Issue1

NEWSLETTER

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Editor's Comment:

Dear Reader,

As editor it becomes my main focus to organize, create and coordinate valuable content for this newsletter. Together with the Life Science Technical Committee Chairs, the editorial team has tried to define a frame of content; content which is in the scope of life sciences and of particular interest for the readership. Through many sessions of intense discussions, it became clear, that the field of content is as diverse as the sponsoring societies for IEEE Life Sciences. In every field, so it seems, there is always a connection to life science, may it be through a biomedical or technical concept, life science motivated research or an application scenario. The unique diversity makes it very interesting to explore and discover the field of life sciences and all its facets ranging through the areas of research, academia and industry.

We design the newsletter as a forum for Life Sciences, presenting articles, columns and interviews from experts about trending topics, promoting upcoming events of Life Science and partners and reporting on past events with life science representation.

In this issue, the first from the Life Science Committee, we start with the essence of our life, the first instance of the creation of life, DNA and Genomics. Modern technologies are becoming more and more capable to analyze and assess genetic mechanisms and subsequently using these technologies to enhance human health or improvement in agriculture. This issue's articles focus on next generation DNA analysis, algorithms/AI-approaches for genomics and a research profile about cerebral palsy, which refers to a group of permanent disorders affecting muscle coordination and movement from early childhood.

I would like to welcome you to get in contact with us. Let us know if you have any suggestions, questions, comments or interest in contributing to the Life Science Newsletter. We are looking forward to hear from you.

Editorial Contact: editorlsc@ieee.org

Tobias Cibis,
Chief Editor,
Life Science Technical
Committee,
t.cibis@ieee.org

President Chair's Comment:

Welcome from the LSTC Chair

I welcome you to the first LSTC newsletter!

This is a major mile stone for the Life Science Technical Community. LSTC is a new initiative supported by five IEEE Societies, Engineering Medicine and Biology Society, Circuit and Systems Society, Consumer Electronics Society, Control Systems Society, and the Signal Processing Society. In addition, we have support from IEEE Standards, Society for Social Implications of Society, and Product Safety Engineering Society. Our Chief Editor, Tobias Cibis, worked hard to get the newsletter started. Starting such an initiative is not easy and requires a lot of support. We still need editors or people willing to contribute a regular column. If you are involved in any activity that may be of interest to our readers, please contact Tobias Cibis and propose an article or column. I am sure he will be interested in your proposal. Our long term goal for the newsletter is to transform it into a magazine. The aim of the magazine is to provide a forum for the Life Sciences Community to have an avenue to publish their work in a peer reviewed publication that is indexed and archived in IEEE Explore. We decided to make it a magazine as it will allow for a broader field of interest and can also contain the "newsletter".

LSTC is growing its activities, and has approved a new Life Science conference (Life Tech) that will be held annually in Japan. The first edition of this new conference will be held in March 2019 in Osaka, Japan. The call for papers is in this newsletter. Professor Hase is the inaugural chair. He has helped the consumer electronics society build a strong portfolio of conferences, and notably has guided and started the Global Conference on Consumer Electronics, which is 8 years old this year. It is a highly successful event. The GCCE has a steadily increasing number of presentations on healthcare and life sciences. The demand in Japan to host a life sciences conference is very large and the time is right for LSTC to launch this event in 2019. Our international roaming conference will take place in Montreal, Canada. It will be held from the 28 to 30 October 2018. This is the second edition of this conference. It will be as exciting as the first conference in Sydney. There will be some excellent tutorials, and panel discussions. The submitted papers are in the final stages of the review process, and the conference program will be out shortly. To find out more about the event, please visit the website at https://lsc.ieee.org/2018/. This is a conference that is not to be missed. The first LSC conference in Sydney had many delegates that attended to see what is happening in the Life Sciences field. They were not disappointed. I hope I can welcome you to Montreal. We are looking for volunteers who would like to join our conferences committee, and who are willing to "roll up their sleeves" in order to help us build a vibrant Life Sciences community. If you are interested in joining us, please contact me or our Administrator Scott Woodhouse (s.woodhouse@ieee.org).

As growing IEEE OU we always welcome feedback and suggestions. Please don't hesitate to contact me if you have any suggestion on how we can make LSTC more relevant to our members. I look forward to hearing from you!

Stefan Mozar,
Chair
Life Science Technical Committee
s.mozar@ieee.org

# Next Generation DNA Led Analysis - Challenges and Threats

DNA is the source of life and has been studied since a generation, but very little is known about it as yet. Several sophisticated technologies of the current era have laid their foundations on the principle of DNA based mechanisms. DNA based technologies are revolutionizing Forensic Investigation, Medical Diagnosis, Paternity Disputes, Individual Identity, Health insurance, Motor Insurance sectors.

Recent years have witnessed an explosive growth in biological data and gave birth to the pacemaker of biology called Bioinformatics. More than 350 fully sequenced genomes are publicly available, and more than 780 are in the pipeline. We can expect automation; it is already happening. There will be more integration of computerized analysis with laboratory tests. Capillary electrophoresis will require less material and produce faster results; DNA chips are in the pipeline too. We can also expect miniaturization with attendant portability. Recently a hand-held chip that can analyze 8 STRs in a few minutes came into limelight. We can foresee the time when forensic analysis can take place at the crime scene itself. If immediate results are produced, it can offer prompt clearance of erroneously identified suspects,

avoiding much needless apprehension. I would emphasize, however, that what can be done in pilot experiments will usually not be good enough for forensic use, for which a system must be thoroughly tested and validated. Primitive DNA Analysis methods required higher cell count in order to develop profiles. Current DNA Fingerprinting from swabs is particularly fast; results may be expected in hours, yielding accurate results.

While the appropriate use of DNA can be helpful in reducing and reversing wrongful convictions, inappropriate use of it and the sway of it, over other evidence on juries and judges can create a system of wrongful convictions.
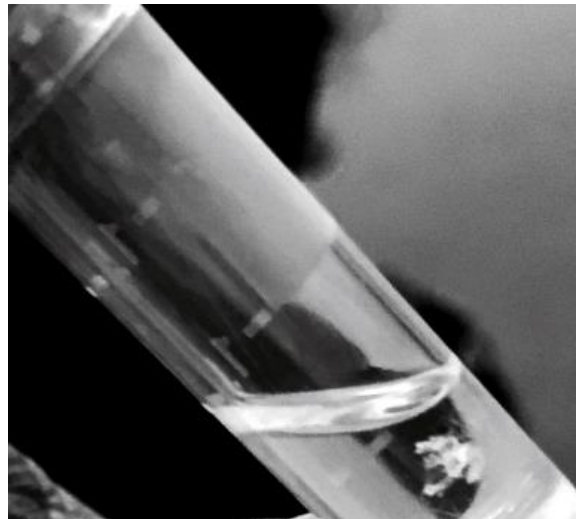
The expansion of publicly available information resulting from Human Genome Project has justified the role for bioinformatics capabilities worldwide. With the regular increase in the Biological data scientists started focusing on challenges like-where to store the data? How to analyze them? Do we have enough expertise and manpower to secure and manage the massive data coming out of different genome projects across the globe? If Computers are being hacked, Biological data stored in computers and databases can also be hacked. Cells are compared to the hardware

and DNA as the Biological software. What next??? Will bad biologists start developing bad synthetic biomolecules for disturbing the human race and making them unhealthy? DNA testing which is used to free innocents and convict the criminals may start working other way round? Can Biology be hacked? If yes, what is the way forward? We are in 1980s era; if you talk of Biological hacking – a very early stage. There have been only a few Biological attacks, which were sponsored by Governments as of now (Including the white powder, Anthrax attack), but genomics is changing with jet speed and the silence of Biological hacking may last soon in absence of corrective measures and ignorance. We may need to be prepared for listening and handling DNA Spams, DNA Spoofing and bio identify theft sometimes soon. The current era of incredible innovations toward the zeal to chase the heights of development has made science and technology one of the most powerful tools to accomplish the tasks of incremental prosperity for human welfare and sustainable development. It has been rightly said that science, technology, and innovation work together for growth and development. With the multifarious aspects of science there is a need for thought-provoking ideas and cumulative efforts that can strengthen the scientific capacity to produce successful innovation systems.

A Dr. Amit Kumar
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Artificial Intelligence (AI) for Genomics

Based on algorithm/architecture co-design, our team at the National Cheng Kung University (NCKU) and the National Center for High Speed Computing (NCHC) has been studying analytics algorithm and analytics architecture at specific or cross levels-of-abstraction including algorithm, system architecture, and microarchitecture in spanning the **ABC**s (**A**lgorithm, **B**ig Data/Storage, and **C**loud/Edge/Computing) of Artificial Intelligence in genomics. Based upon mathematical fundamentals as foundations for complexity aware analytical algorithms anticipating high accuracy, intelligent, flexible, and efficient low-power analytics parallel and reconfigurable architectures, including both software and hardware has been be concurrently explored and designed, whereby our team envisions efficient exploration of genomic informatics in Precision Medicine including e.g. prediction of chemotherapy induced toxicities with high accuracy.

Chris Lee,
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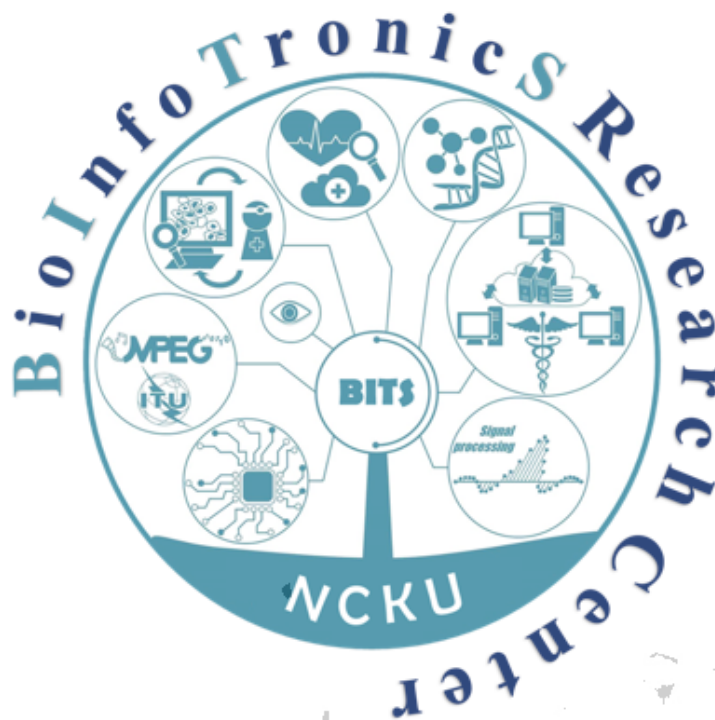
Research Profile:
Cerebral Palsy

Technology is improving lives of people with disability

Advances in mobility, communication and thought-to-speech technologies are progressing at such a speed that two Cerebral Palsy Alliance (CPA) research staff are convinced major breakthroughs are not far away.

Professor Alistair McEwan, Ainsworth Chair of Technology and Innovation, Cerebral Palsy Alliance and School of Electrical and Information Engineering, University of Sydney, and Dr Petra Karlsson, Senior Research Fellow, Brain and Mind Centre, Cerebral Palsy Alliance Research Institute, became aware of these advances at a recent conference held in San Francisco.

The Advancing Innovation in Assistive Technology Summit, held in May, was funded by CPA. It was organised and facilitated by Cerebral Palsy Alliance Research Foundation's IMPACT for CP and attracted 74 thought leaders from 12 countries.

"The summit was a huge success, assisted by the people with cerebral palsy who attended and encouraged participants to create mobility, communication and thought-to-speech technologies to improve the lives of people with a disability," says Petra.

Alistair and Petra agree that the discussions and demonstrations indicate that major breakthroughs in these areas are not far off. The BrainGate video is an example of a thought-controlled robotic arm in action.

The BrainGate Research Team at Brown University, Massachusetts General Hospital, Stanford University, Case Western Reserve University, and Providence VA Medical Centre comprises clinicians, scientists, and engineers working together to advance understanding of human brain function and to develop neuro-technologies for people with neurologic disease, injury or limb loss.

"Watch the BrainGate video and look for the joyous moment when the woman takes a drink without assistance for the first time since she lost the use of her arms," Alistair says.

Alistair points out that while BrainGate is an example of "invasive" technology, it is similar to a Cochlear implant that is now widely accepted and implanted in toddlers. However, non-invasive technologies are also being explored.

Other examples of technology in action shown at the summit included:

- Talkitt, an app that translates difficult speech into words family and carers can understand.
- Exoskeletons that allow people with a disability to walk by themselves. There is a Spanish video of CP walker which shows a girl graduate from a wheelchair to walking without crutches!

"There are clear breakthrough opportunities in providing long-term, rapid, intuitive, useful communication and mobility for people with cerebral palsy using technology such as artificial intelligence, flexible technology and robotics," Alistair says.

With these in mind, the participants in the summit have set three goals to be reached by 2021:

- engage five people with cerebral palsy participating in today's ongoing clinical trials to restore communication

- provide children less than two years of age with access to devices that enhance their mobility
- break down the barrier to the human right to communicate by accurately assessing the learning and use ability of children and adults with severe complex communication needs.

"There is a lot of great work being done," Alistair says. "Through a novel and multidisciplinary approach, researchers, people with lived experiences, clinicians, engineers and industry partners are joining forces."

This allows them to stimulate development that leverages newly available technologies, such as virtual reality, voice recognition and modern software, to design solutions that hold the key to unlock vast potential in people with severe disabilities, who today have limited means to learn, play and communicate.

"We look forward to seeing the progress that will be made by bringing experts together globally and defining a common strategy and research priorities as proposed at the technology summit," he says.

Prof. Alistair McEwan, Cerebral Palsy Alliance, University of Sydney

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Reprint from Cerebral Palsy Alliance
(https://www.cerebralpalsy.org.au/sstposts/StoryId1522298671037)

Apply for Research Grant

Each year Cerebral Palsy Alliance Research Foundation invites researchers to submit funding applications to its Grants Program.

The Research Foundation has a strong on-going commitment to funding high quality research into the prevention, treatment and cure of cerebral palsy.

Since 2006, our friends at Cerebral Palsy Alliance Research Foundation the Research Foundation in Australia have awarded more than $37 million into supporting 300 Cerebral Palsy research projects around the world.

From 2016, the Grants Program is supported by the Research Foundation of Cerebral Palsy Alliance based in Australia, and in the USA. As a result, researchers who are based in the USA are able to submit their proposed budget in US dollars.

Two types of grants are offered:
- Research Project Grant
- Career Development Grant

Application open:
1 October – 30 November 2018

For more information, email:

cparesearchgrants@cerebralpalsy.org.au

or visit:

cparf.org/funding

Note: The Grants Program only funds projects that will expand Cerebral Palsy research.

Call for Application:
Postgraduate Study at the Center for Innovative Bioengineering

For more information, visit:

www.arctcibe.org

or view the projects:

www.arctcibe.org/wp-content/uploads/2018/09/infomation scholarships.pdf

THE UNIVERSITY OF
SYDNEY

ARC Training Centre for
Innovative BioEngineering

Upcoming IEEE Life Science Events:

IEEE Life Sciences Conference
Montreal, Quebec, Canada,
28-30 October 2018
http://lsc.ieee.org/2018/

2019 IEEE 1st Global Conference on Life Sciences and Technologies

LifeTech 2019

March 12-14, 2019
Senri Life Science Center,
Osaka, Japan

The 1st IEEE Global Conference on Life Science and Technologies (LifeTech 2019) will bring together top technical professionals from Life Science industry and academia to exchange information and results of recent work on systems, circuits, technologies, processes and applications.

LifeTech 2019 will provide a forum for researchers, engineers, system developers, and service providers to share their ideas, designs, and experience in emerging technologies.

LifeTech 2019 is asking for submissions of technical papers for oral and poster presentations. Student papers are particularly encouraged.

All accepted and presented papers will be published at IEEE Xplore.

Organized Session Proposal:
July 31, 2018

2-page Paper Submission:
October 1, 2018

Acceptance Notification:
November 19, 2018

Final Paper Submission:
January 11, 2019

Conference:
March 12-14, 2019

For more information: http://www.ieee-lifetech.org

Upcoming Events:

MNMC 2018

10-14 December 2018
Grand Hyatt Kauai, Hawaii

EMBS Micro and Nanotechnology in Medicine Conference
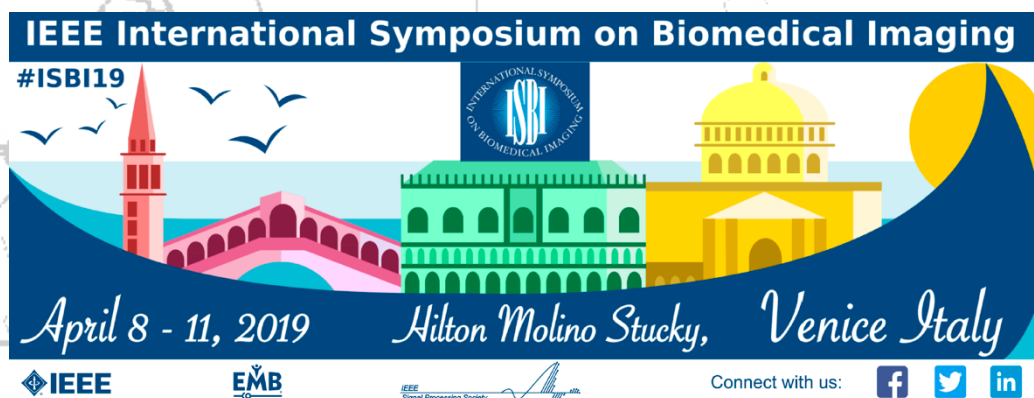TRANSLATING TECHNOLOGY FROM THE BENCH TO THE BEDSIDE

NER'19

20-23 March, 2019
San Francisco, CA, USA

International IEEE EMBS Conference on Neural Engineering

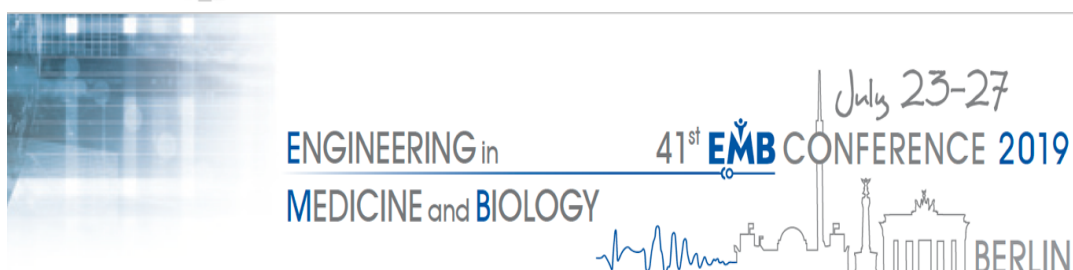"Neurotechnologies for Medical Therapies and Beyond"

IEEE International Symposium on Biomedical Imaging

#ISBI19

April 8 - 11, 2019   Hilton Molino Stucky,   Venice Italy

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ENGINEERING in MEDICINE and BIOLOGY

July 23-27
41st EMB CONFERENCE 2019
BERLIN

Reports on past IEEE Life Science Events

Life Science Conference'17 Sydney

The inaugural life science conference was hosted at the University of Technology in Sydney Australia over three days in late August 2017. It was attended by over 100 delegates from more than 15 countries. The conference theme was multi-society perspectives on Personalised Healthcare & Wearables which was covered by 11 conference tracks. The event included key note speakers Prof. Chin-Moi Chow, *The University of Sydney, Faculty of Health Sciences*, Prof. Carolyn McGregor, *Canada Research Chair in Health Informatics, University of Ontario, Institute of Technology UOIT* and Dr. Katina Michael, *University of Wollongong*. The format of the event provided delegates the opportunities to

listen to key note speakers, participate in panel discussions, tutorials and the opportunity to present their own research using a range of mediums. The mediums included both oral presentations and posters sessions. On the Thursday night a conference dinner was arranged for all attendees at a beachside restaurant at the famous Manly Beach. Attendees were invited to experience Sydney and see the city and the sites as the locals do. This included catching the local subway train to Circular Quay followed by catching a ferry and seeing the city by water as they made their way to Manly. The most wonderful surprise of the night was the return ferry trip and seeing the city lights and the world famous Sydney Opera House and Sydney Harbour bridge at night.

Chris Poneil
https://lsc.ieee.org/2017/

Dr. Stefan Mozar (conference chair) giving a thank award to Prof. Chin-Moi Chow (keynote speaker)

Prof. Chin-Moi Chow with Prof. Carolyn McGregor (conference co-chair and keynote speaker)