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Our institute turns 25!

Dear readers!

Welcome to this special issue of our newsletter, which celebrates the 25th anniversary of our Institute! For this milestone in our history, I would like to highlight some accomplishments from our past quarter century -not only those in scientific research.

It has been a special privilege to have been a part



In addition to Jonathan Gershenzon, the board of directors includes Bill Hansson, Sarah O'Connor and Martin Kaltenpoth.

Photos (from left to right): Anna Schroll, Sebastian Reuter, Anna Schroll of the Max Planck Institute for Chemical Ecology from the beginning. I moved to Jena with my family 25 years ago to join the newly founded institute together with Ian Baldwin, Wilhelm Boland and Tom Mitchell-Olds. Although we started out very small in a few rented rooms, we had big ideas and a pioneering spirit that served us well. When the first scientists were hired in the four departments, the young institute soon

moved to rented space in the Carl Zeiss factory. We grew fast and in 2001 moved to our present building on the Beutenberg Campus. A fifth department was established when David Heckel joined us in 2004, and Bill Hansson replaced Tom Mitchell-Olds in 2005.

Now, looking back after 25 years, there are some impressive facts and figures to share with you: almost 3,000 publications that have been cited

Jonathan Gershenzon is the managing director of the institute.

Photo: Anna Schroll

more than 130,000 times, 300 successfully completed PhD theses, and 12 Otto Hahn Medals for outstanding dissertations in the Max Planck Society. But most of all, I'm proud of all the scientists we have produced- more than 900 alumni who have successfully established themselves in science and related areas throughout the world. Included among these are the leaders of 14 Max Planck Partner Groups that were established in India, China, Kenya, South Africa, Chile, and Peru.

Of the four founding directors, I am the only one still remaining, but the institute is far from a lonely place! Bill Hansson and I were joined by Sarah O'Connor in 2018 and Martin Kaltenpoth in 2020. These new directors bring new perspectives and new excitement to our research field. The microorganisms associated with insects are now receiving more attention than ever before in our work. At the same time, research on biosynthetic pathways has been invigorated with new approaches. Scientists from all over the world, currently from 46 countries outside Germany, still find their way to Jena bringing fresh new ideas and energy to drive our agenda forward.

Apart from scientific achievements, I would also like to celebrate the excellent tradition of service in our institute, which has been absolutely crucial for our success over the years. From the gardeners in the greenhouse, technicians in the labs, and the IT, workshop and building services, to the administrative staff, the librarians and the departmental assistants - none of our research would be possible without these essential people. It is hard to imagine how this institute would function without their support.

We can only look back with satisfaction for so long, however, since there are new challenges on the horizon, including recruiting three new directors in the next six years. We hope to be able to celebrate a very successful 50th anniversary with many of you in 25 years!

Jonathan Gershenzon

25 YEARS MPI FOR CHEMICAL ECOLOGY

Institute history in figures

70,000

This is how many plants are grown by the gardeners in a year. Plant cultivation is based on 40-50 culture instructions per month. In total, our greenhouse has about 400 species in stock, although not all of them are used experimentally. With the establishment of the Department of Natural Product Biosynthesis in 2019, plant species diversity in our facilities has again increased significantly. We also began to house many plants with medicinally relevant metabolites. One example is Tabernanthe iboga. This African plant from the dogbane family contains the alkaloid ibogaine, which was originally used for rituals and is now an interesting candidate for drug addiction treatment. The department elucidates the biosynthetic pathway of ibogaine and other plant alkaloids.

310

This is the number of successful doctoral degrees (listed in our internal databases) that have been completed at the institute. About 90% of the doctoral students earned their degrees at Friedrich Schiller University. The numbers per year and department vary. The most recent doctoral defenses include Christin Walther's "Fungal endophytes mediate tree-insect interactions" and Benjamin Fabian's "Experience-dependent plasticity of olfactory circuits".

1,407

Based on citation counts in the Web of Science on May 2nd, 2022, two papers from our institute have been cited 1,407 times: a 2006 review paper by Barbara Halkier and Jonathan Gershenzon in the Annual Review of Plant Biology, "Biology and biochemistry of glucosinolates", and a 2004 original paper by André Kessler and Ian Baldwin in Science, "Defensive function of herbivoreinduced plant volatile emissions in nature."

5

Although we began as an all-male institute, we now have a female director, Sarah O'Connor, Department of Natural Products Biosynthesis, and four female

research group leaders, Yuko Ulrich, Hannah Rowland, Franziska Beran, and Silke Sachse. We hope that the proportion of female scientists in leadership positions will continue to increase in the future!



One of about 400 plant species: the iboga plants in our greenhouse. Of particular interest is their possible medicinal use in the treatment of drug addiction. Photo: Mohamed Omar Kamileen

800

This is approximately how many construction measures have been implemented since the move to the new institute building in 2001. These range from the renovation of a single laboratory to the complete new building of the Schneiderhaus (with wind tunnel and insect

breeding facilities as part of the Department of Evolutionary Neuroethology) and the greenhouse in Rosalind-Franklin-Straße on the south side of the Beutenberg Campus. Our building services team oversees the application and implementation of each change in cooperation with outside companies.



Hannah Rowland (center) with her doctoral students Elisa Elstermann, Francesca Protti Sanchez and Paola Rubiano. She has been a Max Planck Research Group Leader at the Institute since 2017. Photo: Angela Overmever



Christin Walther from the Department of Biochemistry after defending her doctoral thesis, the 308th at MPI. Photo: Sybille Unsicker

329

Safety first: although fortunately we have never had a major accident at the institute, the institute has 329 fire dampers, 186 fire extinguishers, 108 emergency showers and 151 safety cabinets.



Our trainee Walid Rahman Safi in one of our server rooms. The primary data storage systems currently hold a data volume of around 600 terabytes. Two backup systems store another 750 terabytes of data. Photo: Sebastian Reuter

980

No data analysis and data archiving without IT infrastructure! The institute has about 430 personal computers and 200 notebooks as well as 250 laboratory PCs and about 100 peripherals, making a total of 980 computers. To meet the increasing demand for storage, the IT department has regularly expanded our tape libraries.



Josefa in her summer home. Photo: Angela Overmeyer



The leaf beetle Sagra femorata is just one of nearly 150 insect species at the institute, most of which are at home in the Departments of nsect Symbiosis and Evolutionary Neuroethology. Approximately 90 species belong to the genus Drosophila (vinegar flies). Photo: Martin Kaltenpoth

124

Demand for growth chambers has increased in recent years, and we currently have a total of 124 climate chambers of all sizes. To meet the needs of new appointments Sarah O'Connor and Martin Kaltenpoth, a new climate chamber center is currently being built. The plant species used in the Department of Natural Product Biosynthesis come from different continents and vegetation

> zones and have different temperature and humidity requirements. The plants are used to elucidate the metabolic pathways of plant metabolites of medicinal relevance. The Department of Insect Symbiosis focuses on the symbiosis of insects and microbes. Insects are hosts for many symbiotic bacteria. The func-

tions of these bacterial symbionts and the origins of these symbioses are not well understood yet. Insect species studied in the department include beewolves, bark beetles, fire bugs, and leaf beetles. Martin Kaltenpoth's department works with about 25 different species.

The head of the NMR service group Christian Paetz at the magnet of one of the three NMR spectrometers with a working frequency of 700 MHz. Photo: Sebastian Reuter

11,000

Between 8,000 and 11,000 orders are placed each year. Our administration takes care of the sometimes complex booking processes. These include, for example, obtaining suitable offers.

1

Almost everyone who has worked at the Institute knows her: our yellow-bellied slider Josefa, a land and water turtle. She belongs to the family of emydids and is native to North America. She spends most of her life in freshwater. As she is not adapted to winter condtions, she lives in our pond in the biotope in the summer and in an aquarium in our greenhouse in the winter.

3

The NMR group operates three nuclear magnetic resonance spectroscopes. They are important for the structural elucidation of new substances. For example, among many other molecules, the group has elucidated the structure of certain cardenolides. These highly toxic plant substances are produced by Asclepias species to protect themselves from herbivore damage, but bugs of the subfamily Lygaeinae, such as the large milkweed bug Oncopeltus fasciatus, are precisely adapted to these toxins, readily eating the plants' seeds and storing cardenolides for their own defense. Together with the NMR group, the Max Planck Research Group Predators and Toxic Prey is investigating which cardenolides are formed by which Asclepias species and in what form and insect developmental stage they are stored.

3,510

The scientists at the Max Planck Institute for Chemical Ecology have been very productive. Since the institute was founded, 3,510 publications (as of May 5, 2022) have been published and deposited in our PuRe database. Of these, 3,283 have appeared in peer-reviewed journals. A quick Web of Science analysis shows that our publications have received about 130,000 citations!

25 YEARS MPI FOR CHEMICAL ECOLOGY

This is the number of the different nationalities the institute has hosted since its beginnings. Researchers from China and India are most strongly represented, followed by the USA, which is due to the large number of exchange students and short-term visiting scholars from American partner universities. Although other countries are less strongly represented, we are very happy to have researchers from Costa Rica, South Africa and New Zealand, for example. Our human resources department takes care of many bureaucratic details for our staff hires, and our departmental assistants help newcomers settle in when they arrive.

25

This is the approximate amount of sand in kilograms the Department of Evolutionary Neuroethology needs every week for egg laying during the breeding of the migratory locust Locusta migratoria. In addition, five square meters of wheat seedlings are required as food for for 30 breeding cages. The department wants to find out which signals are responsible for the transformation from a solitary life to mass migration.

40

This is the number of ant colonies of the species Ooceraea biroi that can be filmed in parallel to observe their behavior. In this process, one camera observes 4-6 colonies at the same time. The Lise Meitner Group Social Behavior of Yuko Ulrich, the first Lise Meitner Group at our institute, wants to use this system to find out how infections are spread in social groups and how the behavior of an individual or of the group may help to increase immunity.

2,400

This is how many pitchers we have estimated are growing on the 60 carnivorous pitcher plant Nepenthes in our greenhouse. This corresponds to an average of about 40 pitchers per plant. The Research Group Plant Defense Physiology not only looks at how insects are digested in the pitchers but also asks how this plant genus protects itself against predators.

12

Otto Hahn Medals are awarded to outstanding

former doctoral researchers of the Institute. Our most recent recipient is Mohammed Khallaf, who will be awarded the medal in June 2022 for his dissertation "Wired for love: Evolutionary neurobiology of sexual communication in Drosophila".





14 former scientists founded a Max Planck partner group in their home country. The most recent partner groups are led by Jingyuan Chen in

the city of Zhuhai in China, who is interested in the role of polymethoxylated flavones in a variety of mandarin, and by Shantanu Shukla in Bangalore, India, who is studying microbiome-mediated dietary adaptations in dung beetles. The beetles' symbiotic partners could be described as ecosystem engineers for defense against various fungal pathogens.

former doctoral researcher of our institute to receive the Otto Hahn Medal from the Max Planck Society. Photo: Anna Schroll

Digestive fluid is taken from one of the approximately 2400

the research greenhouse.

Photo: Anna Schroll

Nepenthes pitchers in Cabin 4 of



institute, led by Yuko Ulrich (photo), studies the behavior of social ants. Photo: Anna Schroll

IMAGES OF SCIENCE

The most beautiful pictures of our research on tour in Jena





Here you can learn more about the "Images of Science".

In February 2022, a call went out to all scientists at our institute to submit their best images from their research. The call resulted in the submission of 55 outstanding images from which all employees could choose their five favorites. Although selection was extremely difficult, 16 photos received more than 15 votes. They are now available as printed postcards for events with school classes, visiting groups and for the "long night of the sciences." For two weeks, the five winning photos (see above) have been avail-



able to see as posters in local buses and trams as well as on three large posters. They show (from left to right) microscopic images of different cell types in *Arabidopsis* roots with nuclei fluorescing in different colors (image: Veit Grabe and Maite Colinas), the highly sensitive olfactory organs of a male European gypsy moth in search of a mating partner (photo: Franziska Eberl), the frog-legged beetle *Sagra femorata* under the microscope (image Veit Grabe and Roy Kirsch), various local interneurons in the olfactory center of the brain of the vinegar fly *Drosophila melanogaster* (image: Benjamin Fabian), and the leaf of a *Tococa* plant in the Peruvian rainforest with a symbiotic ant (photo: Andrea Müller).

The "images of science" campaign is a collaboration with our neighboring institute, the Max Planck Institute for Biogeochemistry, which is also celebrating its 25th anniversary. If you follow the QR code on the left, you will not only see the posters of the two institutes, but you can also listen to a podcast to learn what the researchers who submitted the images hope to discover.

The members of the two MPIs, which are celebrating their 25th anniversary this year, on the lawn between the two institutes.

Photo: Martin Strube

RESEARCH NEWS

Hormonal teamplay in trees

In contrast to previous assumptions, the defense hormones salicylic acid and jasmonic acid do not always suppress each other in regulating plant chemical defenses against pests and pathogens. In trees, the interplay of both hormones can actually increase plant resistance. This is the conclusion researchers from the Department of Biochemistry led by Chhana Ullah draw in a new study on poplars. The scientists showed that high levels of jasmonic acid were detectable in poplars that had been modified to produce increased levels of salicylic acid as well as in those that had been treated with salicylic acid. Plants that had higher cocentrations of both hormones were also more resistant to the rust fungus *Melamspora larici-populina*, with no negative effect on growth. Knowledge of how these hormones interact to defend plants could help to better protect poplars and other trees against pathogens.

Original Publication:

Ullah, C., Schmidt, A., Reichelt, M., Tsai, C.-J., Gershenzon, J. (2022).Lack of antagonism between salicylic acid and jasmonate signaling pathways in poplar. **New Phytologist,** doi: 10.1111/nph.18148



Chhana Ullah studying poplars in the greenhouse. He heads the project group "Chemical ecology of plant-pathogen interactions".

Photo: Anna Schroll

Chemical defense against plant sap-sucking leafhoppers decoded



Unsurprisingly, given the sheer number of potential enemies, plants are resistant to most insects. In a new study published in the journal Science, researchers at the Max Planck Institute for Chemical Ecology describe a newly discovered

Leafhopper of the genus Empoasca on a tobacco leaf: Scientists have now elucidated the chemical defense that tobacco plants use to defend themselves against this plant sap-sucking pest.

Photo: Danny Kessler

mechanism that protects a wild tobacco species from plant sap-sucking leafhoppers. Genetic screening, combined with knowledge about chemical changes in tobacco leaves, helped identify a previously unknown defense substance important for the tobacco's resistance to leafhoppers. The team was also able to characterize the genes for its biosynthesis. .

Original Publication:

Bai, Y., et al. . (2022). Natural history guided –omics reveals plant defensive chemistry against leafhopper pests. **Science** 375, eabm2948

Unexpected benefits from food competitors

A research team from the Department of Evolutionary Neuroethology has found that gravid tobacco hawkmoths (*Manduca sexta*) show an unusual preference for Datura plants that are already infested with leaf beetles when laying their eggs. The beetles and their larvae actually compete with tobacco hornworms, the larvae of *Manduca*, for food. Plants infested by beetles change their odor profile and increase the production of the substance alpha-copaene, making them, however, more attractive to tobacco hornworms seem to benefit from their mothers' choice of such host plants because in the presence of beetles and their larvae they are better protected from parasitic wasps that avoid beetle-infested plants. The researchers were also able to identify the tobacco hawkmoths' olfactory receptor that controls this behavior.

Original Publication:

Zhang, J., et al. (2022). Competing beetles attract egglaying in a hawkmoth. **Current Biology**, doi: 10.1016/j. cub.2021.12.021



Egg-laying Manduca sexta female.

Photo: Danny Kessler



NEWS & EVENTS

Yuko Ulrich receives the Zukunftskolleg Research Award



Yuko Ulrich Photo:Anna Schroll Yuko Ulrich is the first recipient of the new research award of the Zukunftskolleg of the University of Konstanz. The head of the Lise Meitner Group Social Behavior studies the spread of diseases as well as disease resistance in social insects. The newly introduced Zukunftskolleg Research Award recognizes scientific achievements of young researchers and supports them in further developing their personal profile. In 2022, the prize will be awarded for outstanding research on the topic of "Evolution of Behavior".

www.uni-konstanz.de/zukunftskolleg/

Sustainability at the Institute



The MPI for Chemical Ecology's climate bed is part of the "Pflanze KlimaKultur!" project. Photo:Angela Overmeyer

At the end of 2021, the new Sustainability Commission of the Max Planck Institute for Chemical Ecology met for the first time. The main goal of the group, which meets once a month, is to make the institute more sustainable in many ways. The group would like to get involved in the following areas and call on all employees to help: Conserving energy and other resources, avoiding and separating waste, reducing paper use, reducing the carbon footprint of travel to conferences and meetings, and supporting initiatives to improve sustainable food on campus. Preserving biodiversity on the Institute's campus is also an important concern. In this context, the institute participates in the observation network "Pflanze KlimaKultur!", a Citizen Science project of the universities of Berlin, Leipzig, Halle-Wittenberg and Jena, which relies on the cooperation of citizens. The aim is to observe the seasonal development phenomena (phenology) of ten different native plants.

www.pflanzeklimakultur.de

Scientific symposium on the occasion of the 25th anniversary



On September 29 and 30, 2022, we would like to celebrate our 25th anniversary together with all those who have shaped the Institute – our former and current employees. There will be a scientific symposium with presentations by the heads of the departments and independent research groups, as well as by a former member from each group who embarked on a successful scientific career after their time with us at the institute.

The program will conclude with a family celebration and party. Since it is not possible for everyone to travel to Jena for this event, we will also broadcast the talks online. For both on-site participation in Jena and online participation, all alumnae and alumni are invited to register here:

https://zoom.us/webinar/register/WN_yyls-pw6QRq-Ti4S1G9FnA

www.ice.mpg.de

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