Disc4All Training network to advanceintegrated computational simulationsin translational medicine, applied tointervertebral disc degeneration

Annual Winter & Summer Schools and Advanced Training Event Public Reports

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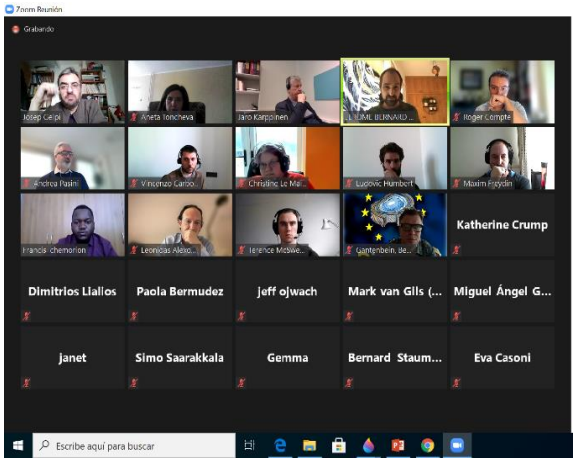
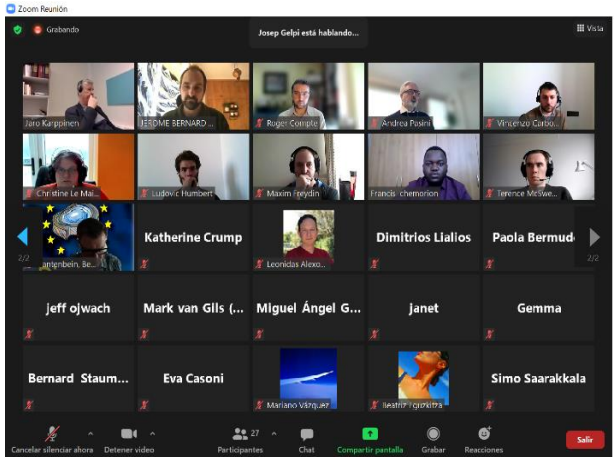
The First Disc4All Winter School on ¨**Transversal training in data, ethics and business innovation in translational medicine**¨ was held remotely, March 22-26, 2021!

The first Disc4All Winter School kicked off this MSCA Innovative Training Network virtually, hosted by the University of Oulu with Organisation Committee: Prof. Jaro Karppinen, Prof. Simo Saarakkala and Terence McSweeney.

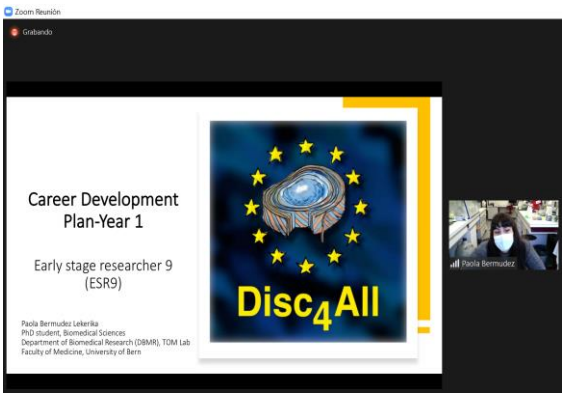
During this first edition, we were very pleased to welcome 15 international speakers, 75+ Disc4all Consortium Members, Early Stage Researchers (ESRs) and external attendees.

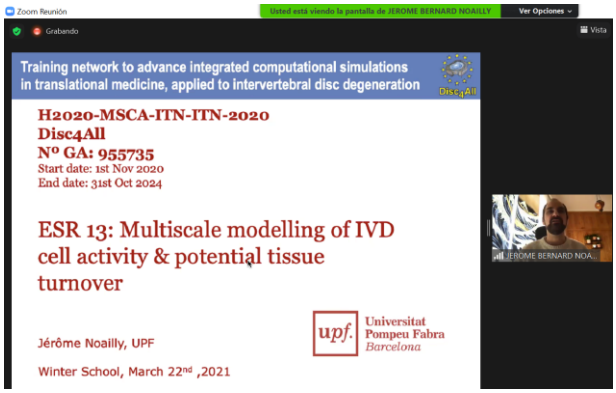




In a week long programme, it combined the internal activities of the Disc4All consortium with a series of private and open workshops around the topics of data and translational medicine as applied to the problem of intervertebral disc degeneration.

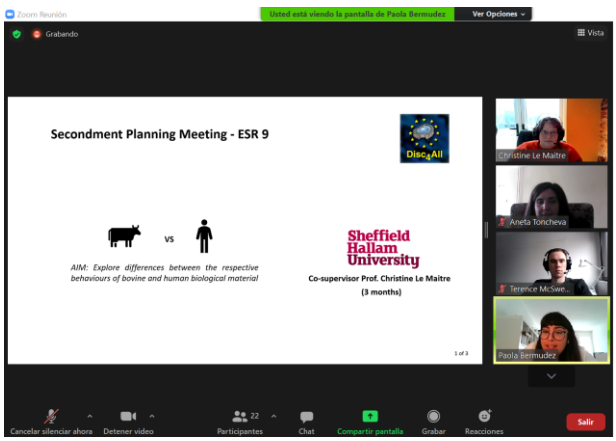
The event started with Welcome note, Disc4All Project Objectives & Overall Methodology, given by Prof. Jérôme Noailly and Prof. Christine Le Maitre. Followed by scientific presentations and discussions.

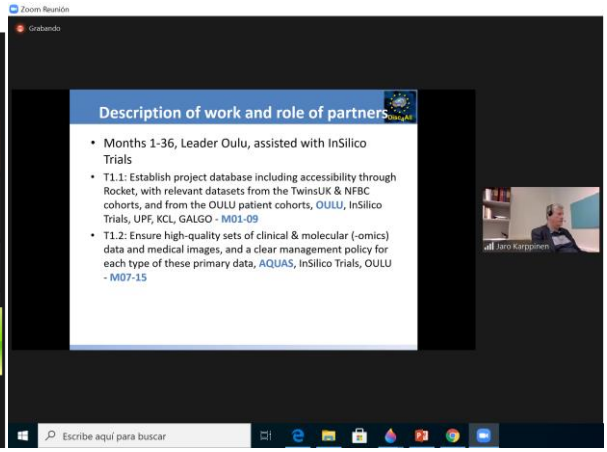




ESRs and Supervisors formally presented their projects to the Partners. The work of each ESR was discussed and constructively challenged.

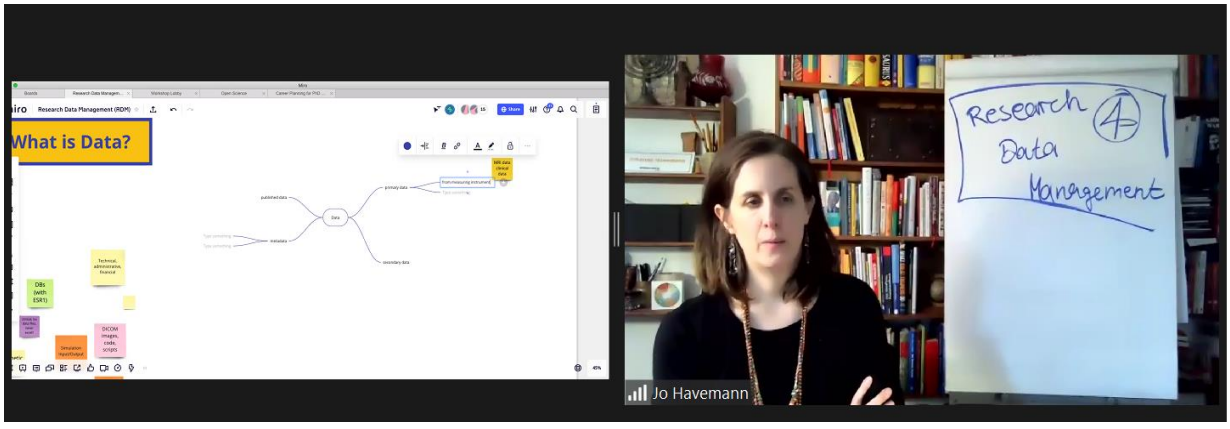
Day two was dedicated to ESRs Secondments planning and a Disc4All Consortium and Supervisory Board meeting. The project implementation and its working packages and deliverables were discussed.





It was a very memorable event with five open workshops on data, ethics and business innovation in translational medicine, presented by leading international experts as follow:
Workshop 1: Data (NFBC, TwinsUK, EU infrastructures, policy, quality)
Workshop 2: Clinical ethics, privacy, RRI
Workshop 3: Translational medicine (sectors and challenges)
Workshop 4: Technology for patient stratification and clinical support
Workshop 5: Introductory workshop: Northern Finland Birth Cohorts (NFBC)

One private workshop on ¨Research Data Management (RDM) in accordance with the FAIR and CARE principles given by Johanna Havemann was specially organised for the ESRs. This workshop gave an introduction to RDM, the contextualisation of datasets by adding relevant metadata, theory and practical application of FAIR and CARE (people & purpose) principles as well as an overview of appropriate research data repositories along with legal and ethical aspects to take into consideration in the process. To support the integration of the recruited ESRs in the end of the day an informal ESR meeting was organised.



This Winter School with a total of 19,5 hours transversal training successfully introduced the project and the Consortium to the new ESRs. We are very excited to see them as future trainers during forthcoming Summer Schools in Barcelona.

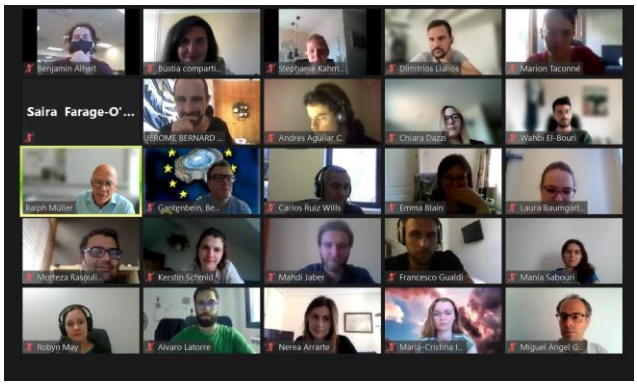
More about the event here: https://www.notion.so/First-Disc4All-Winter-School-34e7350f0bea42a2b0f67044b1eee38c

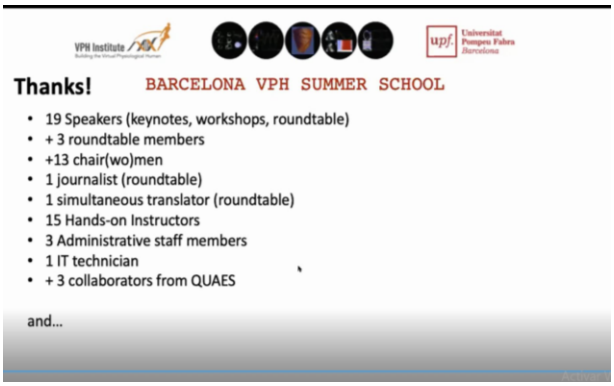
The 5th Barcelona VPH Summer School focused on the ¨**Tackling Complexity in Health & Medicine**¨ was held ONLINE, June 7-11, 2021!

The VPH Summer School was co-organized by BCN MedTech at the Department of Information and Communication Technologies, Universitat Pompeu Fabra (UPF), Chair: Prof Jérôme Noailly and by the Virtual Physiological Human Institute (VPHi), with the collaboration of the UPF department of Experimental and Health Science and the QUAES Foundation.

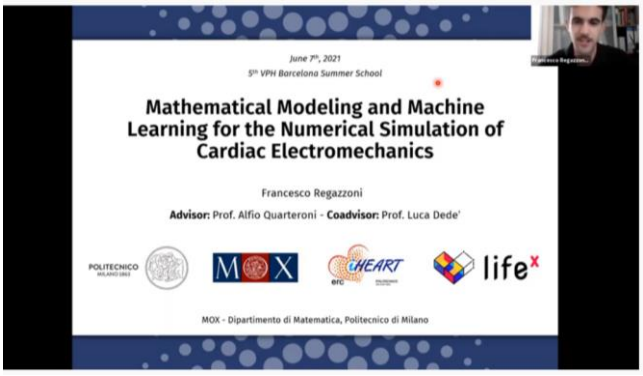
This year, we had the pleasure to welcome 19 speakers and 140+ attendees, from different international institutions and Disc4All Project Members. The event provided junior engineers, early researchers and medical doctors with an integrative view of state-of-the-art research for in silico medicine, following a complete pipeline from basic science and clinical needs, to model application.

It was a memorable event with 16 lectures & workshops plus one honorary VPH lecture, given by leading international researchers. The key methodological and technological concepts were enriched by afternoon hands-on sessions that stand for 15,5 hours of transversal training in in silico medicine technologies during the whole week. The most of the attendees participated to the 7 hands-on sessions led by a total of 15 expert researchers (13 from UPF and 2 external).



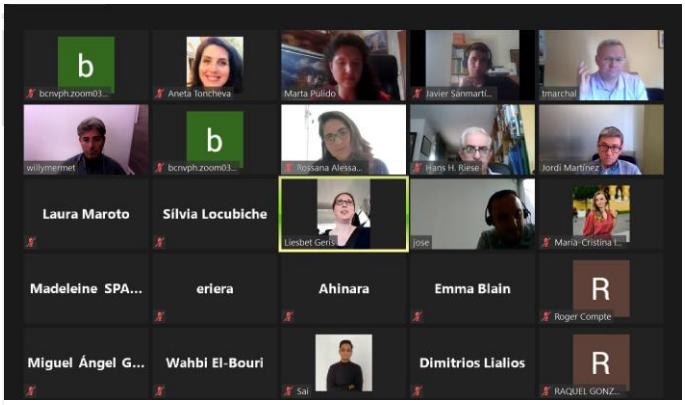


The **Best VPHi Thesis Award** in In Silico Medicine was given to Francesco Regazzoni, Chairs: Robyn May & Mojtaba Barzegari for his fantastic thesis ¨Mathematical Modeling and Machine Learning for the Numerical Simulation of Cardiac Electromechanics¨.



The everyday scientific talks and practical works took place together with poster sessions that fed the scientific discussions during the afternoons. The **Best Hands-on** was also awarded by the UPF-QUAES Chair, and the winners were: Paula Garcia Hernandez, Ricardo Caballero Masa, Marina Echeverría Ferrero, Keith Kennedy, Patricia Hernández López, Mònica Font Murillo, Itziar Ríos Ruiz, Raquel González López, Zeynep Karagoz, Berta Mateu.

The last afternoon of the VPH Summer School hosted a round table, gathering patients, physicians, researchers and public authority representatives to discuss on ¨In silico Medicine and new medical technologies for the society: Awareness, expectations and effective capacity¨.



Undoubtedly, the 5th VPH Summer School has been a great inspiring experience, for both junior and senior scientist!

Stay tuned! Watch the recordings on our YouTube: Disc4All European Innovative Training Network, join & follow us in Linkedin:@Disc4All_EU_Project, Twitter @Disc4all_EU, website: https://disc4all.upf.edu!
Read the fantastic article below, translated and originally published in Investigación y Ciencia.

In silico medicine, the future of clinical practice

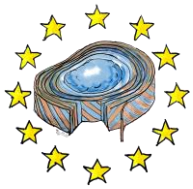
Digital twins will enable personalized healthcare. However, in silico medicine still faces some challenges.

In silico medicine, also known as computer-based medical experimentation, makes use of computer simulations for the prevention, diagnosis, prognostic assessment, and treatment of a disease, as well as the development of a biomedical product. Personalized digital twins can be used to test the reaction of patients to a given therapeutic strategy, improving the safety of treatments and reduce the unnecessaryuse of drugs.

Nowadays, in silico medicine is advancing in multiple fields such as precision cardiology, cancer research,regenerative medicine, drug development, diagnostic imaging and, more recently, it has been a valuabletool in the care of patients with COVID-19. Computer-generated models make it possible to integrate andcombine multiple data from the mechanical, biochemical and physiological processes taking place in the patient's own body and that of the rest of the population. However, the success of this technology requires researchers, clinicians, regulators, industry and patients to work together.

«Working together is key to make in silico medicine a reality», points Thierry Marchal, Secretary Generalof the Avicenna Alliance, who participated in a round table on awareness, expectations and capabilities of in silico technology, an initiative of Jerome Noailly, Principal Investigator, UPF and co-organized by the QUAES-Universitat Pompeu Fabra Chair and the European project Disc4All, held on Friday 11th June 2021, within the framework of the VPH Summer School. «Not forgetting to educate society and decision-makers, as well as to answer any question they might have, sothat they become aware of the benefits that this technology can bring to the national health systems», he concludes.

Artificial intelligence, as well as the concept of the digital twin, is already applied in other industry sectors.



«The question is, why do patients need the in silico technology? Before starting any research project, it isnecessary to do a good design that answers this question», explains Rosanna Alessandrello, Value Based Procurement Director at the Agency for Healthcare Quality and Evaluation of Catalonia (AQuAS). «We, regulators, must ensure that any solution that reach patients, doctors, hospitals and health centers brings value to them. To do this, we must take into account the scalability and sustainability of the project, as well as the ownership of the technology. For instance, in partnerships between academia and industry, itis necessary to indicate any potential conflict of interests, as well as who has done what. Lack of transparency in providing this information hinders the approval and application of in silico medicine.

But what does in silico medicine mean for medical practice? «For us, it is a support tool with great potential to improve the accuracy of diagnosis and treatment», says Dr. Guillermo Mermet, radiologist atCetir Ascires. «This technology has also a great potential for simulation at the hospital level, not only with patients. Namely, if we want to modify a certain process within the hospital, we can evaluate that changeand predict the outcome before carrying it out in real life, saving time and resources», adds Dr. Jordi Martínez Roldán, Director of Innovation at the Hospital del Mar in Barcelona.

Increased efficiency also has an impact on the doctor-patient relationship, meaning that the doctor can spend more time with his or her patient and establish a deeper relationship of trust. «Patients appreciatetransparency. We want our doctor to tell us what we are suffering from straightforwardly and understandably, so we can understand how the disease will develop, what to expect from the treatmentand what we can do to improve our quality of life. We hope that in silico medicine will help empower us,as well as making it easier for any doctor to consult our data and treat us wherever we are», says Javier Sanmartín, representative of the Think Tank People Health Living Lab.

«In silico medicine is based on data. Patient data must be collected according to data protection regulations and standards. If data can only be used in one hospital or laboratory because the protocol is not universal, the system loses its usefulness», states José Manuel Santabárbara, Head of Research and Development Projects Department at ASCIRES Biomedical Group. «We are facing a data revolution and regulating it is a challenge. Years ago, the process was very simple. We only needed few permissions to work with patient data. Now, however, we have a contradiction between protection and open science policies. This is why anonymizing any data is imperative when working with in silico technologies», says Juan E. Riese, Scientific Advisor at the Health Institute ‘Carlos III’,

National Contact Point for the EU HealthProgramme. «But even with all the precautions, there are certain data and images that are difficult to anonymize. There is no perfect solution, but regulators are working to find one in order to avoid delaying the development in silico medicine», adds Alessandrello.

«Researchers also play an important role in data management and quality», says Liesbet Geris, from the University of Liège and KU Leuven in Belgium and Executive Director of the Virtual Human Physiological Institute. «We can develop good laboratory practices, based on regulatory standards, which will increaseresearch quality», she continues. «We are making progress, and I firmly believe that virtual twins are thefuture of medicine, but at the moment the data does not have all the answers to complex questions, «In my opinion, if you work suchas the processes that take place in degenerative diseases». «In my opinion, if you work

and specific cases, you can say that we are very close to having complete digital twins, but in the case of general questions, there is still a long way to go», clarifies Santabárbara.

The experts agree that in silico medicine will change research, healthcare industry, and clinical practice inthe coming years. But they insist once again on the need to work together to face the challenges ahead and make it a reality.

Marta Pulido Salgado

References:

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«Multiscale Regulation of the Intervertebral Disc: Achievements in Experimental, In Silico, and Regenerative Research», L. Baumgartner et al., in International Journal of Molecular Sciences. 22:703, published the 12th January 2021.

«In silico medicine and new technologies for society: awareness, expectations and efective capacity», co-organized by the QUAES-Universitat Pompeu Fabra Chair and the European project Disc4All, held on Friday 11th June 2021. Speakers: Liesbet Geris, Thierry Marchal, Rosanna Aalessandrello, José Manuel Santabárbara, Dr. Jordi Martínez Roldán, Dr. Guillermo Mermet, Juan

E. Riese and Javier Sanmartín. Moderated by: Marta Pulido Salgado.

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