strategies and Progress in 2024"* and *"Science Organizations in the Digital Age"*. We will also explore an updated version of last year's AI paper, *"A guide for policy-makers: Evaluating rapidly developing technologies including AI, large language models and beyond"* to be released in the last week of April. **If interested in this, please register via: https://council.science/events/isc-emcr-forum-april/** (https://eur03.safelinks.protection.outlook.com/?url=https%3A%2F%2Flink.council.science%2Fclick%2F1rII6Z9EuEiu1F.F2BXF_clH41BZ%2FyROQlB8t%2F3s%2Fcouncil.science%emcr-forum-april%2F%3Futm_source%3DMembershipUpdate%26utm_medium%3Demail%26utm_campaign%3D20240411MU&data=05%7C0

Michel Talagrand Wins the 2024 Abel Prize

The Norwegian Academy of Science and Letters awards the Abel Prize 2024 to Michel Talagrand, Centre national de la recherche scientifique (CNRS), Paris, France, "for his groundbreaking contributions to probability theory and functional analysis, with outstanding applications in mathematical physics and statistics.

The development of probability theory was originally motivated by problems that arose in the context of gambling or assessing risks. It has now become apparent that a thorough understanding of random phenomena is essential in today's world. For example, random algorithms underpin our weather forecast and large language models. In our quest for miniaturisation, we must consider effects like the random nature of impurities in crystals, thermal fluctuations in electric circuits, and decoherence of quantum computers. Talagrand has tackled many fundamental questions arising at the core of our mathematical description of such phenomena.

One of the threads running through Talagrand's work is to understand geometric properties of a high- dimensional phenomenon and to crystallise this into sharp estimates with broad scopes of applicability. This led him to obtain many influential inequalities. For instance, Talagrand derived powerful

quantitative results to prove the sharp threshold phenomena that often appear in the study of phase transitions in statistical mechanics. He also obtained a useful inequality bounding the quadratic transportation cost distance between a probability measure and a Gaussian distribution by their relative entropy.

Much of Talagrand's work concerns the geometry of stochastic processes. A classical problem going back to Kolmogorov – arising for instance when one wants to analyse regularity properties of stochastic processes – is to estimate the supremum of a large collection of correlated random variables. Building on the works of Fernique and Dudley, Talagrand developed his theory of generic chaining, which provides sharp upper and lower bounds on the expectation of suprema of Gaussian processes. This illuminated the mysterious connection between the distance function (on the underlying index set) determined by the covariance of the process and the expectation of its supremum.

A key result in probability theory is the law of large numbers asserting that the normalised sum of independent random variables converges towards its mean. This normalised sum is therefore concentrated, using the terminology coined in the early work of Milman, or self-averaging, using physics terminology. It was gradually realised that concentration is ubiquitous, since many random variables defined as functions of a large number of independent random variables appeared to be close to their mean with high probability. In an amazing tour de force, Talagrand provided quantitative versions of this phenomenon that hold in great generality, including the case of discrete random variables. This result applies to functions of independent variables that are Lipschitz with respect to the Euclidean metric and convex, yielding one of several celebrated "Talagrand inequalities." It laid the groundwork for a non-asymptotic theory of independence applicable to high-dimensional statistical problems.

Since the works of Edwards and Anderson, physicists have been fascinated by the complex behaviour exhibited by disordered systems, which describe phenomena like magnetisation in the presence of impurities, and more recently also the energy landscapes arising in machine learning. In 1980, Parisi (Nobel Prize in Physics, 2021) proposed an expression for the free energy of one of the simplest models of this type, namely the Sherrington–Kirkpatrick model. Guerra showed rigorously that this formula is an upper bound for the free energy. In a groundbreaking article, Talagrand proved the complementary lower bound, hence completing the proof of the Parisi formula. This provided the foundation for the development of a mathematical theory of spin glasses and its applications in statistical learning.

Talagrand also obtained a rich variety of important results in measure theory and functional analysis. To cite only the most recent one, he answered a longstanding question by von Neumann and Maharam in the negative by showing that there exist submeasures which are exhaustive, but are not absolutely continuous with respect to any finitely additive measure. This fact implies the existence of radically new Boolean algebras.

Talagrand is an exceptionally prolific mathematician whose work has transformed probability theory, functional analysis, and statistics. His research is characterised by a desire to understand interesting problems at their most fundamental level, building new mathematical theories along the way. He disseminated many of his insights in the form of very influential research monographs. Combining technical virtuosity with deep analytical and geometric insights to construct new powerful tools and answer longstanding hard questions, Michel Talagrand has had and continues to have an enormous impact on mathematics and its applications.

From a Press Release

Association for Computing Machinery

Avi Wigderson Receives ACM A.M. Turing Award for Groundbreaking Insights on Randomness

ACM, the Association for Computing Machinery, has named Avi Wigderson as recipient of the 2023 ACM A.M. Turing Award for foundational contributions to the theory of computation, including reshaping our understanding of the role of randomness in computation, and for his decades of intellectual leadership in theoretical computer science.

Wigderson is the Herbert H. Maass Professor in the School of Mathematics at the Institute for Advanced Study in Princeton, New Jersey. He has been a leading figure in areas including computational complexity theory, algorithms and optimization, randomness and cryptography, parallel and distributed computation, combinatorics, and graph theory, as well as connections between theoretical computer science and mathematics and science.

The ACM A.M. Turing Award, often referred to as the “Nobel Prize of Computing,” carries a $1 million prize with financial support provided by Google, Inc. The award is named for Alan M. Turing, the British mathematician who articulated the mathematical foundations of computing.

Why is Randomness Important?

Fundamentally, computers are *deterministic* systems; the set of instructions of an algorithm applied to any given input uniquely determines its computation and, in particular, its output. In other words, the deterministic algorithm is following a predictable pattern. *Randomness*, by contrast, lacks a well-defined pattern, or predictability in events or outcomes. Because the world we live in seems full of random events (weather systems, biological and quantum phenomena, etc.), computer scientists have enriched algorithms by allowing them to make random choices in the course of their computation, in the hope of improving their efficiency. And indeed, many problems for which no efficient deterministic algorithm was known have been solved efficiently by probabilistic algorithms, albeit with some small probability of error (that can be efficiently reduced). But is randomness essential, or can it be removed? And what is the quality of randomness needed for the success of probabilistic algorithms?

These, and many other fundamental questions lie at the heart of understanding randomness and pseudorandomness in computation. An improved understanding of the dynamics of randomness in computation can lead us to develop better algorithms as well as deepen our understanding of the nature of computation itself.

Wigderson’s Contributions

A leader in theoretical computer science research for four decades, Wigderson has made foundational contributions to the understanding of the role of randomness and pseudorandomness in computation.

Computer scientists have discovered a remarkable connection between randomness and computational difficulty (i.e., identifying natural problems that have no efficient algorithms). Working with colleagues, Wigderson authored a highly influential series of works on trading hardness for randomness. They proved that, under standard and widely believed computational assumptions, every probabilistic polynomial time algorithm can be efficiently derandomized (namely, made fully deterministic). In other words, randomness is not necessary for efficient computation. This sequence of works revolutionized our understanding of the role of randomness in computation, and the way we think about randomness.

Read more about Avi Wigderson receiving the ACM A.M. Turing Award in *Communications of the ACM* (https://cacm.acm.org/turing-news).

About the ACM A.M. Turing Award

The A.M. Turing Award (https://amturing.acm.org/) was named for Alan M. Turing, the British mathematician who articulated the mathematical foundation and limits of computing, and who was a key contributor to the Allied cryptanalysis of the Enigma cipher during World War II. Since its inception in 1966, the Turing Award has honored the computer scientists and engineers who created the systems and underlying theoretical foundations that have propelled the information technology industry.

From a Press Release

Mathematical Congress of the Americas 2025: Deadline for Special Session Proposals Extended

The fourth Mathematical Congress of the Americas, MCA 2025, will take place in Miami, Florida, USA; the dates are July 21-25, 2025. A list of invited speakers and other information can be found at the Congress website (https://www.mca2025.org). Proposals to organize a special session are welcomed; the new deadline is May 31, 2024. Organizational teams should have representation from two or more countries in the Americas, and proposals should be topically broad, with the potential to bring together diverse groups of researchers from multiple countries in the Americas. Proposals are being reviewed on a rolling basis. Descriptions of Special Sessions that have already been approved can be found here (https://www.mca2025.org/event/9e9666dd-2643-423b-b343-91f10f36e686/websitePage:f3552742-6e9a-44e3-a319-6b6056ba9900). There is space for roughly 60 special sessions. More information and instructions for submitting a proposal may be found here (https://www.mca2025.org/event/9e9666dd-2643-423b-b343-91f10f36e686/websitePage:cd17a057-cb25-4de1-b822-d311708b3e56).

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