DESY inFORM.

11/2009
Newsletter of the
Research Centre DESY

How does life come into being?

Nobel Prize in Chemistry for ribosome scientist Ada Yonath

"Ada Yonath always very much encourages new ideas," Frank Schlünzen recollects. It seems that this kind of creativity, linked with a brilliant idea and real persistence is what it takes to win the Nobel Prize. Schlünzen had worked with Ada Yonath for 14 years, when she – with her small Max Planck Ribosome Structure Working Group at DESY – grew ribosome crystals and investigated them in the X-ray beam of the DORIS beamlines BW6 and BW7. She was obsessed by the idea of decoding the atomic structure of these complex molecules with the help of synchrotron radiation. This year, Yonath was awarded for her efforts: on 7 October, she won the Nobel Prize in Chemistry for uncovering the structure and function of ribosomes, together with the US citizens Thomas Steitz und Venkatraman Ramakrishnan.

Ada E. Yonath, surrounded by her colleagues and students, at the Nobel Prize press conference at Weizmann Institute in Rehovot, Israel. (Photo: Weizmann Institute)

Ribosomes are the factories of life, nothing works without them. Based on the genes, they build functioning proteins and produce the vital proteins from the DNA blueprint. These proteins fulfil many tasks in the organism: they are used to transport oxygen; they act as messengers and form muscles. Understanding how they are produced is the first step to understand how diseases emerge – i.e. when something goes wrong at the production of proteins.
It took many years for Ada Yonath, who comes from Israel, to decode the structure and function of ribosomes. From 1986 to 2004, she was head of the Max Planck Working Group and at the same time working at the Weizmann Institute in Israel. She made decisive measurements at DORIS for the work that brought her the Nobel Prize.

Yonath has grown ribosome crystals since 1980. She came to DESY because of the ideal research conditions with direct access to a synchrotron radiation source and a strong support from the HASYLAB management. Frank Schlünzen joined the working group in 1990, first doing a student job. He digitised the scattering images – at that time X-ray films – for evaluation. However, both, the research field and the research persistence of Ada Yonath fascinated him: after his diploma thesis in theoretical physics, he started to work in her group for his PhD. "I think we grew thousands of ribosome crystals and investigated them with the DORIS beam," he says. This is the only way to get at the atomic structure of the ribosomes. Very regularly-structured crystals are X-rayed with synchrotron radiation, and from the pattern of the diffracted light it is possible to calculate the structure of the ribosome.

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inForm in Winter

The Christmas DESY inForm newsletter will again cover two months. Thus, the December/January issue will be released on 10 December, the second Thursday of the month.

Anniversary T-shirts and brochures

The DESY-50 anniversary T-shirts are now for sale at the PR department. The price is 5 Euros and there are different versions for women and men. The anniversary brochure is available for free as of 7 November.

DIRECTOR'S CORNER

Dear colleagues,

particle physicists all over the world – and of course here at DESY – are eagerly looking towards Geneva, where the LHC is about to resume operation after approximately one year of repairs, which also brought many improvements for machine control. If everything goes according to plan, a few weeks later protons will collide at the highest energies ever reached. In the past years, DESY colleagues had made many important contributions to two of the four large experiments – ATLAS and CMS.
The discoveries at the LHC will give direction to particle physics and its future projects. We at DESY are also preparing for the future at the LHC and beyond. One example is the establishment of a detector laboratory in HERA hall west. It will be a centre for detector development and construction for the LHC and the ILC, which we are planning with our partners from home and abroad. At the same time, this is a DESY contribution to the Helmholtz Alliance "Physics at the Terascale" and to the Cluster of Excellence "Connecting Particles with the Cosmos", for which DESY and the University of Hamburg receive funding.
Another success for us is the good rating the ILD detector concept received from an international experts' committee for the ILC. This concept – promoted under the leadership of DESY and KEK – was judged as promising, with the recommendation to further development – a clear signal that we are on the right path with the preparation for experiments at the ILC.

On the Open Day on 7 November, we will have the opportunity to communicate the fascination of DESY research directly to the visitors. Already now, I want to take the opportunity to say many thanks to all helpers of this day who are going to sacrifice their well-earned weekend.

Yours,
Joachim Mnich

But still the experimental methods were not sophisticated enough to decode the structure of the complex molecules. Ribosomes consist of long ribonucleic acid (RNA) chains and of up to 70 proteins, a total of more than one hundred thousand atoms. For crystallisation, hundreds of thousands of identical ribosomes must be arrayed in a crystal lattice in a regular pattern. During protein production, however, the ribosome goes through various stages. Parts of the ribosome are constantly in motion, which makes crystallisation extremely difficult. Moreover, the obtained ribosome crystals were very delicate: at room temperature, they were immediately destroyed by the intense X-ray beam.

To increase the stability of the crystals, the group experimented with shock-freezing the samples with liquid helium and investigated them at minus 170 degrees Centigrade with synchrotron light. Thus, the group was able to extend the lifetime of the delicate crystals for hours or even days. The development of this cryotechnology for the investigation with synchrotron radiation, a common method today, has decisively benefited from the experimental methods at DORIS. "We transported the samples in liquid propane; this would now be a problem," Schlünzen says with a smile.
The group headed by Ada Yonath consistently developed and refined the crystallisation and analysis methods. The breakthrough was made in 1999: the working group was able to publish the structure of the small ribosomal subunit named 30S, and in 2000, also the more complex structure of the large ribosomal subunit (50S).

Another characteristic of the ribosomes brought about a direct research benefit: many of the common antibiotics bind at important functional points of the ribosome, blocking the protein production and thus fighting bacterial infections. Therefore, the Yonath group mixed antibiotics with the ribosomes to examine the connection of ribosomes and antibiotics in the crystal. The X-ray pictures clearly revealed the target points for the drugs and also how bacteria defend themselves with resistances. These insights are a decisive step for the development of new and more effective antibiotics. "We already collaborated with pharmaceutical companies at that time," Schlünzen reports. The pharmaceutical industry is continuously looking for new medication to win the battle against new bacterial resistances.

Frank Schlünzen, now working at DESY IT, will give a talk for the general public (in German) on the Nobel Prize investigations on 10 November at 19 h in the DESY auditorium. *(tz)*

One sheet to plot them all

DESY database becomes standard tool for cavity research

The idea sounds simple enough: collect all the data that exist in the world on cavities – nine-cell TESLA-style cavities, to be precise – including all tests, manufacturers and achieved gradients and merge it into a common format so that all cavity professionals around the world can extract the data they need, compare and learn. Anyone who has ever set up a database and tried to merge existing data sets into one knows: it's not that easy. However, the ILC's accelerator experts have just decided that they will all use a database system developed by DESY for the European XFEL up the world's first global cavity database.

The main driver behind this is a key ILC challenge called yield – an efficient word for a concept that means something like "the probability that cavities produced by a certain manufacturer will reach the required gradient". "Gradient" in turn means the rate at which a cavity can accelerate electrons or positrons over the distance of one metre – the challenge at the heart of the ILC, because a high gradient means efficient acceleration, which means short accelerators, which in turn means lower cost.

The cavity-treating labs (Fermilab, JLab, Cornell, DESY and KEK) agreed in July that they would use the DESY database system, and 76 cavities have been entered – from their production name (TB9ACC011, for example) to all the radiofrequency tests done in the last years to surface treatments.

Eventually this could lead to improved statistics about niobium handling or cavity surface treatments, but the database is not used for R&D purposes yet. All cavities for the European XFEL will be keyed into the database as well, even though the gradient they are expected to produce is much lower. The team expects to add some 30 more by next summer and learn more about yields and cavity production along the way. *(baw)*

Karl Witte (left) and Massimo Altarelli are the first managing directors of the European XFEL GmbH, at present a fully owned DESY subsidiary.

Smooth start-up

European XFEL GmbH was founded

by Karl Witte

On 28 September 2009, the European XFEL Company was founded with DESY as sole shareholder. Initially, the plan was for the Governments of the participating countries to conclude a Convention specifying the general concept and the financial contributions to the project and entrusting the construction and operation of the Facility to a Limited Liability Company under German law. The shareholders, designated by the various governments, were then to jointly found the Company.

However, it turned out that not all Governments were going to be able to nominate their shareholder right away. In addition, the registration of the founding imposes rather strict legitimating formalities for the non-German shareholders. It was therefore agreed that, in the first instance, DESY alone would found the Company and the other shareholders would join later.

What are the immediate consequences here at DESY? Practically none for the construction of the accelerator complex, as this is coordinated by DESY itself. The work package groups, of which the European XFEL Project Team (EPT) is directly in charge, are also hardly affected for the time being. The Company is currently still an almost empty shell, with a primary deposit of 25 000 Euro and two Managing Directors. Staff Rules and Financial Rules first have to be confirmed by the Council before personnel can be hired or the budget set up and implemented. Regular contributions are expected only after the accession of further shareholders. As to the contracts concluded by DESY on behalf of the European XFEL Company, including those for the construction of the tunnels, the modalities and risks related to the transfer to the Company are currently being evaluated. A Host Agreement regulating the services some DESY groups provide to the European XFEL Company is in preparation.

Consequently, the transition to the new constellation with two separate legal entities should be rather smooth.

November

5 68th Physics Research Committee Meeting
8:30 h, DESY, Hamburg, auditorium

7 http://ideen.desy.de
DESY's Open Day and Night of Knowledge
12–24 h, DESY, Hamburg

8 Sunday lecture on the occasion of "Potsdamer Köpfe"
Das Jahrhunderträtsel: Kosmische Teilchenschleudern
Christian Spiering, 11 h, Altes Rathaus, Potsdam

10 Public Lecture
Ribosomenforschung bei DESY – Von der Ursuppe zum Nobelpreis
Frank Schlünzen, 19 h, DESY, Hamburg, auditorium

11 Jentschke Lecture (www.desy.de/jentschke)
Black Holes and the Fate of the Universe
Günther Hasinger, 17 h, DESY, Hamburg, auditorium

11-13 TERASCALE (http://www.terascale.de/alliance2009)
Annual meeting of the Helmholtz Allianz "Physics at the Terascale"
DESY, Hamburg

12 Science Café DESY (http://sciencecafe.desy.de)
Vom Quark zum Kosmos – Die Geschichte vom Anfang der Welt
Thomas Naumann, 17 h, DESY cafeteria

16 Inauguration
Inauguration of PETRA III
14 h, DESY, Hamburg

26 Science Café DESY (http://sciencecafe.desy.de)
Die spezielle Relativitätstheorie und ihre Anwendung
in Physik und Technik
Peter Schmüser, 17 h, DESY cafeteria

December

2 Public Lecture
PETRA III: DESYs Speicherring – Lichtquelle der Superlative
Hermann Franz, 19 h, DESY, Hamburg, auditorium

3 Science Café DESY (http://sciencecafe.desy.de)
Wasser – ein ganz besonderer Stoff
Frank Lehner, 17 h, DESY cafeteria

9 Science Forum
Science Forum from Hamburger Abendblatt and NDR 90,3
19 h, DESY, Hamburg, auditorium

10 Science Café DESY (http://sciencecafe.desy.de)
Dunkle Materie – Oder das neue Gesetz der Schwere
Phil Kröger and Dennis Reher, 17 h, DESY cafeteria

18 DESY's 50th Anniversary (http://www.desy.de)
Reception in the Hamburg Town Hall and
Colloquium honouring Ada Yonath

PETRA III – Site of Ideas

At the Open Day, at 17:30 h, PETRA III will be nominated "Site of Ideas 2009", just days after it broke the world record of synchrotron light sources with the smallest emittance. On 16 November, DESY's new light source will be officially inaugurated. The picture shows the PETRA III experimental hall at dusk

A lookout platform, a monitor displaying all four webcam pictures and a small exhibition – all this is on offer at the new two-storey double container near the gate to the European XFEL construction site in Schenefeld. Out of 34 propositions, "FELIX" was selected as the new name of the information point. On 25 September, Schenefeld Mayor Christiane Küchenhof (left) and Massimo Altarelli, now Managing Director of the European XFEL GmbH, announced the new name and congratulated the winners. Except for the exhibition, the FELIX info point is open around the clock.

Accelerated into the future

Workshop at DESY on accelerator research for large facilities

United we are strong. This insight is not new in physics, especially concerning large facilities like the ones that are built at DESY. Particle physicists in Germany, for example, are organised in the German Committee for Particle Physics (KET), that sets out a strategy and common goals for the field. This kind of umbrella organisation still does not exist for accelerator physics – one reason might be the great variety of accelerators that exist: linear and circular, warm or cold ones, operated with electromagnetic waves or plasmas. Equally manifold are the fields of application of these accelerators – from medical therapy up to collider physics. For upcoming future research projects like free-electron lasers, energy recovery linacs or spallation sources, a separate accelerator physics research field becomes more important, also with the effect that it attracts young scientists for this discipline. Funds for German accelerator physics too come from different sources: apart from the German Research Foundation (DFG) or funds from the Helmholtz Alliance, accelerator projects, for example, may be financed by collective research funds for nuclear physics or for condensed matter – there is no separate funding programme for accelerator research.

Wanting to visibly act in concert in the future, representatives of major research centres and of all ten German universities doing research and teaching accelerator physics met at DESY in September. At this workshop, around 45 participants decided on the foundation of a committee for accelerator physics, with the task to coordinate the universities' efforts concerning research, accelerator physicists' teaching and fundraising. Thus, accelerator physics is to become more visible as a separate field of research. Since most of all university groups involved in accelerator research are closely linked to the accelerators of large research centres, the committee will later integrate the accelerator physics of these centres.

An ad hoc committee that was formed at the workshop currently works out a statute and prepares elections. Moreover, the internet address "beschleuniger-physik.de" has already been reserved.

Eventually a special fund for accelerator physics in Germany might be created. In this case, particle physicists would no longer be able to apply for the other collective research funds; however, the application conditions would become much clearer for the accelerator physicists. *(tz)*

Two new Young Investigators Groups at DESY

Gernot Maier and Alexander Westphal will take over the leadership of two new Helmholtz Young Investigators Groups, to be established at DESY in spring 2010.

In Zeuthen, Maier and his group will use the Cherenkov Telescope Array CTA to get to the bottom of the processes that take place in the close surroundings of black holes. The CTA is a network of telescopes that will investigate our galaxy with a high sensitivity and at a so far unprecedented energy range. First observations will be possible in 2014. Until then, the group will work on the sensitivity optimisation of the CTA.

The universe will also play an important role at DESY in Hamburg, although there will be no direct observation. Westphal and his group will investigate "Strings and cosmology – an interface to test fundamental theories". With the investigation of different models, the group will be able to make predictions that will then be examined with future cosmological experiments. This would pave the way towards the first direct experimental test of string theory.

The creation of Helmholtz Young Investigators Groups offers an outstanding possibility for young scientists to do independent research at a Helmholtz Research Centre, at the same time fostering a close connection to a university. In Zeuthen, Maier will do research with the Humboldt University whereas Westphal will cooperate with the University of Hamburg.

Both groups will be funded for an estimated five years with 125 000 Euros from the Impulse and Networking Fund of the Helmholtz Association. The other half of the costs is coming from DESY and the corresponding partner universities. *(gh)*

The new detector laboratory in close neighbourhood to HERA-B is nearly completed.

Old hall – new detectors

New Helmholtz laboratory in HERA hall west

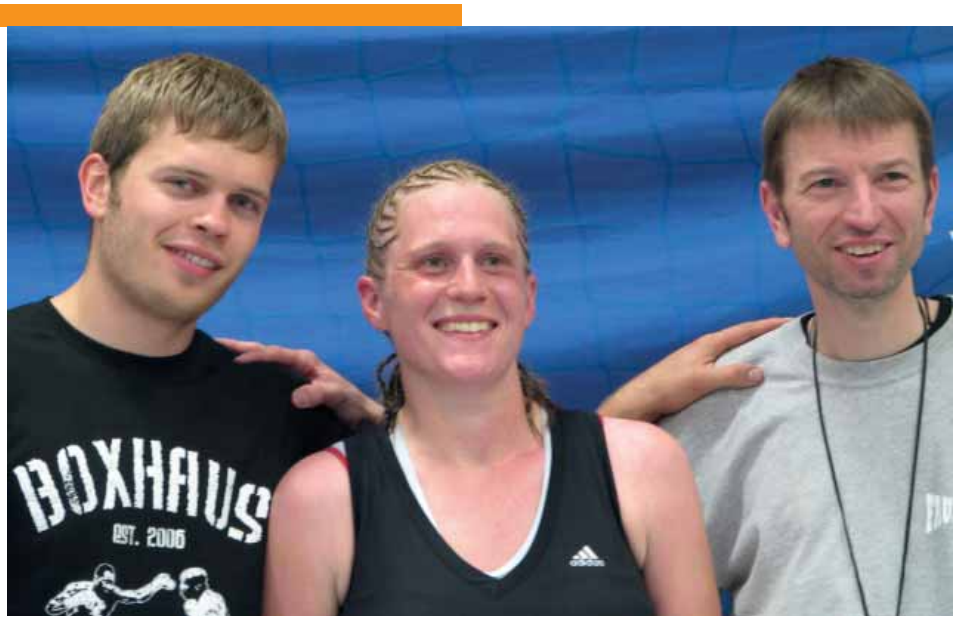
When you plan to move and try to find helpers, they often ask: to which floor? If the DESY people working in the detector lab would depend on the help of friends, they would have difficulties to find volunteers because the answer would be: seventh floor! Everything has to be transported from the ground floor to deep down underground. The HEP groups' detector lab moves from hall 5 to HERA hall west. In order to make room the electronics hut of the still present HERA-B detector was dismantled.

The laboratory is now placed at the former site of HERA-B's electronics hut, and consists of parts of it – this allowed a stable and at the same time cost-effective construction of the laboratory. At this site, in three laboratories of 70 square metres, part of the detector development is done for the future International Linear Collider ILC and, soon, also for the next upgrade of the Large Hadron Collider LHC at CERN in Geneva – the sLHC.

"We decided to use the HERA hall west because it is within reach for our students and guests and it is already equipped to house a detector says Felix Sefkow, deputy head of the FLC group. Unfortunately, HERA hall west will not provide enough space for the complete detector development, thus it will be necessary to use HERA hall north for part of it. Moreover, the electronics laboratories in building 1 will still be used extensively.

In the coming years, all these premises will be used for the activities within the framework of the Helmholtz Alliance and of the Cluster of Excellence with the University of Hamburg. In the future, the free space in hall 5 will be used for serial production of the undulators for the European XFEL that is currently under construction. Part of the hall is already in use for the production of these special magnets.

On 7 November, the Open Day at DESY, the detector laboratory will be more or less complete. Visitors to HERA hall west will thus be able to see not only existing detectors but also the newest developments in the field of detector construction. *(gh)*



Cecelie Hector (centre) – with her coaches Alexander Riemann (left) and Helmut Jung (right). At her first fight in June she won the second place at the university championship in Cologne right away.

The boxing ring theory

DESY physicist was finalist in University Championship in Cologne

"Oh… a physicist?" The boxing trainer looked doubtfully at Cecelie Hector (DESY) when she asked him for training lessons. This happened in January this year. Nine months later, in September, Hector entered the finals of the Hamburg female middleweight championship. And she lost by a narrow margin.

Nevertheless, this event removed all doubts. Her DESY colleagues too, who cheered her on at the finals, respect her hobby which the 25-year-old practices almost professionally. This is what fascinates her: "The hard and intense training is a lot of fun." But rapid success was not only achieved through hard training. According to Hector, a time of reflection between the training units was equally important. This is where the physicst comes through – Hector studied in Hamburg, graduated in Cambridge in 2008 and now works on her PhD in the DESY theory group.

Hector caught the bug for competitive sports through rowing, a tradition in Cambridge. She trained before and after lectures – 15 hours per week in the end. In Hamburg, she continued with sports as a hobby, this time joining the box sports group Barracuda from FC St. Pauli. Her first fight was in June this year. "Before a fight, I am completely nervous, but somehow I manage to concentrate in the end," she says. 700 spectators watched her boxing at the Hamburg championships – getting her adrenaline flowing, making her completely happy. "This kick is the reward for all the hard training," Hector declares with shining eyes, looking forward to the next championship. *(jde)*

HELMHOLTZ ASSOCIATION

KIT has been launched

On 1 October, Forschungszentrum Karlsruhe merged with the University of Karlsruhe to form the Karlsruhe Institute of Technology (KIT). KIT was founded as a public corporation based on Baden-Württemberg state law and is both a university of the federal state of Baden-Württemberg and a research centre of the Helmholtz Association.

KIT was launched with great expectations: federal research minister Annette Schavan describes it as a "flagship" of science in Germany; Baden-Württemberg research minister Peter Frankenberg says that it has exemplary status. This is definitely true for its size: more than 8000 staff members and a budget of 650 million Euros make KIT a major partner in the German scientific landscape.

www.helmholtz.de/hermann

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Green light for the ILD detector concept

A committee of international experts has validated the different concepts for the ILC detectors. The committee recommended to further develop two of the concepts, one of them being the ILD (International Large Detector) which is largely based on the TESLA detector concept and for which DESY has made significant contributions.

ILC research director Sakue Yamada has now asked the ILD and SiD concept groups to optimise their concepts for a Technical Design Report until 2012. Two detectors are planned for the ILC which can alternately be pushed into or pulled away from the collision region of the accelerator.