Professor Steve Simpson from the School of Biological Sciences has been named as the NSW Scientist of the Year 2009 for his cutting-edge work on nutrition and its implications for ecology, evolution, agriculture and human health.

Professor Simpson's research on locusts and what causes them to swarm, has led to some amazing findings and his body of work has had a significant impact on a variety of scientific fields - from locust swarms to obesity, to more effective and environmentally sustainable dietary supplements for aquaculture.

Originally from Australia, Professor Simpson worked at Oxford University for 22 years, before returning to Australia as a Federation Fellow in 2005.

Professor Simpson's research is helping to tackle challenges in a range of different areas: it has provided fundamental insights into the dietary causes of the human obesity epidemic and the aging process; it has linked individual physiology, including chemical events within the brain, to mass migration in locusts, which has helped predict and manage locust outbreaks; it is driving new approaches to optimising animal feeds in the aquaculture industry, which is supporting efforts to minimise environmental impacts and maximise fish welfare; and his work is also helping conserve endangered species such as kakapo parrots and wild primates.

Nutrition touches all aspects of biology, agriculture and the medical sciences. By devising and applying a new way of modelling nutrition, Professor Simpson has made novel advances in major problems in ecology, evolution, agriculture and human health.

He has developed the foundation for a single theoretical model that connects individuals to communities, offering a new foundation for understanding the impact of environmental change.

In 2008, Professor Simpson was awarded the University of New South Wales Eureka Prize for Scientific Research for outstanding curiosity-driven scientific research.

The Faculty of Science congratulates Steve on yet another wonderful achievement.

The NSW Scientist of the Year Awards were established in 2008 by the NSW Office for Science and Medical Research to recognise and reward the state's leading researchers for cutting edge work that generates economic, health, environmental or technological benefits for NSW.
Events & updates

The University of Sydney Information Day
Tuesday 5 January 2010, 9:30am-4pm
The University of Sydney, Camperdown Campus

The University of Sydney Information Day provides prospective students with course advice and support for making final decisions regarding UAC preferences.

If you’re still unsure about which science degree to choose or want to find out more about a particular area of study, then come along to our Information Day.

There will be a series of mini-lectures about each of the degree paths in Science as well as booths staffed with representatives from the Faculty Office and each of the Schools and Disciplines within the Faculty in the Great Hall, Quadrangle.

On the day there will be over 130 mini-lectures and talks, a variety of exhibitions and free entertainment... If you’re still unsure about your study options, you should definitely come and visit us.

The Sky’s the Limit: Astronomy in Antiquity
3 May 2009 - June 2010
Nicholson Museum, Quadrangle,
The University of Sydney, Camperdown campus

How did the ancient Egyptians know when the Nile was about to flood? Why was Stonehenge built? How did the ancient Greeks know when to plough their fields? Which zodiac sign did Augustus use to legitimise his rule?

The answers were in the sky.

The sun, moon, stars and planets and their movements were of great significance to the people of the past. Their religious beliefs and ritual activities regularly involved the movement of the sun, moon and stars. Beliefs grew of peoples’ destiny being told in the sky: the zodiac and horoscopes were developed. The movements helped to signal regular events and, with devices such as the Antikythera Mechanism, these were systematised into the calendar that we still use. The philosophical reasoning and the scientific investigations and instruments that have helped to explain the world from Aristotle to Galileo, provide a continuum of human investigation and discovery.

Dr Karl's new book, game and song!

Dr Karl's new book - Never mind the BULLocks Here's the Science is launching this month! And in another first, Imagination Entertainment and Dr Karl will launch his first board game, Fact or Fishy? in November. This fast-paced interactive trivia game will have you wowing the opposition with how much you know. From the day-to-day to the truly bizarre, you will be asked the one question that really counts: Is it FACT or FISHY?

He may be better known for his work on television, radio and his dozens of popular science books, but Dr Karl Kruszelnicki saw an opportunity to branch out into other media – and fulfill a lifelong dream at the same time: to sing in a punk band.

The result is a song called GET FACT, inspired by the very same thing that spawned the punk generation decades ago: the need to vent frustration. For the punks, it was a desire to rail against society in general, but for Dr Karl, it’s the massive amounts of scientific disinformation being spread on the internet that prompted him to unleash his vocal cords.

Of course, one man can’t make a punk song, so Dr Karl turned to the experts, enlisting the help of punk legend Jay Whalley from Frenzal Rhomb to help pen the music, his colleague Caroline ‘Pegs’ Pegram to scribe some lyrics, and prominent Aussie producer Justin Shave to work his magic in the studio.

Verse 1
God save the queen bee
She eats regurgitated royal jelly,
Don't chuck unopened mussels
’Cause they're not poisoning your belly!
Never mind the facts, they'll ruin ya story
So go and get fact before you start to annoy me

Chorus 1
Get fact get fact, no more disinformation
I'm getting the cranks and it's a source of frustration
Get fact get fact, got to stop the reliance
On believing silly things when you don't know the science.

Verse 2
They say recessive genes mean the end for the ranga
And four wheel drives 'll keep you safe in a prang---a
They say your cells renew every seven years
And when you get old, you'll have really big ears…
Mobile phones don't cause a petrol pump to explode,
And the shroud of turin, what a massive (whoppin') load!

Chorus 2
Get fact get fact, … something else you should know
The people down at nasa didn't invent velcro
Get fact get fact... guitar solo!!!

Bridge
I don't get angry and annoyed very often
I just stick to the facts 'cause i'm a certified boffin

Chorus 3
Get fact get fact, epic aggravation
I blame the interweb for this fact mutation.
Get fact get fact, got to stop the reliance
On finding clever words wot rhymes with scien…..Ssah.

Who are they, anyway?
If you’ve got $1000 to burn, you can send a sample of your saliva to a company that will, in return, send you back a “genomic profile”.

While this test report may state that you have an increased risk of heart disease or diabetes, it may also tell you that “the test is not a clinical service to be used as the basis for making clinical decisions”.

Welcome to the brave new world of direct-to-consumer DNA tests. Yup, this testing is done entirely between you, your credit card and the testing company. And your doctor doesn’t come into it. But before you start reaching for your credit card and start working up some spittle, there are a few things to realise about these genomic profiles.

First, they do not look at all of your DNA, but at much less than one per cent of it. This is a problem. After all, only those bits that get tested will change the consumer’s risk profile. And please note, the person who is paying for this so-called “medical” service (that’s you) is now a “consumer”, not a “patient”.

A good example of the problems that come with looking at only a tiny section of your DNA is the disease, type 2 diabetes.

Some 25 per cent of Europeans will suffer from this illness during their life. Back in 2007, there were fewer than 10 DNA markers known for type 2 diabetes. Based on those markers, the consumers would have been sold a risk assessment.

But since 2007, there have been two major updates in our knowledge of type 2 diabetes, with each update adding more DNA markers.

After the first update, “more than 11 per cent of people went from being told they were at above-average risk to below-average or vice versa. After the second update more than 10 per cent were similarly reclassified”. In other words, the risk profile you get will change from year to year, depending on how much of the DNA gets tested.

Second, “many of the diseases listed by the direct-to-consumer testing companies (for example, diabetes, various cancers and heart disease) are so-called complex diseases thought to be caused by multiple gene variants, interactions among those variants, and interactions between variants and environmental factors”.

In plain English, with all of our medical knowledge, we still don’t fully understand how these diseases work.

But the direct-to-consumer testing companies will ignore the thousands of possible interactions; they just want your money.

They will sell you the information that you probably have one or two genes that could increase your risk of a specific illness.

That information is actually worse than useless – it can be harmful (we’ll see how, later on).

Third, no test made by humans is perfect. I used the word “probably” a few moments ago. For example, there is a genetic test for bipolar disease. But it’s not a very good test.

So unfortunately, this test will wrongly report that more than 80 per cent of those who actually do have bipolar disease do not have the supposed single gene for bipolar disease.

And just as confusingly, many people will be reported as having the gene, when in fact they do not.

Fourth, this early in the 21st century, we really still do not have the big picture of DNA. We humans have about 20,000–23,000 genes. That is about the same number of genes as a pinot noir grape!

So obviously, our understanding of just what is a gene is very primitive, and we clearly have a long way to go.

Fifth, this is still early days for direct-to-consumer DNA testing. We have found only a minuscule fraction of the genes involved in various diseases. The vast majority is still to be found.

Suppose that you fork out $1000 for a genomic test, and the report says that you do not carry any genes associated with the risk of a particular disease.

Then you might decide that you can indulge in risky behaviour, such as all-night drinking binges, or a diet based entirely on fast foods and saturated fats.

As a result, your life will be worse for having taken the test.

In early 2008, The Observer newspaper in the UK interviewed psychiatrist Professor Nick Craddock, of Cardiff University. He said, “These tests will only worry, confuse and mislead the public and patients. There is a long way to go before we have genetic tests that may be helpful to patients. Using tests at the moment is only likely to cause harm”.

In other words, our understanding of DNA is still very poor.

There is absolutely no provision by the companies making money from direct-to-consumer DNA testing to provide appropriate support and counseling for the patients.

Professor David Collier, of the Institute of Psychiatry, London, said much the same thing. “At best, these tests are clinically useless. At worst, their results could cause serious worries for patients.”

So, with that advice in mind, sending saliva through the post with the promise of useful DNA test results, is one deal you shouldn’t even spit on.
The cruise, supported by The University of Sydney’s School of Biological Sciences and the Marine National Facility, is part of the Next Wave program that provides a unique opportunity for early career researchers and students of marine science to experience working on a blue water research vessel.

Supervising the students on the October Southern Surveyor cruise are marine biologists Dr Will Figueira and Dr Sebastian Holmes from the University of Sydney.

“This is a fantastic opportunity for students of marine biology to experience life as working marine scientists – living aboard an oceanographic vessel, carrying out experiments and getting

Forget fish dissections. The new way to teach marine biology to students is to let them dredge the sea floor or trawl the water column using epi-benthic sleds and neuston nets whilst on board a 66-metre ship.

On October 11, The University of Sydney will send eight marine biology students on a six-day voyage from Hobart to Sydney to work as scientists on board Australia’s Marine National Facility Research Vessel, Southern Surveyor. The students come from Universities associated with the Sydney Institute of Marine Science including the University of Sydney, UTS, UNSW, Macquarie and UWS.

Budding marine biologists ride the Next Wave

By Caral Avolio

Extracts from the blog...

Saturday 10 October (Hobart) – Setting sail

“4 pm arrives, all equipment is stowed, the gang plank is raised and we’re off. HURRAY!! Everyone is excited now.” Dr Sebastian Holmes, biologist, School of Biological Sciences, Sydney

Sunday 11 October – Day 1 (4am – 2pm)

“We deployed the giant windsock (referred by scientists as a neuston net) over the side of the boat. About 1000 tons of water passed through this net as we towed it beside the boat. One would assume that there would be many fish in this vast quantity of water. One would be mistaken.

“Although many creatures appeared in the net including; copepods, mysid shrimp, isopods and a salp (resembling the extra terrestrial life form which erupted out of Sigourney Weaver’s chest in Aliens) no larval fish were found.” Antony Gould (UWS)

Sunday 11 October – Day 1 (2pm – 2am)

“The most exciting “op” of the shift occurred when we dropped the neuston net at around 10 m below the surface.

“The neuston net was ambushed by a sea of salps and pelagic sponges, 150 got themselves caught.

“All hope of finding larval fish was lost. The team found solace in an octopus that was also in the catch, spending the rest of the shift minutes admiring our new pet cephalopod, feeding it a steady diet of shrimp.” Steven Hawes, biology student, Sydney

Sunday 12 October – Day 2 (2am – 2pm)

“The sediment grab obtained by BOAGs provided us with very clay-like mud to sieve, and I’m sure we will all have the softest hands tomorrow after such treatment. Only some broken urchin tests, a live polychaete and various detritus could be found amongst the mud sample.” Melissa Tan, third year marine science student, Sydney.

Monday 12 October – Day 2 (2pm – 2pm)

“This is the first time any one across the world has tried to use Benthic Optical Acoustic Grab System (BOAGS) and we were glad that it proved to be a big success. The system hit the ground a few times causing a spray of sandy sediment and a complete white out of the camera but other than that the test was a complete triumph.” Belinda McCarthy, second year marine science student, Sydney.

“The sediment grab obtained by BOAGS provided us with very clay-like mud to sieve, and I’m sure we will all have the softest hands tomorrow after such treatment. Only some broken urchin tests, a live polychaete and various detritus could be found amongst the mud sample.” Melissa Tan, third year marine science student, Sydney.
practice at using specialised oceanographic research equipment – all while in an educational setting," Dr Figueira said.

"By taking the students to sea, we hope to nurture and encourage budding marine biologists to pursue this rewarding career," Dr Figueira said.

During the cruise, students will examine the deep-sea fauna of Bass Strait and may turn up some interesting finds and even new species.

"We are really excited to be using a novel piece of equipment (Benthic Optical Acoustic Grab Sampler, BOAGS), developed by Dr Rudy Kloser at CSIRO, which can film the sea floor with a live feed to the surface and then selectively sample what it sees to take a closer look at what lives in the deep sea at a depth of 2800 m," says Dr Holmes.

"Who knows what we may find down there, if we’re lucky, we might even catch a giant squid swimming past the camera," says Dr Holmes.

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**Tuesday 13 October – Day 3 (2am – 2pm)**

"We began the next operation on our agenda: receiving data from BOAGS which had been deployed for the second time ever.

"Everyone crouched in front of the tiny TV to follow the live video footage of this high tech machine on its decent into the ever-black benthos to a staggering 1550 m. The muddy sea floor was seeded with holes. Salps and sea stars were the most common groups of invertebrates on the sea floor. Rat tail fish hushed through the picture. Burried in the sediment – as we discovered later when we searched the sample that the grab brought to the surface – were more invertebrates: snails, bivalve shells and heart urchins."

Mattias Roth (Macquarie University)

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**Wednesday 14 October – Day 4 (6:45am - 2pm)**

"Whale watching is also a duty of ours whilst on the ship. This has had mixed success ranging from no sightings to the occasional sighting. Our luck changed today when a group of approximately 10-15 humpback whales where spotted travelling parallel to the boat, in the opposite direction (i.e. south)." Josh Humphries (UNSW)

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**Thursday 15 October – Day 5**

"The crew returned to put the BOAG down on a rocky bottom at 400 metres below sea level. This time we included some passengers: Our Styrofoam cut outs. The video caught surprising footage of a wide variety of life. There were several sharks, innumerable krill crowding around the camera, coral life, even sting rays. It was amazing how the environment changed as we moved to 400 meters. We pulled up the Boag to find that our Styrofoam buddies shrunk on average 20%.

"It’s the last day and we’re left remembering what this trip meant to us. For many of us it gave us an opportunity to discover our interests. For some of us, it inspired passion for the sea and a desire to try something similar in the future. But for all of us, the trip gave marine biology an inspiring face that cannot be found in books." Zachary Warburg, marine science student at Sydney.
Both India and Australia are blessed with extraordinary diversity in their indigenous plants. Natural products have been a fertile source of lead compounds in medicinal chemistry for centuries. Much knowledge of these leads comes from traditional uses of plants and many people in India employ traditional medicinal practices based on the Ayurvedic system. There is a thriving “nutraceutical” market there that uses natural extracts from plants as dietary supplements, and this area is mooted as a growth area in Australia. Basil Roufogalis (Pharmacy) and I were awarded a grant from the Australia-India Strategic Research Fund to organise a workshop in India to examine what could be learned from traditional medicines and nutraceuticals, and how we might examine indigenous plants anew to discover medicines for modern-day diseases.

The workshop took place in June at the JSS College of Pharmacy in Ootacamund (Ooty) in the Nilgiri Hills in the south of India. Besides Basil and I, the University was represented by Associate Professor Michael Kassiou from Chemistry and Professor Iqbal Ramzan, Associate Professors Mary Collins and Dai Hibbs from Pharmacy. Australia was also represented by Dr David Camp from the Eskitis Institute in Queensland which specialises in the extraction of natural products, and by Dr Wayne Best from Epichem, which specialises in medicinal chemistry and custom synthesis. Logistics were made easier through the help of the University’s Research Institute for Asia and the Pacific. In India, we were looked after extraordinarily well by Professors Nanjan and Suresh from the College of Pharmacy in Ooty.

Besides a stimulating discussion of the potential medicinal and financial benefits of new approaches to natural products discovery in the two countries, we were treated to numerous extra-curricular entertainments, the highlight of which must surely be Professor Suresh’s traditional housewarming. This party involved our celebrating the first entrant into the house (a cow with her calf) amid much music and smashing of fruit. Ooty itself is a small and very picturesque hill station high in the hills, to which we drove from Bangalore. The final ascent involves a very rapid climb involving 36 hairpin bends, dutifully numbered with large road signs. We were wined and dined at the colonial-era Ooty club, in which snooker was invented, and, at a downtown restaurant ate pancakes called dosas the size of a cricket bat.

Back in Bangalore, we were given tours of two centres of excellence of commercial natural products research, SamiLabs and Natural Remedies.

I stayed on after the meeting, and gave a talk at Jubilant Biosys, one of the largest contract research companies in India, where my student Ahamed was working before he came to Sydney. All the discussions were very fruitful, and we are now assembling a research proposal for an Australian-Indian collaborative project to identify new bioactive compounds from both countries’ flora.
Caught in the act: Andromeda Galaxy and neighbouring Triangulum Galaxy hook up

By Katynna Gill

Caught on film for the first time ever, paparazzi to the stars - astronomers - have captured images of our nearest large galaxy, Andromeda, hooking up with its neighbour, the Triangulum Galaxy. Just like any good star gossip, the liaison was suspected previously, but these images are the first to reveal the connection between the two.

Published in the journal Nature on 3 September 2009, the research shows how large galaxies grow by incorporating stars from surrounding smaller galaxies. This popular model of galaxy evolution, called the 'hierarchical model', predicts that large galaxies such as Andromeda, which can be seen with the naked eye from the northern hemisphere, should be surrounded by relics of smaller galaxies it has connected with.

Now astronomers have the images to go with the hierarchical model - a close liaison between the Andromeda and Triangulum galaxies.

The discovery was made by a team of international astronomers, including Professor Geraint Lewis from the University of Sydney's School of Physics. The team was led by Dr Alan McConnachie, from the National Research Council of Canada's Herzberg Institute of Astrophysics, and included astronomers from universities in Canada, Australia, France, Germany, the UK and the USA.

"The Andromeda Galaxy is our closest giant neighbour, located more than 2.5 million light years from the Milky Way. Our new survey charts an area with a diameter of nearly a million light years, centred around Andromeda - it's the broadest and deepest image of a galaxy ever made," said Professor Geraint Lewis.

"We mapped Andromeda's unexplored outskirts for the first time and found stars and giant structures that are remnants of smaller galaxies, which have been incorporated into Andromeda as part of its ongoing growth," explained Professor Lewis.

"The big surprise in the data was finding that Andromeda is interacting with its neighbour, the Triangulum Galaxy, a galaxy which is also visible in the Northern Hemisphere using a small telescope. Millions of Triangulum's stars have been pulled in by Andromeda as part of the encounter."

Just like any good star pairing, the paparazzi are predicting a more solid union between the two will result.

"The two galaxies may eventually merge together entirely," explained Professor Lewis.

In addition to the affair between the two galaxies, the new survey has shown that galaxies may be much larger than previously thought, with their gravitational influence stretching well beyond stars near the centre of the galaxy.

"We've found coherent structures and star formations over the entire survey area, showing that galaxies are much bigger than we originally thought. Andromeda is considered by astronomers to be a typical galaxy, so it's surprising to see how vast it really is. We found loosely bound stars at distances up to a hundred times the radius of the large galaxy's central disk."

The team used the Canada-France-Hawaii Telescope, located on the summit of Mauna Kea on the island of Hawaii, to probe the faint outer reaches of Andromeda with unprecedented sensitivity. Their surprising results, reported in Nature, set the stage for a more detailed reconstruction of the formation of Andromeda, a process that appears to be continuing to this day.

Watch a movie of the Andromeda and Triangulum Galaxy affair at: www.nature.com/nature/journal/v461/n7260/extref/nature08327-s2.mov
Spotlight: Fröhlich condensates and the chemistry of consciousness

By Katynna Gill

Research conducted by a first year Bachelor of Science (Advanced) student at the University of Sydney, Laura McKemmish, and her University of Sydney Talented Student Program project supervisors, Professor Jeffrey Reimers and Professor Noel Hush, along with colleagues at the University of Queensland, provides a definitive analysis of a forty year old biochemical hypothesis, by showing the conditions that Fröhlich condensates will form under.


Professor Reimers, from the School of Chemistry, and Professor Hush, from the School of Molecular and Microbial Biosciences, along with University of Queensland scientists Professor Ross McKenzie and Professor Alan Mark, worked with Laura McKemmish, who is now in her third year of her Bachelor of Science (Advanced) degree at the University of Sydney, as part of her first year Talented Student Program project.

The Talented Student Program, run by the Faculty of Science at the University of Sydney, gives top science students the opportunity to work on more challenging science projects and engage in real research opportunities.

"Herbert Fröhlich proposed in 1968 that there could exist condensates composed of a collection of vibrational oscillators that had all of their vibrational energy concentrated in just one collective motion - the motion of lowest frequency," explained Laura.

"These Fröhlich condensates were postulated to develop a highly ordered non-equilibrium state with properties similar to a Bose-Einstein condensate," said Laura.

"All of the energy in this lowest frequency mode was thought to arise from Jaser-like 'coherent excitation', creating large scale dynamic properties in the whole system. So you end up with macroscopic properties in the system that are significantly different. Superconductivity is another example of this sort of collective property within a system.

"There's lots of interest in finding applications of Fröhlich condensates in physics, chemistry, biology and medicine. The problem is that there has never been an unambiguous example of Fröhlich condensates identified," said Laura.

The team determined the most likely experimental signatures of Fröhlich condensation.

Professor Reimers explained, "We investigated the basic properties of Fröhlich condensates and classified them into three types: weak condensates, strong condensates and coherent condensates.

"Weak condensates allow for profound effects on chemical and biochemical kinetics, while strong condensates form when an extremely large amount of energy is channeled into one vibrational mode, and coherent condensates form when this energy is placed in a single quantum state," said Professor Reimers.

"We showed that Fröhlich condensates may have significant features quite distinct from the extraordinary properties normally envisaged."

The team considered several properties of Fröhlich condensates, including their robustness to parameter variations, the temperatures at which they form, the limitations of the basic assumptions, and one specific physical proposal for their production from a chemical energy source - the Wu-Austin model.

"We found that coherent condensates involve extremely large energies, are extremely fragile and are not produced by the Wu-Austin dynamical Hamiltonian that provides the simplest depiction of Fröhlich condensates formed using mechanically supplied energy," explained Professor Reimers.

"This means they are unable to form in any biological environment."

No Fröhlich condensates in the brain

"One application of Fröhlich condensates that has attracted lots of interest is in theories to explain how consciousness comes about in our brains," said Professor Hush.

"It's been proposed that the usual Turing-type architecture in computers is an insufficient model for the working of the human mind and unlikely to achieve the emergence of consciousness. Instead, it's been suggested that quantum behaviour must be involved, so that the mind is really a neural quantum computer," explained Professor Hush.

"The most celebrated exponent of this view is Sir Roger Penrose, the eminent British mathematician, whose two books for the general public advocating this view - 'The Emperor's New Mind' and 'Shadows of the Mind' - have both been best sellers.

"Sir Roger Penrose, along with US medical scientist Professor Stuart Hameroff, advanced the view that the seat of consciousness and quantised mental activity are microtubules, which form the cytoskeleton of cells," said Professor Hush.

"The Penrose-Hameroff theory of quantum consciousness is the only detailed hypothesis so far in support of the idea of a 'quantum mind' and of 'quantum consciousness'. An essential feature of quantum computers is 'coherence' - the ability of a system to move in a completely regular fashion for long times, in this case the millisecond timescale of neural processes. To produce this coherence, the theory evokes Fröhlich condensation as an essential element.

"Our work has shown that this theory for consciousness, and related theories for cognitive function that involve Fröhlich condensates, are untenable on the grounds of basic physics," said Professor Hush.

The Australian team’s research also demonstrates that the Penrose-Hameroff proposal is also untenable on biological grounds, because it is incompatible with the known biology of microtubules.

"Our two papers together remove any basis for the Penrose-Hameroff theory of quantum consciousness - an erroneous view has been energetically advertised for a long period. Now we can put a stop to his theory," said Professor Hush.

"The fact that Laura McKemmish contributed to this research when she was only in her first year of university and has published her work at such a young age, shows what a very remarkable young scientist she is," concluded Professor Hush.

No Fröhlich condensates in the brain