KAVLI NEWSLETTER

Kavli Institute of Nanoscience Delft

No.09

March 2014

IN THIS ISSUE:

Philanthropist Fred Kavli passed away

On 21 November 2013, the Kavli Foundation announced that its founder Fred Kavli has passed away peacefully in his home in Santa Barbara at the age of 86. As philanthropist, physicist, entrepreneur, business leader and innovator, Fred Kavli established The Kavli Foundation to advance science for the benefit of humanity. He visited Delft when our Institute was initiated in 2004, and we kept in close contact since then. We will miss him and continue the nanoscience that he loved so much. Finances of the Kavli Institute of NanoScience Delft will not be affected by the passing away of Fred Kavli.

FROM THE DIRECTOR

A full newsletter again this month! First, our frontpage news that our benefactor Fred Kavli passed away. I very well remember when I met him for the first time, in 2003: Fred was a soft spoken and kind man, with a strong determination to use his business-generated fortune to advance science for the benefit of humanity by supporting scientists and their work. Throughout the years I interacted with him a number of times, where this first impression was reconfirmed time and again. Now he has passed away. We will miss him, and continue the nanoscience at Delft that he has supported so generously.

Also, this month, we celebrate our 10-year birthday as a Kavli Institute. For this occasion, Hans Mooij recalls the history of the start of our institute - a very interesting story indeed, read it on page 6-7.

Finally, this newsletter features our Kavli Colloquium speaker Hongkun Park, introductory self-interviews by Marileen Dogterom and Greg Bokinsky, wonderful columns, and more.

Enjoy!

• **Cees Dekker**

COLUMN

Management meeting March 2064

'So,' the hawk-like woman said. 'What exactly are we going to tell the board about the budget deficit?' She looked around the table.
'We overspent more than 20 million,' the director continued. 'The renovation of the crèche, the generous start-ups for Flowerstein and de Braaf, the increasing salary costs... They are bound to ask critical questions next week.' She peered over her horn-rimmed glasses.
A short woman who was sitting at the centre of the table was the first to speak. 'I still think it is a shame that we only raised the salaries of our female faculty members,' she said.
The director looked at her. 'It was a tough decision,' she said. 'But we had no choice. Given that we already overspent…'
'It's not good for the reputation of our institute,' the short woman persisted. 'It may be seen as over-positive discrimination.'
'Rubbish,' a brisk-looking woman said. 'We hired the top two female physicists on the market, which has brought our faculty female:male ratio to 3:1. Our daycare and the adjacent boarding school are a huge success, and…'
'Didn't Helena Flowerstein join us because of that school?' a mousy woman interrupted.
The director nodded. 'We did not overspend,' the brisk woman continued. 'We merely consolidated our advanced gender position. The board of the Foundation must sympathize with that. Our institute is an example for the other 42.'A murmur of agreement sounded around the room.
'Thank you,' the director said. 'I'll take that along. Any other remarks?' She glanced around. 'If not, let's move to the next item on the agenda.' She looked at the screen in front of her.
'The faculty search committee. Who is going to report?' The short woman in the middle cleared her throat. 'We received an interesting application from W. Daring,' she said. 'PhD Harvard, postdoc Munich, currently faculty at…'
'Where is she from?' the mousy woman asked.
The short woman hesitated almost imperceptibly. 'He is British' she said.
For a moment the room was completely silent.
'He does have rather a lot of publications in Nature and Science,' she quickly added. 'And an H-index of 33.'
'Has he published with female scientists?' the director asked matter-of-factly. 'How about his FC-index?'
In the back the brisk woman pressed her neighbour's arm. 'It is a really useful criterion, isn't it?' she whispered. 'The Female Co-authorship-index we introduced? The number of female co-authors divided by the total number of co-authors?'
Her neighbour nodded in agreement.
'0.5,' the short woman replied. 'Which, I guess, is not too bad.' 'But certainly not outstanding,' the brisk woman loudly remarked.
A few women shifted in their chairs. Nobody spoke. The director looked around the room.
'Since his credentials on this point are not clear,' she slowly said. 'I propose we do not invite him.' She addressed the institute secretary. 'Let him know something like…' she paused for a moment. 'Although we think that the scientific aspects of his research are excellent, we unfortunately feel that the cultural side of it is not quite up to our standards.'

• Miriam Blaauboer

INTERVIEW

Interview with Hongkun Park

What was the dream of your childhood?
As far as I remember, my childhood dream was always to become a "scientist." I do not believe, however, that I knew exactly what I meant by "scientist": for instance, at one point, I wanted to become a scientist who would build a cool looking rocket and explore Mars. I never thought that being a scientist would involve countless hours spent in the basement filling up a cryostat with liquid helium and looking at a computer screen. My fascination with "becoming a scientist" nevertheless provided a major motivation for reading widely about science and studying hard.

Was it a difficult or obvious choice for you to study chemistry at the university?
I grew up in South Korea and got my bachelor's degree at Seoul National University (SNU). At the time I was applying for the university, I also had to choose which department to join. Up until three days before submitting the application, I was sure that I would apply for the physics department at SNU. But my uncle, who is currently a renowned professor at Purdue University specializing on drug delivery and who was then studying polymer science at the University of Wisconsin, Madison, convinced me that "chemistry" (and more exactly polymer science) is the future and that there would be many more opportunities for a chemist. Although I did try to resist at first, I eventually decided to follow his advice and enroll in the chemistry department. The funny thing is that even as a chemistry student, I took almost every course offered by the physics department besides those offered in the chemistry department (I took ~40 upper level undergraduate/graduate courses in science as an undergraduate. I was, without doubt, an absolute nerd!).
Looking back, I do believe that enrolling in the chemistry department at SNU was an absolute blessing that shaped my scientific path/course in many important ways.

How would you describe a scientist? What core qualities he/she should have in order to perform outstanding research?
On the second question, I would repeat what my graduate mentor told me: LOVE. You should love what you do if you want to excel. Yes, this answer sounds cliché, but it is so true. On the first question, I would say that a scientist is someone who is curious about how the natural world around us/him works and who strives to answer that question in a structured, careful, and well-thought-out fashion. Sometimes, you are smart enough and lucky enough to solve a truly groundbreaking problem. But more often than not, it will be grudgingly hard work to solve seemingly small problems. You should have resolve and perseverance to see your work through to have a chance to impact.

Are there any common mistakes young researchers should avoid?
I believe that one thing that is important is not to fall into the trap of following the road that other people have travelled. Yes, it's much easier and comfortable to do so. But often, it's much more rewarding and fun to follow your heart and discover a new track that has not been travelled before.

As a final question, could you give any advice for young scientists who just started their pathway in the field?
To repeat myself, I believe that a young scientist should choose the subject matter that he/she loves most and strive his/her very best to excel at it. You should be ambitious and "shoot for the stars", because otherwise you won't realize your full potential, but at the same time, you should be firmly grounded and realize that not everyone has to neither be, nor will be, the Einsteins of this world. Sometimes, I give my students a lighthearted joke: if the world were filled with professors at top-flight universities, it would be hell. Don't get me wrong, as a professor in a major research university, I love my job, and I love what I do everyday: after all, I get to work on the problems that I love and get to interact with bright students every day. But at the same time, I firmly believe that it's not the only thing that's fruitful. There are many different ways that a young scientist can contribute to society and fulfill his/her dreams.

• Anastasia Holovchenko

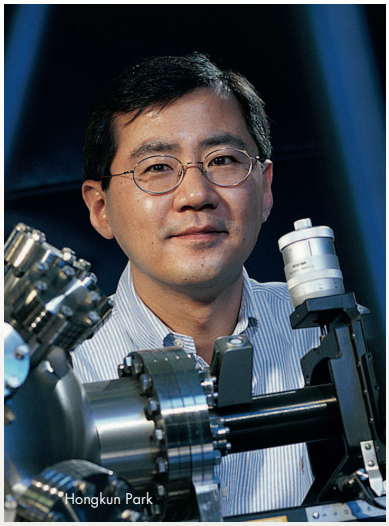
KAVLI COLLOQUIUM APRIL

KAVLI COLLOQUIUM

‘A Nanoscientist’s Journey to Biology’

Hongkun Park

Harvard University


Hongkun Park

April 3, 2014 will feature a Kavli colloquium by Hongkun Park.

In this colloquium, Hongkun Park will describe two new experimental platforms – vertical silicon nanowires and single-cell transcriptomics – that have been developed in my laboratory and discuss their applications in various biological inquiries, especially in relation to immunology and neuroscience. First, I will describe a vertical nanowire platform that enables high-throughput interrogation and manipulation of living cells by providing multiplexed chemical and electrical interfaces to a cell’s interior in a minimally invasive fashion. Using this platform to deliver surface-bound molecules into the cell’s cytosol, we are investigating intracellular molecular circuits that govern the behavior of various immune cells. We are using the same nanowire platform to gain direct electrical access to neurons, thus controlling and monitoring of neuronal activity in a multiplexed fashion. Second, I will describe a newly developed pipeline for single-cell RNA-Sequency that is broadly applicable to various cell types, and discuss how we are using it to discover variations between individual cells in both the abundance and splicing of RNA transcripts. This new profiling method provides a powerful new tool in immunology and neurobiology, enabling the elucidation of functional diversities between cells and the discovery of distinct cell states and circuits.

15.00 h	**Pre-programme: ‘Science Fiction gets real’**
	Dries van Oosten: Invisibility - Optical cloaking: is truth stranger than fiction? Ronald Hanson: Teleportation - From Star Trek fiction to a quantum technology Guido de Croon: Flying machines - Autonomous flight of micro-drones
15.45 h	Break
16.00 h	Kavli colloquium by Hongkun Park: ‘A Nanoscientist’s Journey to Biology’
17.15 h	Drinks & time to meet

EXTRA SEMINAR

‘Quantum Optoplasmonics and Diamond Based Sensing’

On April 4, 2014 Hongkun Park will give an additionally lecture on: “Quantum Optoplasmonics and Diamond Based Sensing”. The abstract for this lecture reads as follows:

Manipulating light-matter interactions at the nanoscale has broad implications for many research areas, ranging from spectroscopy and sensing to communications and quantum information processing. In this presentation, Hongkun Park will discuss our research efforts to develop nanoscale plasmonic and diamond optoelectronic devices that enable engineered light-matter interaction in solid state. I will also describe an unexpected offshoot of this research effort toward developing diamond-based sensors that allow high-fidelity interrogation of electromagnetic environments within a living cell in an organelle-specific fashion.

KAVLI COLLOQUIUM

‘A Nanoscientist’s Journey to Biology’

Date: April 3, 2014 at 15.00 hours

Location: Faculty of Civil Engineering, Stevinweg 1, Lecture room B

EXTRA SEMINAR

‘Quantum Optoplasmonics and Diamond Based Sensing’

Date: April 4, 2014 at 10.00 hours

Location: Faculty of Applied Physics, Lorentzweg 1, Lecture room E

NEWS

New Chair QN

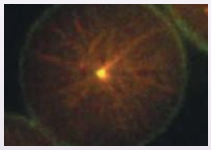
Prof. Herre van der Zant has been appointed Chair of the Quantum Nanoscience department, starting from December 1, 2013. Herre van der Zant is professor in the Molecular Electronics and Devices research group and will henceforth combine his professorship with his tasks as Departmental Chair. Prof. van der Zant is not new to this position. From 2008 until 2012 Professor Herre van der Zant fulfilled the position of Chair of the Quantum Nanoscience department with great enthusiasm.
Departing Departmental Chair Prof. Leo Kouwenhoven will be turning his full attention to the new Advanced Research Centre 'QuTech', which he is heading since January 1st 2014. Starting in 2012, he has fulfilled the position of Departmental Director with dedication. We would like to express our heartfelt thanks for his active efforts and cooperation and wish his successor Herre every success.

EPS Emmy Noether Distinction for Nynke Dekker

Nynke Dekker received the EPS Emmy Noether Distinction for Women in Physics for her research in biophysics. The European Physical Society has established the Emmy Noether Distinction for Women in Physics to bring noteworthy women physicists to the wider attention of the scientific community, policy makers and the general public and to identify role models that will help to attract women to a career in physics.

FOM Program on membrane proteins patterns granted

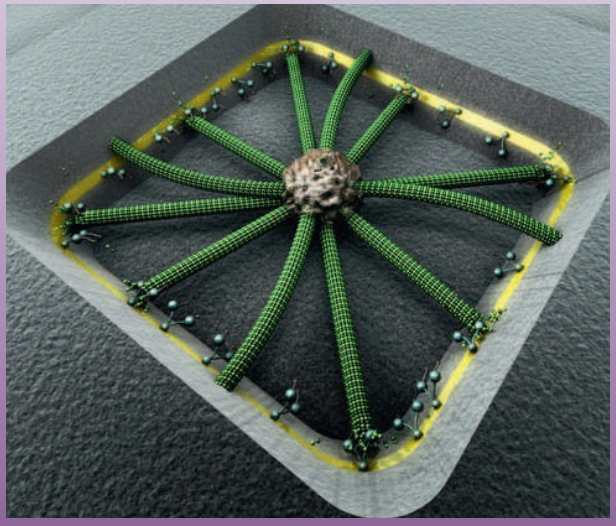
In November 2013 FOM granted 2.3 MEuro to the new FOM program 'Spatio-temporal patterns of membrane protein activity'. The research team consists of two members of our institute, Christophe Danelon and Marileen Dogterom, Doris Gadella (UvA), Philippe Bastiaens (Max-Planck Institute, Dortmund) and Pieter Rein ten Wolde (AMOLF, program leader). This program aims to, through a bottom-up approach, get a better insight in how patterns of signaling proteins are generated at cellular membranes. And, how these patterns drive cellular shape changes by controlling the organization of force generating protein filaments in the cell interior. Better knowledge of these processes will in the end lead to a fundamental insight in how healthy as well as diseased cells polarize and move in response to external signals.



ERC GRANT

ERC Synergy grant for Dogterom and Akhmanova

Marileen Dogterom, from 1 January chair of the Bionanoscience Department, and Anna Akhmanova from Utrecht University have received a prestigious ERC Synergy Grant of 7,1 million euro for their project "MODELCELL: Building a Model Cell to Achieve Control of Cellular Organization". The Synergy Grants of the European Research Council (ERC) are intended to enable interdisciplinary collaboration between excellent scientists.



Anna and Marileen aim to understand the basic principles of internal cell organization. This knowledge will eventually make it possible to control essential cellular processes such as cell movement and division. In this Synergy program they focus on the cytoskeleton, a network of protein filaments responsible for the organization and transport of cellular components. By performing experiments both in simplified artificial cells and in real living cells, they propose to obtain insights into how the organization of the cytoskeleton is achieved and modulated in the context of different biological functions.
Other researchers who will contribute to the program by bringing in additional expertise are Gijsje Koenderink, Bela Mulder and Pieter Rein ten Wolde (AMOLF) and Lukas Kapitein and Sander van den Heuvel (Utrecht University).

On my way to Kavli

I was once asked to give a seminar for postdoctoral fellows about the why and how of the different career choices that I made in my life. I gave that talk the title "A hidden agenda". The truth is that besides my deep love for science, I have always been very motivated by other benefits that come with a life in science. I chose the subject of my master thesis (the fractal distribution of matter in the universe) based on the fact that I was fascinated by the topic, of course, but also because a professor at the University of Groningen who was working on this topic, had just moved to "La Sapienza", the University of Rome. As a result I had the pleasure of living in a small Piazza in Trastevere in Rome for almost a year.

After coming back to Groningen to finish my degree, I quickly decided that later in life there would be plenty of time to spend many more years in the Netherlands, so I again looked for a position elsewhere in Europe. This time I focused on Paris, where I ended up in an apartment close to the Place Vendome with a rooftop view on the Ritz hotel and very important for my future career a PhD project in biophysics! When my supervisor moved to the US, I ended up in Princeton (this was not part of the plan), but this fortunately led to a subsequent postdoc at Bell Laboratories and an apartment in the Greenwich Village in New York. Next stop was Amsterdam with a tenure track position at AMOLF, the perfect place to start my independent scientific career.

Since 2006 I live in the small town of Nieuwkoop. Not exactly a city. Instead, it was strategically chosen (in hindsight) so that I could join BN without having to move to a new house again, and it is perfect for bringing up my children and living with my family! Together with Rene (who is the general director of Otis Elevator Company in the Netherlands), I have two daughters: Anne (6) and Sophie (4), who both happily go to school in this little town.

And now I'm a proud member of the Kavli institute! At AMOLF, I was of course already on the mailing list of the Newsletter, which led to some high expectations. Still, it didn't prepare me for the fabulous welcome that I felt, starting with the legendary lipdub right before Christmas. At the Kavli institute, my group will get the opportunity to take important next steps in our quest for building a minimal synthetic cell, besides our continued interest in the biophysics and cell biology of the cytoskeleton. As the chair, I'm looking forward to bringing more excellent biology to the department, as well as contributing to the success of our young and talented faculty.

I'm looking forward to bringing more excellent biology to the department, as well as contributing to the success of our young and talented faculty.

On a different note, if I may give one piece of advice about places-not-to-be-missed in the Netherlands to my new colleagues who come from so many places around the world: go to the Wadden eilanden! You'll find some of the most beautiful spots on earth there. The picture shows my father's sailboat one evening between Schiermonnikoog and Ameland in August last year. We spend the night there waiting for the water to return, without a soul in sight (the perfect place for making career choices).

• **Marileen Dogterom**

HOW WE BECAME A KAVLI INSTITUTE

It all started on July 17, 2003. In my mail I found a message from a certain David Auston of a certain Kavli Foundation, which I'd never heard of before. "Dear professor Mooij", the message said, "the Kavli Foundation has recently launched a program to assist universities in establishing interdisciplinary research institutes in three areas of basic science: nanoscience, neuroscience and cosmology. Our intent is to provide funding to establish up to 3 or 4 new institutes in each of these three areas of emphasis. Although most of these will be in the U.S., we would also like to have an international presence by establishing one or more institutes outside the U.S.". The message went on to say that if we were interested in a "preliminary discussion about this opportunity", David Auston would be prepared to visit us on October 30.

At that time one received numerous mails from Nigeria or Swasiland promising large sums to help recover blocked funds from deceased uncles or deposed dictators. Before hitting the delete button, I read that the Institute for Theoretical Physics in Santa Barbara and the Institute for Particle Astrophysics and Cosmology at Stanford had now added Kavli to their name. I knew the ITP in Santa Barbara very well and indeed saw on their website that it was now the KITP. We spoke with colleagues in Delft and I answered to David Auston that we would certainly be interested. In the meantime, I made some further inquiries. The director of the KITP told me that they were happy with the Kavli association. I also tried to find out where the money came from. The Kavli website gave a biography of the benefactor Fred Kavli. Originally an engineer in Norway, he came to the U.S. in his twenties and made true the country's fame of unlimited opportunities for those who see them and use them. He established the Kavlico company, developing and fabricating sensors for the car and aerospace industry. He sold the company in 2000 when he was 73 years old, and decided that he wanted to use his capital for the advancement of basic science.

David Auston came to Delft for the suggested meeting on October 30. To provide and receive some initial background information, I had dinner with him in the Prinsenkelder on the previous evening. He turned out to be a rather formal but pleasant person, very careful in what he said. On the 30th he came to the lab, had a tour, talked with us nanoscientists, with dean Karel Luyben and university president Hans van Luijk. He left us, saying that he would present his observations to Fred Kavli and the Board of the Foundation. We would hear from him. Within our nanoscience community we agreed that Cees Dekker and I would be the acting committee on this matter.

Would we be accepted as a Kavli Institute that day?

A few weeks later we were told that the Board was interested in further discussions with us. We were asked to provide a plan on how we would use the money and to indicate how we would handle the financial side. The latter was a problem. Goal was a long-term relationship where the capital is maintained indefinitely and only the yearly yield after inflation can be spent. U.S. universities have an endowment fund that actively invests money from many sources and returns a spendable income that is often more than 10%. Plagued by recent scandals, our country strictly enforced the rule that public bodies such as universities could not invest in risk-running enterprises. We did not know how much money could be involved for Delft, but made a guess that was much to optimistic.

The next important step in the process was a visit by Cees Dekker and myself to the Board in Santa Barbara, on 12 December. The appointment was made at short notice, as Cees was on his way to a conference in California. We flew to Los Angeles on December 11 and stayed overnight in an airport hotel. Waking up early we went through our plans and our arguments in detail. We produced a financial scheme and had it printed in the hotel just before we left to catch the flight to Santa Barbara. David Auston met us at the small airport and had lunch with us at a restaurant on a beach with many pelicans, close to Fred Kavli's private house where the meeting would take place. Cees and I both experienced this day in a dream-like trance, which was enhanced by our jet-lag and our intensive early-morning discussions. We knew that much might be at stake, but had no clue what to expect. Would we be accepted as a Kavli Institute that day?

Fred Kavli lived in a large house, more wide than high, right on the Pacific Ocean just north of Santa Barbara. From the garden a cliff path with built-in stairs led down to the narrow rocky beach far below. The house felt Norwegian to me, not Ikea-light or Marimekko-bright but rather dark with large paintings of Norwegian mountains and fjords. The discussion leader on behalf of the Board was Tom Everhart, ex-president of CalTech. I had expected that we would be asked to present and defend our research program and our infrastructure, but they seemed more interested in Cees and me explaining what our personal research goals were. Like PhD candidates during their final ceremony, we were led by the questions. At one time Fred Kavli suddenly asked me whether I would be willing to lead a Kavli Institute in Delft. He did not say that there would be such an institute so I could only say yes, but I would also be happy with Cees as the director. The meeting was officially adjourned for us to watch the sunset. It was a beautiful clear day. There could have been spotted the green ray, but we did not see it. The atmosphere relaxed and we had a glass of wine from Kavli's own vineyard. Cees had to leave to his conference and I stayed on for dinner with the Board members at a high-class beach resort south of Santa Barbara. I also stayed there the night. With early daylight I made a long walk on the beach, and later left for the airport to fly back.

During the meeting and afterwards it was made clear that our financial plan needed a significant downscale. In the following weeks we had frequent interactions, but the schedule for a decision remained fully unknown to us. The next important fact was the announcement that Fred Kavli wanted to visit Delft. An appointment was made for February 5. Kavli, Auston and Everhart came, university president Hans van Luijk and dean Karel Luyben were again fully involved. We had a lab visit and we had discussions. Executive Board of Delft University of Technology had arranged that we would have lunch in the Town Hall on the Market square. The mayor of Delft, with his official chain, received us. Unfortunately no pictures were taken. At the lunch, speeches were given by Hans van Luijk and by Fred Kavli. During the latter speech, Kavli said something that could only make sense if we were accepted as a Kavli Institute. Cees and I do not remember what he said precisely. I asked Kavli whether he meant that their decision was now taken, and that was confirmed. The manner of the procedure created a bit of an anticlimax to an intensive process of more than half a year. The endowment capital we would receive was a capital of 7.5 M$, the same as all other institutes.

The Kavli Foundation had in the meantime established six other new Kavli Institutes at CalTech, Cornell (nanoscience), Chicago, MIT (astrophysics) and Columbia, San Diego (neuroscience). We were at that time the only institute outside the US. On March 10, a grandiose press conference was held at the Carlyle hotel near Central Park in New York. The general aims of the Kavli Foundation were presented and all institutes were introduced. Each of the new directors, I among them, presented their institute briefly. A lot of press were present. In the margin of that press conference, just before it started, the contract between Delft University and the Kavli Foundation was signed by the two presidents David Auston and Hans van Luijk. That is why March 10, 2004 is our birthday.

• Hans Mooij

Remembering Fred Kavli

When we first met Fred Kavli he was already 76 years old. He was a very active person. He had sold his Kavlico company but had started a real estate business and spent his days in his office in Oxnard. He was very fit, regularly descending and ascending the high stairs to the beach below his house for jogging. He was very closely involved with the Kavli Foundation where decisions were never taken without him. He was a person with a strong personality and strong opinions.

His 80th birthday was celebrated in 2007, starting with a reception in and around his beautiful house. Kavli did not say much, but was visibly happy with all these scientists that were now connected to his name, and the publicity that was generated at the press meeting the next day. The Kavli Prizes came later and were presented in Kavli's native country Norway. When he descended the long stairs together with the king to join a thousand people for dinner in Oslo's town hall, one could see him bursting with pleasure and pride. His goal to perpetuate the Kavli name was realized.

I personally met Fred Kavli at these formal occasions, where he was approachable and I could talk with him on a personal basis. When I came to visit the university in Santa Barbara during the time that I was director in Delft, I also went to the Kavli Foundation office to catch up with developments. Fred Kavli was never included in the schedule of my visit but he always made time to receive me in his real estate office for half an hour, telling me that he was proud of the Kavli Institute in Delft. From my side, I am proud to have known him.

• **Hans Mooij**

KAVLI IN SHORT

Scientific research

In the past 10 years, the Kavli Institute of Nanoscience Delft witnessed scientific breakthroughs in a wide range of topics from quantum nanoscience to bionanoscience. Current research strengths at the Kavli Institute of Nanoscience Delft comprise:

- Quantum computation
- Molecular electronics
- Novel nanotechnology
- Single-molecule biophysics
- Synthetic biology

Output

In the period 2004-2014, research at the Kavli Institute of Nanoscience yielded 2141 publications. This included many publications in the top journals, such as Science (14), Nature (23), Nature-X (72), PNAS (13), Physical Review Letters (163).

Prizes & Awards

Hundreds of prizes and prestigious grants were awarded to faculty members of the Kavli Institute of Nanoscience, such as 15 ERC-grants and 15 NWO Vidi & Vici grants.

HISTORIC HIGHLIGHTS KAVLI INSTITUTE OF NANOSCIENCE DELFT

2004 — Fred Kavli announces that Delft will receive a Kavli Institute

10 March 2004 — Foundation of the Kavli Institute of Nanoscience Delft with a 7.5 million dollar endowment and significant matching funds from the TU Delft. First director of the institute is professor Hans Mooij. Simultaneously 2 sister Kavli nanoscience institutes were founded at Cornell and CalTech

2004 — Start of the Casimir Research School: joint graduate school of Kavli Delft and the Leiden Institute of Physics

2006 — Kavli Nanoscience workshop for international science journalists

2006 — Foundation of a sister Kavli Institute at Harvard University

2007 — First Kavli Future Symposium 'The Merging of Bio and Nano: toward Cyborg Cells' in Greenland

2008 — TU Delft launches an initiative in Bionanoscience as part of the Kavli Institute. The Kavli Institute of Nanoscience Delft receives a second endowment of 5 million dollar and 10 million euro matching funds from the TU Delft.

2009 — Opening of the Kavli Nanolab: a large cleanroom and nanofabrication facility

2009 — First Kavli Colloquium: colloquia of high profile scientists in nanoscience (3 times/year)

2010 — Official start of the Department of Bionanoscience. The Kavli Institute of Nanoscience now exists of 2 departments: Bionanoscience and Quantum Nanoscience.

2010 — Cees Dekker new director of the Kavli Institute

2011 — First Kavli Newsletter (3/year)

2011 — Start of the biannual Kavli Delft Thesis Prize for the best PhD thesis in the previous two years

2012 — 51 million euro funding for the 10 year research program Frontiers of Nanoscience (NanoFront) for a consortium of the Kavli Institute and the Leiden Institute of Physics

2012 — Start of the biannual Kavli Delft Publication Prize for the best publication in the previous two years

2012 — Start of the new bachelor program Nanobiology initiated by Kavli Delft and the Erasmus University Rotterdam

2013 — First International Kavli Nanoscience Nexus Conference in Puerto Rico

2013 — Launch of QuTech: a large effort, headed by Leo Kouwenhoven, that pursues the development of the quantum computer

2013 — Launch of a sister Kavli Institute at Berkeley

2013 — Fred Kavli, founder and chairman of The Kavli Foundation, passes away (1927-2013). The Kavli Institute will continue its groundbreaking work on nanoscience in his spirit.

10 March 2014 — Celebration of 10 years Kavli Institute of Nanoscience Delft

Call for nominations for the Best Publication Prize

On our Kavli Day (September 11), we will award the 2014 prize for the best publication that resulted from our Kavli Institute of Nanoscience at Delft from the previous two years. This prize consists of an award and an amount of € 3000. Nominations are now welcome. Deadline for submission is **May 1, 2014**. A publication is eligible for the 2014 prize when it is published from our Kavli Institute (as must be clear from the address) and when the publication date where the paper appeared in print was between 1-1-2012 and 1-4-2014. Please send in your nomination(s) - email to c.dekker@tudelft.nl. Concretely, please send me a pdf of the publication and a letter motivating why you consider this the most outstanding paper from our institute in the past 2 years that is worthy of this prize.

NEW EMPLOYEES

Name	Date of employment	Title	Lab
Albert Franquet Gonzalez	10/1/13	PhD	QN/TN
Xiaoli Huang	10/15/13	PhD	QN/TN
Mohammad Ansari	11/1/13	Postdoc	QN/TN
Maurits Kok	1/1/14	PhD student	BN/Marileen Dogterom lab
Sophie Roth	1/1/14	Postdoc	BN/Marileen Dogterom lab
Ignatio J. Olavarria Contreras	1/1/14	PhD	QN/MED
Nandini Muthusubramanian	1/1/14	PhD	QN/MED
Nuria Taberner	1/1/14	PhD student	BN/Marileen Dogterom lab
Roland Dries	1/1/14	Technician	BN/Marileen Dogterom lab
Gesa Helms	1/1/14	Postdoc	BN/Marileen Dogterom lab
Georges Weber	1/1/14	Postdoc	BN/Marileen Dogterom lab
Stef van der Meulen	1/1/14	PhD student	BN/Marileen Dogterom lab
Florian Huber	1/1/14	PhD student	BN/Marileen Dogterom lab
Magdalena Preciado Lopez	1/1/14	PhD student	BN/Marileen Dogterom lab
Marileen Dogterom	1/1/14	Head of the department	BN
Kevin Felter	1/1/14	Guest researcher	BN/Cees Dekker lab
Eugen Ostrofet	1/5/14	PhD student	BN/Nynke Dekker lab
Stefano Poletto	1/6/14	Postdoc	QN/QT
Dominik Schmieden	1/15/14	PhD student	BN/Anne Meyer lab/ Marie-Eve Aubin lab
Hui Wang	1/15/14	Postdoc	QN/HREM
Anaïs Dréau	1/16/14	Postdoc	QN/QT
Kaveh Lahabi	2/1/14	PhD	QN/KN
Floris E. Kalff	2/1/14	PhD	QN/MED
Ranko Toskovic	2/1/14	PhD	QN/MED
Dejan Davidovikj	2/1/14	PhD	QN/MED
Mihaela Folea	2/1/14	Postdoc	BN/Andreas Engel lab
Rafal Skolasinski	2/1/14	PhD	QN/QT
Greg Bokinsky	2/15/14	Faculty	BN
Behnem Mirzaei	2/15/14	PhD	QN/QT
Nathan Langford	3/24/14	Postdoc	QN/QT
Laura Restrepo	4/1/14	PhD student	BN/Chirlmin Joo lab
Tomohiro Yokoyama	4/1/14	Postdoc	QN/TN
Yang Zhou	6/1/14	Postdoc	QN/TN

A NEW KAVLI INSTITUTE

The Kavli Energy NanoScience Institute

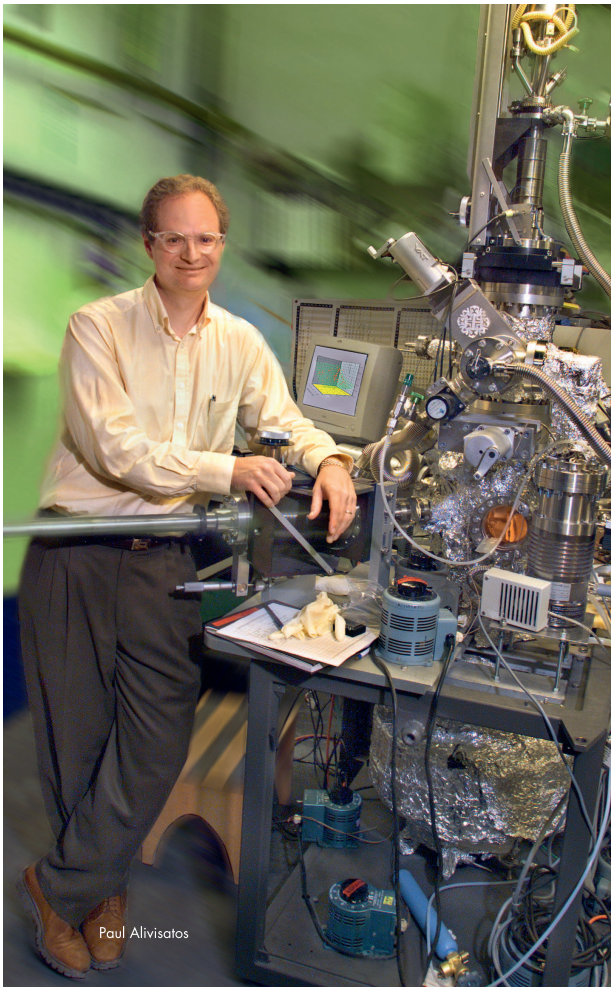
The risk and fun of doing fundamental research

In October last year, the Kavli foundation endowed a new institute at the University of California Berkeley and the Lawrence Berkeley National Laboratory. The new Kavli Energy NanoSciences Institute is looking to discover how nature manages energy at nanoscale. In this same month, coincidentally, the director of this new institute, Paul Alivisatos, gave a Kavli Colloquium at our institute. During his visit I asked him to share his ideas and views about his institute. Paul answered openly 'Ah, it is okay to interview me..., if I can ask you how your Kavli Institute is working, since I am all fresh in this area'.

How did the Kavli Energy Nanoscience Institute come about?
It all started locally. We were all different labs at Berkeley, working on seemingly different topics. We did not work together that much, but in a short period of time, a number of fruitful pair-wise interactions started. This made us think about a bigger cooperation around some common themes and we wrote a proposal to the Kavli Foundation. With the start of this new institute, we are together trying out new ways to control energy flow on very small scales. We choose to keep our institute lean and mean and focussed on around 17 investigators from different directions: condensed matter, physics, theory, chemistry, material science, biophysics and electrical engineering. With this, in our eyes small group to cover this topic, we can be effective and condensed.

We occasionally use the acronym KIND for our Kavli Institute of Nanoscience Delft. Can I abbreviate your institute as KENSI?
Paul laughs and says: "I think it is good to explicitly remember Fred when we talk about the institute, so we prefer Kavli ENSI."

Why was this the right time to start KavliENSI?
At this moment in time we are much better in controlling nanoscale systems than a few years ago. Furthermore we see that the directing of energy is different on a small scale; new principles occur. The different research directions within Berkeley have these new principles in common, which made it logical to start a large cooperation to enforce breakthroughs.


Paul Alivisatos

What will be the game-changing breakthrough of your institute in the coming 10 years?
KavliENSI is a fundamental research institute and will think of completely new ways to manipulate energy. These foundations of energy are not yet exploited. A possible breakthrough is to understand how you get directionality of energy flow and how to make energy flow in specific directions. To be honest, I do not know yet what to find, that is the risk and fun of doing this fundamental research.

What type of activities would you like to develop within the KavliENSI?
I am at this moment thinking of matching funds for early career people to join different parts of the institute (joint postdocs). And I would like to install discovery funds, or in other words 'seed grants for scientists', to enable them to try out things way before competitive peer-reviewed grants. I also like the idea of one of the Neuro Kavli Institutes who have a seed fund competition, which is open for PhD and postdocs, independent of their PI. We are very free on how to use the funds, but the Kavli funds are relatively small, and we will therefore use them strategically. Next week we will have an open brainstorm seminar for all PhD-students and postdocs of all involved research groups to come up with ideas for activities within KavliENSI.

Is there something you like to say the people in our institute?
I really look forward for people from this Kavli Institute of Nanoscience Delft to visit us. And now about my question to you…

• **Jennifer Kockx**

A SELF-INTERVIEW BY GREG BOKINSKY

Greg Bokinsky

A bacterial cell drawn by a child

If I had to choose something that fascinates me the most about the natural world, it would have to be bacteria: those tiny bags of enzymes and DNA that have collectively figured out billions of ways to turn simple compounds into more copies of themselves. One of my favourite aspects of bacteria is their ability to take up foreign genes and integrate them into their own genome, gaining entirely new skills their parent and sibling cells never had. It's kind of like one of us suddenly becoming photosynthetic by bumping into a shrub the right way. These gene transfers are not entirely benign, unfortunately: they also spread antibiotic resistance from species to species.

Installing new genes into bacteria is something I did almost daily as a postdoc in a synthetic biology lab at UC Berkeley. After a year or so, I began to realize what the other researchers in the lab had concluded: that while we've become quite good at making synthetic DNA and inserting it into bacteria, the DNA programs we write usually crash at worst, or behave unreliably at best. I started to feel that with engineering bacteria, we're not much better than five-year-old kids making drawings of our dream houses (the kind with roller coasters and swimming pools on the roof). We can make DNA that encodes traits we think our cells should have, but our coolest designs rarely show up in reality. At Delft, I'd like to go beyond the DNA codes to understand why our designs so often are incompatible with real living bacteria. In other words, imagine me as a five year old asking his parents to explain why the house they live in doesn't have a roller coaster on the roof.

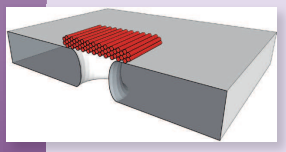
I started to feel that with engineering bacteria, we're not much better than five-year-old kids making drawings of our dream houses

While at UC Berkeley, I would often escape my frustrations with engineering bacteria by backpacking in the glorious mountains that California is so famous for. (My bacterial equivalent of a "dream house," which I did eventually manage to build, was a strain that could eat plants while making one of three different biofuels, so I needed many backpacking trips during that project.) Of course, escaping frustration is not the only reason for these excursions, as there are so many amazing things to see, and exploring places with no clear goal in mind is my favourite hobby. I've heard the mountains of the Netherlands are a bit shorter than those found in California, so my hiking shoes will probably start to gather some dust. On the other hand, I've also heard that the Netherlands is ideal for biking, which, happily, is another one of my favourite means of exploration.

HIGHLIGHT PAPERS

Ionic permeability and mechanical properties of DNA origami nanoplates on solid-state nanopores

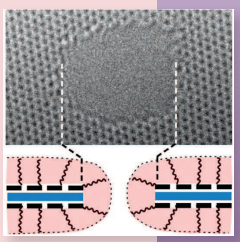
While DNA origami is a popular and versatile platform, its structural properties are still poorly understood. In this study we use solid-state nanopores to investigate the ionic permeability and mechanical properties of DNA origami nano plates. DNA origami nanoplates of various designs are docked onto solid-state nanopores where we subsequently measure their ionic conductance. The ionic permeability is found to be high for all origami nano plates. After docking, we often observe spontaneous discrete jumps in the current, a process which can be attributed to mechanical buckling.



These data show that DNA origami nanoplates are typically very permeable to ions and exhibit a number of unexpected mechanical properties.

C. Plesa, A. Ananth, V. Linko, C. Gülcher, A. Katan, H. Dietz, C. Dekker
ACS Nano, December 2, 2013

Tailoring the hydrophobicity of graphene for its use as nanopores for DNA translocation



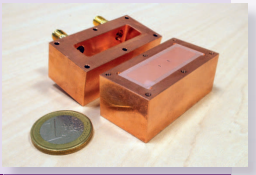
Graphene nanopores are potential successors to biological and silicon-based nanopores. For sensing applications, it is however crucial to understand and block the strong nonspecific hydrophobic interactions between DNA and graphene. In this paper we demonstrate a novel scheme to prevent DNA–graphene interactions, based on a tailored self-assembled monolayer. We develop a general strategy to noncovalently tailor the hydrophobic surface of graphene by designing a dedicated self-assembled monolayer of pyrene ethylene glycol, which renders the surface hydrophilic. We demonstrate that this prevents DNA to adsorb on graphene and show that single-stranded DNA can now be detected in graphene nanopores with excellent nanopore durability and reproducibility.

G.F.Schneider, Q. Xu, S. Hage, S. Luik, J.N.H. Spoor, S. Malladi, H. Zandbergen, C. Dekker
Nature Communications 2013

HIGHLIGHT PAPERS

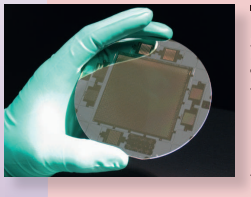
Entangling quantum circuits by measurement and feedback

In quantum mechanics, objects can exist in a superposition of different classical states. However, the mere act of observation usually destroys such superpositions, making the world around us look classical. The Superconducting Quantum Circuits group realized a special type of simultaneous measurement on two superconducting quantum bits in a cavity to achieve the opposite effect. By performing this measurement, the two initially distinct qubits become entangled in a uniquely quantum state, exhibiting correlations that are not possible in a world governed by classical physics. Moreover, by implementing a quantum feedback loop, they generate the desired entangled state on demand, defying the inherent probabilistic nature of measurement. This development brings new capabilities for quantum error correction in the solid state. This is a collaboration with the theory group lead by Ya. M. Blanter and with K.W. Lehnert from JILA-NIST, University of Colorado.



D. Ristè, M. Dukalski, C.A. Watson, G. de Lange, M.J. Tiggelman, Ya.M. Blanter, K.W. Lehnert, R.N. Schouten, L. DiCarlo
Nature 502, 350 (2013)

Fluctuations in the electron system of a superconductor exposed to a photon flux

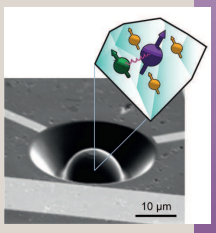


Pieter de Visser and Jochem Baselmans have established for the first time that a special superconducting detector is sensitive enough to be used on a space telescope. By studying the fluctuations in the electron system of the superconductor with, and without radiation, they gained a much better understanding how the superconductor reacts to low quantities of radiation, which is essential for an ultra-sensitive detector.

P. J. de Visser, J. J. A. Baselmans, J. Bueno, N. Llombart , T. M. Klapwijk
Nature Communications, Article number 3130, 2014

Physicists correct quantum errors with diamonds

Quantum states enable powerful new ways to process information. They are, however, also extremely vulnerable to even the tiniest of errors. Scientists at the Kavli Institute of Nanoscience, together with colleagues from Iowa University have now succeeded in detecting and correcting such errors during the storage of quantum states in a diamond at room temperature. The team encoded quantum information in an entangled state of multiple spins so that it is possible to detect and correct errors by comparing the states of the spins, without ever disturbing the encoded quantum information. This is an important step towards protecting fragile quantum information long enough to realize a functioning quantum computer.



T. H. Taminiau, J. Cramer, T. van der Sar, V. V. Dobrovitski, R. Hanson
Nature Nanotechnology, 2014

COLUMN

LEAVING ON A JET PLANE

Imagine the following: You're a Ph.D. candidate (Well, that shouldn't be too hard for many of you…), the project you have spent the past 12 months working on seems to produce some interesting results. At a national conference they have recognized and acknowledged this by letting you give a presentation. Then you sign up for a large international conference, THE yearly conference of the field so to speak, and even there you are selected to give a talk. That's great news! Right?

But wait, you also have a sister. She is a professional snowboarder. She has spent the past 12 years training her (pardon my French) ass off and seems to be getting some interesting results. She's the straight-A student of the national competition so to speak. And she shows this by winning the national championship in her discipline for 5 years in a row. Then she signs up for international competitions, and this seems to run pretty well. So well indeed that they have selected her… - okay, this is where all resemblances stop I am afraid - to head for the Winter Olympics in Sochi. Now that is what I would call great news!

Brother and sister seem to be doing pretty well, both preparing for their respective moment of fame. Now here is the catch: both their time to shine are scheduled at the exact same moment in time (though certainly not in space). It's Murphy's Law put into practice. What to do?!

As you might have guessed, this story is as personal as it gets. My sister went to the Winter Olympics in Russia and yours truly had a talk in San Francisco. But: my sister! An Olympic athlete! Talk about over-classing. I wouldn't know of any conference that would truly be the scientific equivalent of the Olympic games. Maybe the Fields Medal or a Nobel Prize might be called the Olympic Medal of Science.

That being said, even though her world of sports and my realm of science seem universes apart, there are many parallels between both. Though my day-to-day activities often leave her completely clueless (and vice versa), we do share an enthusiasm that is very similar when it comes to our respective professions. She can spend her day off waxing her snowboards just as easily as I can spend mine writing scripts for my data. In her I see a level of ambition and focus that is not unlike my own. We both experience (cliché, but so true) that achieving great results – if any – is hard, often frustrating, sometimes requiring boring, repetitive work and at times requires just that little bit of luck. What makes our professions stand out from others? We both perceive that what we are doing is not a 9 to 5 job, but a way of life.

So, what will it be? Sochi or Cali? Well, you might have guessed by now where my ticket took me mid-February. Though I might have some mixed feelings, this is definitely her once-in-a-lifetime moment and not mine. Besides that, I'm pretty convinced she would make the trip for me too if I get summoned to Stockholm one day…

•Bojk Berghuis

SCIENCE ART

The image shows multicellular mats of newly evolved bacteria in an experiment that examined the evolution of biodiversity in real time.
The work was published under the title 'Founder niche constrains evolutionary adaptive radiation' by R.C.E. Flohr, C.J. Blom, P.B. Rainey, H.J.E. Beaumont in PNAS 110:20663, 2013

Please send suggestions for 'Science Art' to Amanda van der Vlist, A.vanderVlist@tudelft.nl

UPCOMING KAVLI COLLOQUIA

Eric Betzig

June 12, 2014

Janelia Farm Research Campus

George Whitesides

September 11, 2014

Harvard University

KAVLI DAY

SEPTEMBER 11, 2014

COLOFON

The Kavli Newsletter is published three times a year and is intended for members of the Kavli Institute of Nanoscience Delft and those interested. PDF versions of all Kavli Newsletters can be found at www.kavli.tudelft.nl

Editorial staff:
Cees Dekker
Jennifer Kockx
Jur Thöne
Amanda van der Vlist

Lay out: Media Solutions, Saskia de Been

Contact address:

Kavli Institute of NanoScience Delft
Delft University of Technology
Department of Bionanoscience

Lorentzweg 1
2628 CJ Delft
The Netherlands

Phone: +31(0)15-2789352

E-mail: A.vanderVlist@tudelft.nl