BERNHARD NOCHT INSTITUTE FOR TROPICAL MEDICINE

BNITM
Bernhard Nocht Institute for Tropical Medicine

SCIENTIFIC REPORT 2018-2020

CONTENTS

Introduction

Foto: Klaus Juerries

Egbert Tannich

Dear Readers,

Please excuse the lateness of our annual report, it was held up by a pandemic... The cover photos of street art on our building's wall tell the tale. They are emblematic of the last one-and-a-half years of history: the appearance of a novel virus, the frenzied search for a vaccine and gradually gaining control over COVID-19. We hope that further chapters in history will report on scientific accomplishments in this regard, as this annual report does. This time it covers three years: 2018, 2019 and the pandemic year 2020, during which our 120 anniversary celebrations were limited to the virtual realm. SARS-CoV-2 forced us to cancel all planned events, reorganize how the laboratories were laid out and staffed, and recall all staff from the tropics over the course of a few days and send them to the home office.

It very quickly became apparent that SARS-CoV-2 would spread around the globe in short order, especially since, unlike the previous SARS virus, it is also transmitted by presymptomatic and asymptomatic carriers. This makes it virtually impossible to control without vaccines. The most important measure during the initial phase was identifying as many infected people as possible. The institute responded very quickly and made the first SARS-CoV-2 PCR test available in Hamburg. It was further improved in partnership with the company altona Diagnostics. With the support of the German Federal Ministry of Health (BMG), we were also able to expand the diagnostics and sequencing capacity at the BNITM as well as promptly implementing molecular corona diagnostics at our partner institutes in Africa. The Kumasi Centre for Collaborative Research (KCCR) in Ghana became one of the most important testing centers in the country and was designated as the federally accredited corona testing center for Central and Northern regions of Ghana by the Ministry.

The pandemic was also a severe blow to our specialized travel diagnostics. There was almost no demand for this anymore due to travel restrictions. A significant loss of income became apparent, threatening the existence of the MVZ BNITM GmbH. We were only able to compensate for these losses later in the year through increased corona diagnostics. The institute handled diagnostics for the Hamburg fire department personnel as well as employees of various Hamburg cultural facilities such as music venues and theaters.

Rising infection rates also increased public interest in virology, infectiology and epidemiology. The public had lots of questions: How is SARS-CoV-2 transmitted? How can we protect ourselves? How should we behave? For whom is the virus particularly dangerous? … There were times when our public relations department dealt almost exclusively with citizen and media inquiries about these topics, even though SARS-CoV-2 isn't even a tropical virus. The BNITM had to increase staffing levels in the public relations department in order to respond to the massive increase in inquiries. At the same time, institute staff were suddenly in demand as dialog partners for the press, radio, television and online media outlets. Jonas Schmidt-Chanasit in particular became the face of the BNITM on the German talk show circuit. Institute staff were also involved in providing policy advice, both in Hamburg and at the federal government level, and the BNITM sent personnel to Berlin in order to support the corona measures of the German Federal Ministry of Health.

Unlike the university and some other research institutes, the BNITM continued the full extent of its work in Hamburg, but in compliance with corresponding safety measures in order to avoid infections at the institute level. Thus the management board implemented liberal home office regulations. The Animal Facility and Engineering departments began working in shifts. Hygiene plans were developed for the staff and visits were largely prohibited. We had to cancel all workshops and internships for students as well as all courses and continuing education programs. This also applied to the annual three-month diploma course "Tropical Medicine for Doctors", which couldn't be held for the first time since World War 2. The celebrations originally planned for the 120-year founding anniversary of the BNITM also had to be canceled and limited to podcast and media formats.

Despite all adversities the many restrictions didn't do any significant damage to the positive development of the institute. On the one hand, this is due to the exceptional engagement of our staff, who tackled the challenge of "working and researching during a pandemic" with passion and flexibility. On the other hand, we are benefiting from the many things my predecessor as Chair of the Advisory Board, Rolf Horstmann, put in place for the BNTIM during his many years of service: The appointments to the clinical research and epidemiology professorships, for example, have already paid off. Thanks to the dedication of these two departments, it was possible to expand the work in Africa significantly, and the procurement of external funding and the publication output of the institute were increased by over 60 percent over the last three years. Some of the research findings are presented on the following pages.

The idea initiated by Rolf Horstmann of increasing the scope of the institute through the addition of the implementation research field is also slowly taking shape: To date, research at the BNITM on poverty-induced infectious diseases ranged from basic research in molecular biology and immunology to diagnostics development and research on the occurrence and spread of pathogens and extended to clinical research and field studies for the characterization, prophylaxis and treatment of diseases. In the meantime, effective drugs and/or vaccines are available for many of these infections.

However, it turns out that the problems in fighting these diseases lie at the very end of the development chain: in the task of identifying the affected people or population groups in the resource-poor countries and treating them effectively. Health services in remote areas are mostly inadequate, or there is violent conflict. Animal reservoirs and insect vectors of the infectious pathogens are often hard to control. There are often cultural and political barriers to communication as well as prejudices and fears – the coronavirus pandemic has shown us that this is by no means limited to resource-poor countries. Cost-benefit analysis is often lacking as well. They are indispensable in order to clearly illustrate the expenses of effective, successful humanitarian efforts to national and international policy-makers, and if necessary to show that the economic benefits of sustained control measures outweigh the costs. Implementation research is intended to address this topic and provide scientific support so that control and elimination campaigns can be implemented more effectively in the future.

A conference at the BNITM (pre-pandemic) involving international experts and WHO representatives as well as federal and state ministries covering various departments made it clear to all participants just how important implementation research is in order to effectively and sustainably control poverty-related tropical diseases. The WHO views implementation research as a key measure which should be advanced with high priority under all circumstances.

In the end, the awarding authorities were obviously convinced by our proposal: The federal and state governments increased the core funding of the BNITM permanently by over 4.5 million Euros per year. This is a substantial increase of around 30 percent. Since this degree of growth cannot be achieved overnight, it will be implemented incrementally between now and 2023. With the additional funding now available for the new field of work, the BNITM will establish the following new research units over the next few years: a department for "Implementation Research for Fighting Infectious Diseases", workgroups for "Implementation Research for Fighting Zoonotic Diseases", "Implementation Research for Fighting Vector-Borne Diseases", "Social Anthropology and Fighting Infectious Diseases, "Health Communication", "Surveillance in Resource-

Poor Regions for Fighting Disease" and "Health Economy and Sustainability" as well as a "Liaison Office" for interdisciplinary networking and as logistics center. Considerable additional funds will be used annually to strengthen, maintain and operate scientific partner institutes in Africa.

The interdisciplinary nature of the new field of research is particularly challenging for the BNITM: Implementation research combines natural and social sciences, scientific disciplines with very different cultures and approaches. This demands exceptional integration efforts.

On 13 January 2020 we celebrated the official launch of the implementation research section at the BNITM together with the Parliamentary State Secretary at the German Federal Ministry of Health, Ms. Weiss, the Senator in the Office for Science, Research, Equal Opportunities of the City of Hamburg, Ms. Fegebank, the President of the Leibniz Association, Professor Kleiner, as well as Dr. Amuasi from the Kumasi Centre for Collaborative Research (KCCR) in Ghana, one of our African partner institutes. The BNITM Board of Directors recognizes that the awarding authorities – the federal government, the City of Hamburg and the other Federal States – have given outstanding recognition to the work of the institute by committing to a permanent budget increase, but that this is also tied to expectations.

Rolf Horstmann has continued to support the institute in an advisory role as a retiree and member of the Board of Directors of the "Vereinigung der Freunde des Tropeninstituts e.V" since 2018. The institute is greatly indebted to him. In addition to his own successful research, he always supported the overall development of the institute for over 40 years in a variety of positions. He was able to initiate important developments and played a significant role in developing the BNITM into a modern, internationally renowned research institute.

It is now my turn to retire and bid you farewell. It was a great pleasure to support the growth of the institute in a position of great responsibility. Our Managing Director Birgit Müller, my other colleagues on the Board of Directors and our extremely competent Scientific Advisory Board with their constructive support made it easy for me to steer the institute even during the challenging phase of the pandemic. I would like to thank them and all BNITM staff, who worked together in a highly disciplined, goal-oriented and effective manner. Best wishes and success to my successor Jürgen May. Let's hope nothing gets in the way of the next annual report. Or at least no Acts of God.

Enjoy the read.

Egbert Tannich, September 2021

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RESEARCH

Molecular Biology and Immunology
Speaker: Prof. Dr. I. Bruchhaus

Department of Cellular Parasitology
Prof. Dr. T. Gilberger

Bruchhaus Group
(Protozoology)

Spielmann Group
(Malaria)

Clos Group
(Leishmaniasis)

Schnettler Group
(Molecular Infection Immunology)

Lotter Group
(Molecular Infection Immunology)

Jacobs Group
(Protozoa Immunology)

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(Helminth Immunology)

Department of Virology
Prof. Dr. S. Günther

- **Leibniz Junior Research**
  Group Oestereich
- **BMBF Junior Research**
  Group Rosenthal

Department of Arbovirology
Prof. Dr. J. Schmidt-Chanasit

- **BMBF Junior Research**
  Group Lühken

Muñoz-Fontela Group
(Virus Immunology)

Clinical Research
Speaker: Prof. Dr. M. Ramharter

Department of Clinical Research
Prof. Dr. M. Ramharter

- **Leibniz Junior Research**
  Group Omansen

Tappe Group
(Zoonoses)

Department of Infection Immunology
Prof. Dr. M. Addo
associated UKE group

Epidemiology and Diagnostics
Speaker: Prof. Dr. J. May

Department of Infectious Disease Epidemiology
Prof. Dr. J. May

Department of Infection Diagnostics
Prof. Dr. E. Tannich

Amuasi Group
Amuasi Group

Stand 2020

For current information such as research focus or publications of the different departments and research groups, please visit the individual websites .
The overview is continuously updated: **www.bnitm.de/en/research/research-groups**.

CURRENT OVERVIEW THE RESEARCH GROUPS

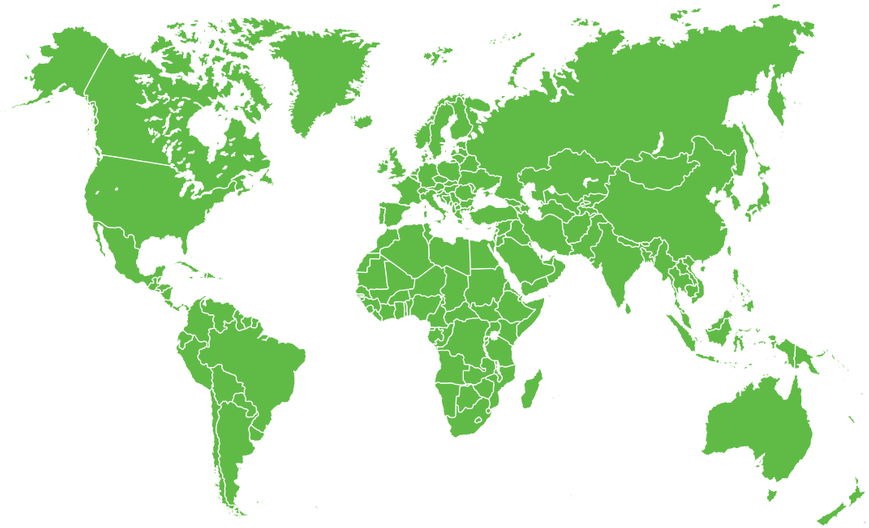
BNITM Bernhard-Nocht-Institut für Tropenmedizin

DEUTSCHES NETZWERK gegen vernachlässigte Tropenkrankheiten (DNTDs)

DTG

Eine Einschätzung des Beitrags deutscher Institutionen bei der

FORSCHUNG ZU VERNACHLÄSSIGTEN TROPENKRANKHEITEN

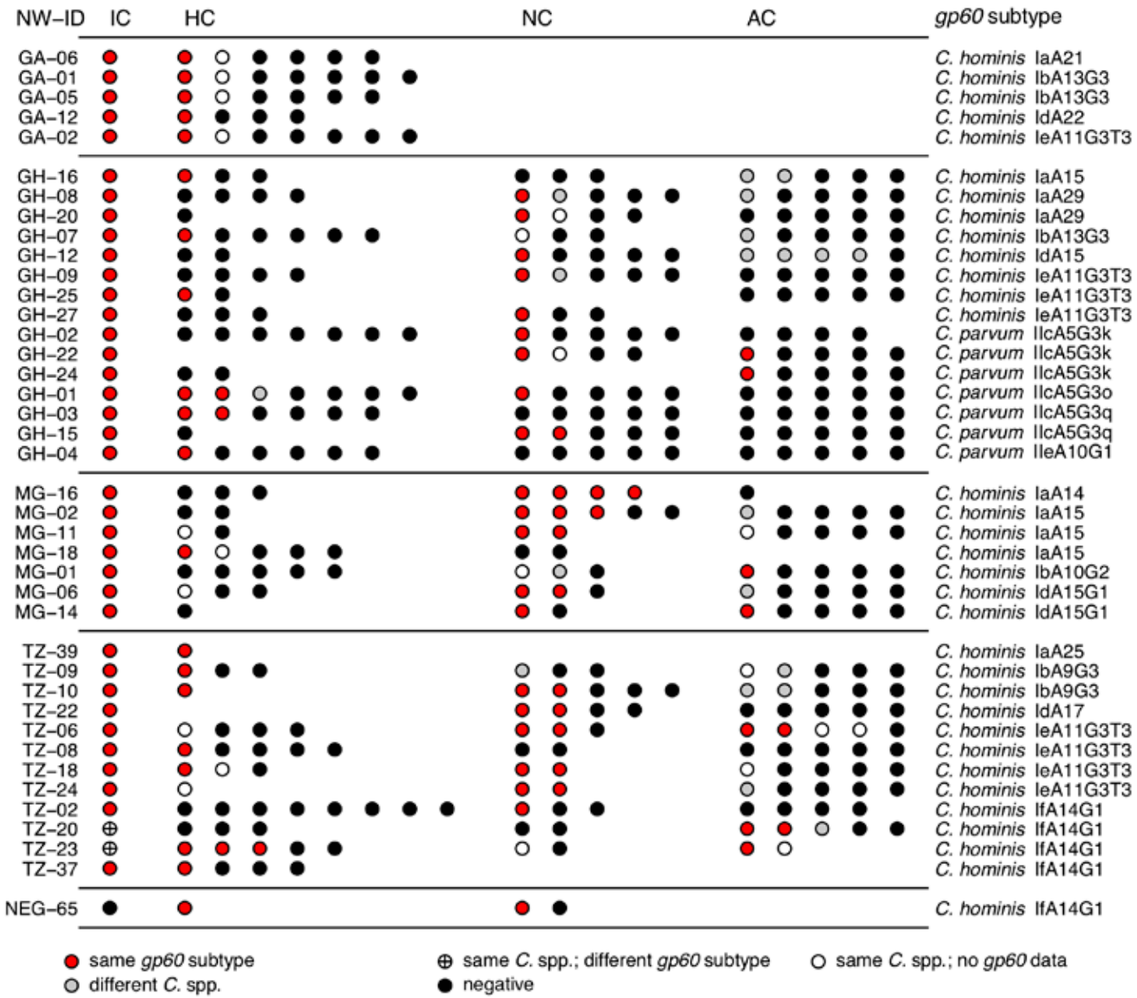


GEFÖRDERT VOM

Bundesministerium für Bildung und Forschung

NEGLECTED TROPICAL DISEASES

Neglected Tropical Diseases (NTDs) are among the poverty-related diseases. Over 1.7 billion people in 149 countries worldwide are affected by NTDs, another two billion are threatened by them. NTDs affect the poorest parts of the population in already poor countries. They frequently lead to severe and long-lasting illnesses. The World Health Organization (WHO) highlights 20 NTDs as particularly important, including diseases caused by worms, protozoa, bacteria or viruses. Snakebite envenoming was recently included in the list of NTDs. The BNITM performs research on a range of NTDs, including leishmaniasis, snakebite and worm infections. Researchers were also able to show that, counter to earlier assumptions, infection with the eye worm Loa loa represented a significant disease burden for the affected persons. We therefore recommend including loiasis, which occurs frequently in West Africa, in the list of NTDs.



TRANSMISSION ROUTE OF CRYPTOSPORIDIUM IN AFRICA

Cryptosporidium is a single-celled parasite which causes severe diarrhea in young children and immunocompromised adults. In South Asia and Sub-Saharan Africa alone, the parasite is responsible for 200,000 deaths a year among children under two years of age. The infection can be passed from animals to people via contaminated water or directly from person to person.

In a large-scale study in four African countries, we were able to show that neighboring children under five years of age exhibited the highest risk for cryptosporidium transmission. The infection is primarily passed from child to child, with zoonotic transmission by animals playing subordinate role.

Krumkamp R. et al., Clin Infect Dis. 2021; 72(8): 1358-1366

Daniel Eibach, Ralf Krumkamp, Cassandra Aldrich, Benedikt Hogan, Sophia Melhem, Christina Rohmann, Doris Winter, Anna Jaeger, Oumou Maiga-Ascofare, Denise Dekker, Maike Lamshöft, Thorsten Thye, Kathrin Schuldt, Egbert Tannich, Jürgen May and external cooperation partner (see publication)

Figure: Transmission pathways of cryptosporidium infections within a household, where persons and animals marked with a red dot have probably infected one another.

TO THE RESEARCH GROUP PAGE

Without surgery

BURULI ULCER, CURE THROUGH COMBINATION OF ANTIBIOTICS

Buruli ulcer is a neglected tropical disease caused by *Mycobacterium ulcerans bacteria*. The disease primarily occurs in West Africa and leads to extensive open lesions of the skin and underlying tissue. For a long time, Buruli ulcer was treated exclusively with surgery. The affected areas of skin were surgically removed, or limbs had to be amputated. For a number of years, attempts have been made to treat Buruli ulcer with various combinations of antibiotics over many weeks. Shorter and more efficient courses of treatment are currently a priority in Buruli ulcer research.

Our research group at the Kumasi Centre for Collaborative Research (KCCR) in Ghana, through a collaboration with the WHO, has now shown that a combination of two drugs (taken orally for eight weeks) is sufficient to heal Buruli ulcer in 97 percent of cases. Surgery is not required.

Phillips RO, et al., Lancet, 2020;395(10232): 1259-1267.

Godfred Sarpong, Nanaa Francisca Sarpong, Richard O. Phillips (KCCR) and external cooperation partner (see publication)

Figure: Aleppo boil, a skin lesion which doesn't heal.

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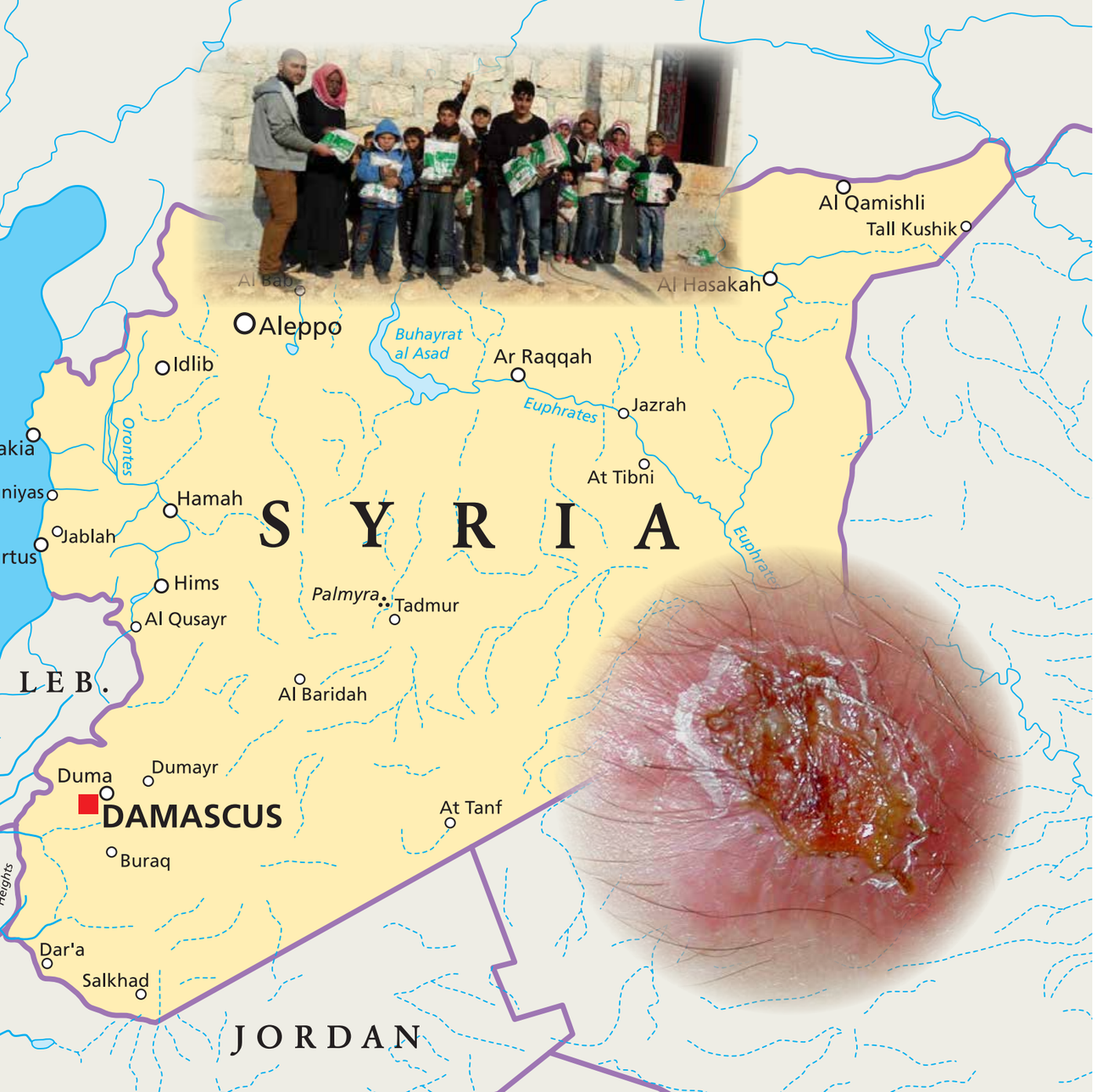


Helping people to help themselves

EPIDEMIC CONTROLLED IN THE MIDDLE OF A CIVIL WAR

Cutaneous leishmaniasis is widespread in the Middle East and particularly in Syria. The parasites, leishmania, are transmitted by sand flies. The infection can lead to large, dry skin lesions which don't heal. The number of infections has increased dramatically during the civil war.

The MENTOR-Initiative, an international non-governmental organization (NGO) with an international mandate, has established a control program for Northern Syria during the civil war. Prof. Michael Ramharter (Clinical Research Department) and Dr. Khalid Rehman have provided scientific support to this initiative by evaluating the epidemiology and molecular species diagnostics in the area covered by the control program. The program comprises timely diagnostics and preventative measures, including issuing mosquito nets, insecticide campaigns and waste management. These measures helped to achieve a sustained reduction in the number of new cases in these extremely challenging conditions.

Rehman K, et al., Emerg Infect Dis. 2018;24(11): 1973-1981.

Johannes Mischlinger, Michael Ramharter and external cooperation partner (see publication)

Figure: Aleppo boil, a skin lesion which doesn't heal.

TO THE RESEARCH GROUP PAGE

LOA LOA, AN UNDERESTIMATED PARASITE

Loiasis is a worm infection transmitted by deerflies and is prevalent primarily in Central Africa. Even though infections with *Loa loa* result in a range of symptoms and large quantities of worm larvae in the blood, the disease was traditionally considered harmless and is not listed by the WHO as a neglected tropical disease (NTD).

We have now completed a large-scale study to research the exact extent of loiasis disease burden: *Loa loa* infections cause sickness, result in time of work and are a factor in preventing the achievement of Sustainable Development Goals in affected African countries. Therefore loiasis should be added to the list of NTDs immediately and included in corresponding control programs.

Veletzky L, et al., Lancet Infect Dis. 2020; 20(11):1339-1346.

Luzia Veletzky, Rella Zoleko Manego, Johannes Mischlinger, Ghyslain Mombo-Ngoma, Michael Ramharter and external cooperation partner (see publication)

Figure: Loa loa is a parasite and is also known as filariasis or eye worm.

TO THE RESEARCH GROUP PAGE

The neglected among the neglected

SNAKEBITE ENVENOMING IN CENTRAL VIETNAM

Snakebite envenoming is a significant and neglected health issue affecting poor people in many tropical countries. In May 2019 the World Health Assembly issued a strategy to counter snakebite envenoming. The number of deaths and disabilities should be reduced by 50 percent by 2030.

Our research on the frequency of snakebites in three geographically and socio-economically different regions in the province of Thua Thien Hue in Central Vietnam clearly confirmed this: The frequency of snakebites was about three times higher in poorer mountainous regions than in the wealthier coastal region or the City of Hue. Green vipers and cobras are responsible for the majority of injuries. Antiserums weren't available in hospitals until 2017, and the medical personnel had no experience administering the drugs.

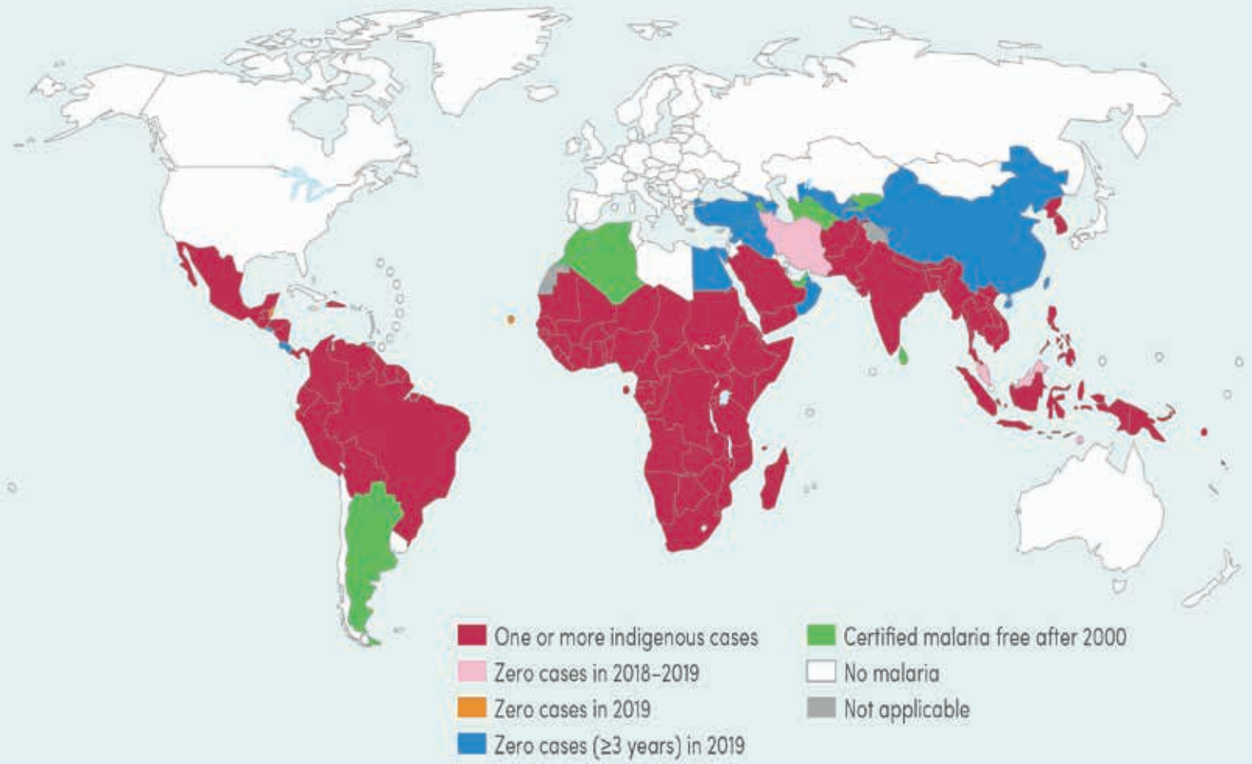
Our study results raised awareness of the problem. Antiserums were introduced in the University Hospital in Hue, and doctors as well as medical professionals received training in order to be able to treat snakebite envenoming adequately on their own.

Blessmann J, et al., Toxicon 2018;156; 61-65

Jörg Blessmann, Ralf Krumkamp, Jürgen May and external cooperation partner (see publication)

Figure: The Pit Viper *(Trimeresurus albolabris)*

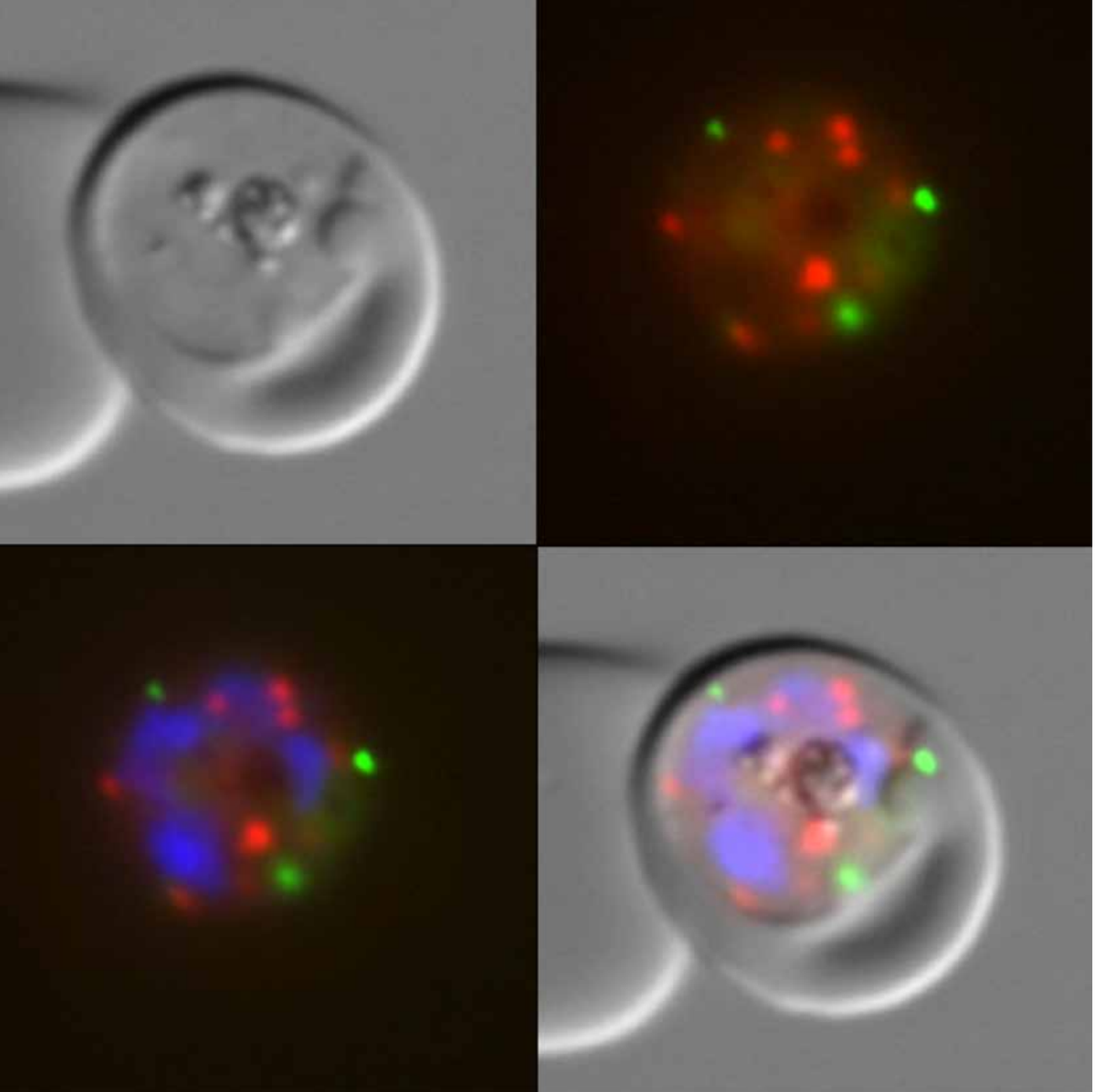
TO THE RESEARCH GROUP PAGE



WHO: World Health Organization.

MALARIA

Malaria is still one of the most important tropical infectious diseases. Thanks to extensive financial support from the international community and improved diagnostics and treatments, the death toll was successfully reduced over the past decade. Yet over 200 million people still fall ill with malaria year after year. To this day, there is no satisfactory vaccine to effectively contain the disease. At the same time, resistance of the pathogen to current drugs is occurring with increasing frequency. This is true of artemisinin in particular, currently the most important anti-malaria drug for treating severe progression of the disease. Thus the BNITM feels a particular obligation to contribute to the fight against malaria, and has expanded its research efforts in this field over the past few years. We present some of the results on the following pages. In particular, we would like to highlight uncovering of the molecular mechanism of resistance to artemisinin.



Balancing act

FASTING FOR RESISTANCE

Artemisinin is one of the most important drugs for treating malaria. However, resistance has now become widespread in South-East Asia, and is of great concern to experts. But how do resistant malaria pathogens develop?

The malaria parasites propagate in red blood cells. They feed on hemoglobin, which they ingest from the blood cell and digest in their digestive vacuole. Hemoglobin metabolites are produced as a result. We discovered that the malaria parasite's protein Kelch13 is important for hemoglobin uptake.

Fatal for the parasite: Artemisinin is activated by the hemoglobin metabolites and can only then develop its deadly effect. If the parasite "fasts" and restricts Kelch13-mediated uptake, correspondingly fewer hemoglobin metabolites are produced; artemisinin isn't sufficiently activated and the parasite becomes resistant. Apparently resistant parasites take up just enough hemoglobin to survive, but not enough to trigger artemisinin activation. A balancing act.

Birnbaum J & Scharf S, et al., Science 2020; 367(6473): 51-59

Jakob Birnbaum, Sarah Scharf, Sabine Schmidt, Ernst Jonscher, Sven Flemming, Marius Schmitt, Ricarda Sabitzki, Bärbel Bergmann, Ulrike Fröhlke, Paolo Mesén-Ramírez, Alexandra Blancke Soares, Hendrik Herrmann, Tobias Spielmann and external cooperation partner (see publication)

Figure: Malaria parasite at 1000-fold magnification in human red blood cell (visible in each quadrant). Fluorescence microscopy: Key protein Kelch13 (green), parasite cell nuclei (blue), Golgi marker GRASP (red).

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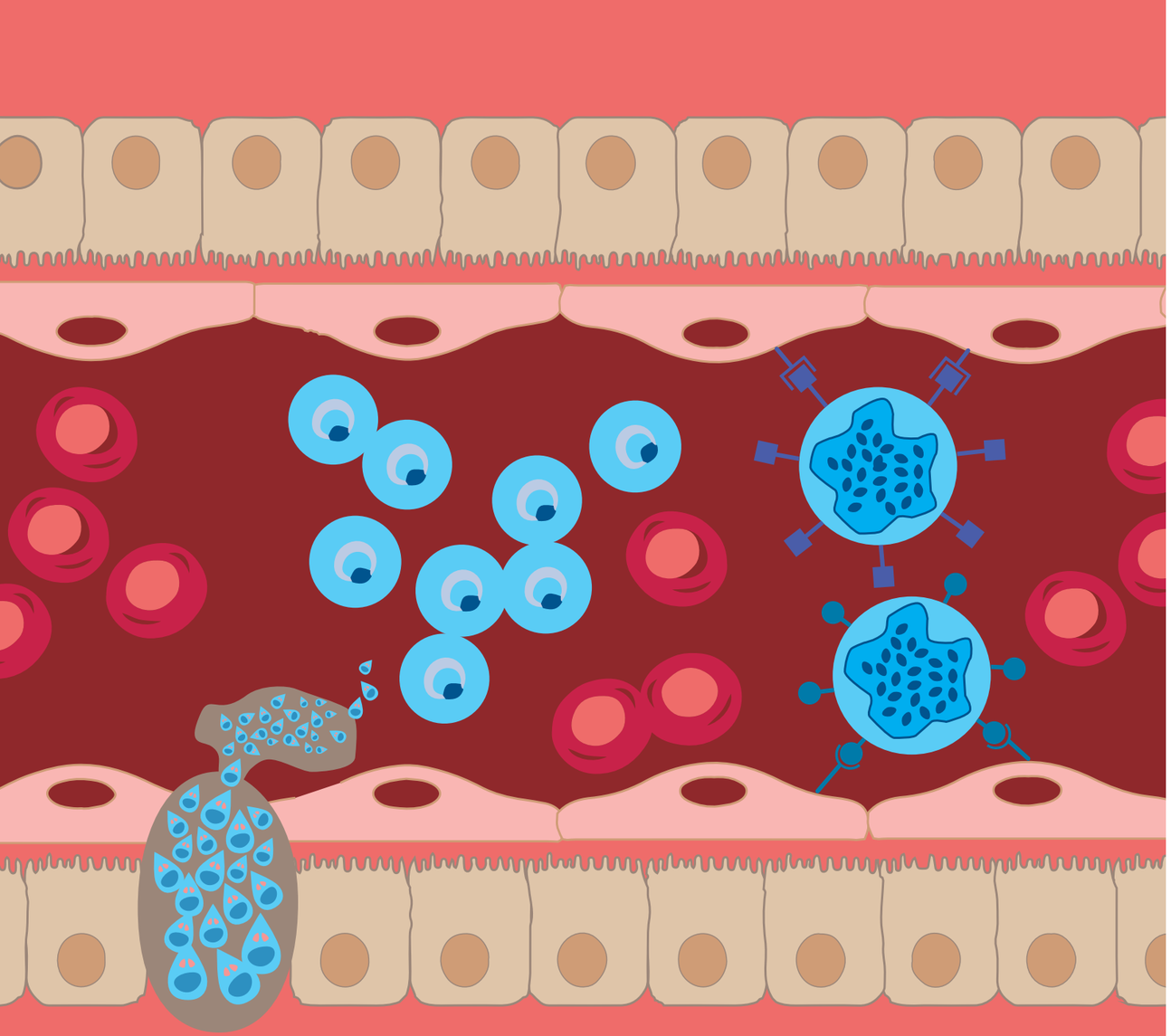

Adapted

EVASIVE ACTION BY MALARIA PARASITES

In order to multiply effectively in human blood, malaria parasites have to infect red blood cells and subsequently ensure that the bloodstream doesn't take them to the spleen where they would be broken down. The parasite does this using specific protein molecules which are integrated into the membranes of red blood cells. Then these allow the parasite to adhere to the vessel walls.

Since humans form antibodies to these surface molecules, the parasite constantly has to replace the molecules with new versions. The parasite has a large repertoire of these proteins and can resist the immune system for a long time through so-called antigenic variation.

We studied the antigenic variation mechanism in greater detail in volunteers infected with malaria parasites under controlled conditions. It turns out that certain patterns of surface molecules are produced at the start of a malaria infection. These patterns depend on whether or not the person was previously infected with malaria parasites and which antibodies were already acquired through previous malaria infections.

Bachmann A, et al., PLoS Pathog. 2019; 15(7):e1007906

Anna Bachmann, Ralf Krumkamp, Jan Stephan Wichers, Egbert Tannich and external cooperation partner (see publication)

Figure: Development of malaria parasites in human red blood cells. Parasite protein molecules reach the surface and cause infected red blood cells to adhere to receptors on the inside of blood vessel walls.

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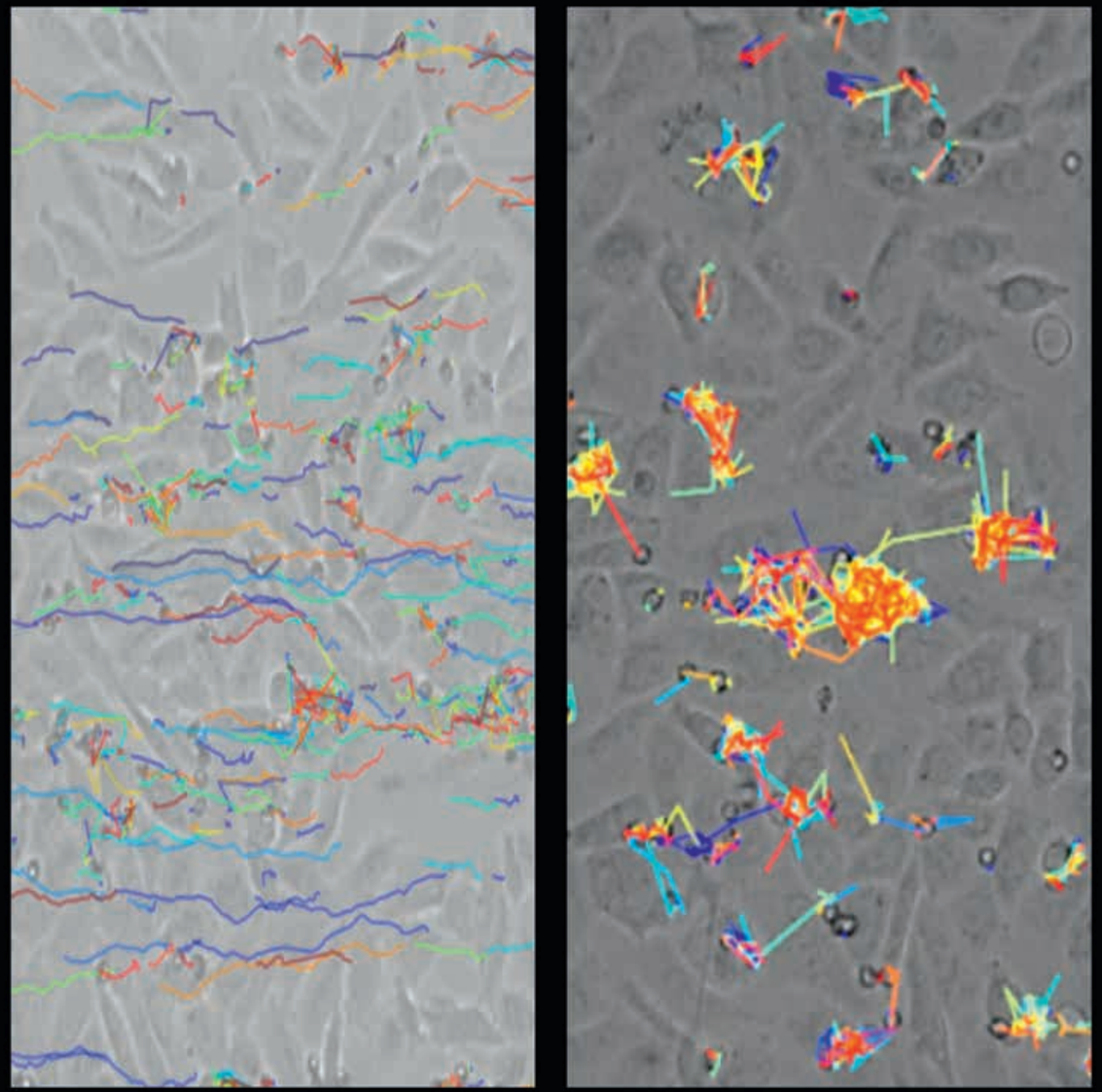

Like glue

A SPECIAL GLUE IN A RAGING TORRENT

Infections with *Plasmodium falciparum*, the most dangerous of the various malaria pathogens, lead to life-threatening disease progression if left untreated. The parasite infects red blood cells (erythrocytes) which subsequently bind to the walls of small blood vessels and damage important organs like the kidneys, lungs or brain through oxygen starvation and over-activation of the immune system.

We have deciphered complex processes which occur during the interaction of infected erythrocytes with the various receptors in the walls of blood vessels. The group used a special technique to simulate the conditions in the blood vessels in the laboratory, in order to be able to observe and measure the binding of infected erythrocytes to the vessel walls under flow conditions. The group discovered that infected blood cells bind weakly to the receptor CD36 and roll slowly along the vessel wall. The rolling stimulates the vessel wall into producing additional receptors, which lead to very stable binding to the vessel walls.

Lubiana P, Bouws P, et al., Sci Rep. 2020;10(1):4548

Nahla Galal Metwally, Pedro Lubiana, Philip Bouws, Lisa Katharina Roth, Michael Dörpinghaus, Jan Stephan Wichers, Anna Bachmann, Katharina Höhn, Thorsten Thye, Jana Brehmer, Iris Bruchhaus and external cooperation partner (see publication)

Figure: Under flow conditions, erythrocytes infected with Plasmodium falciparum roll over cells which present the human endothelial cell receptor CD36 (left), while they bind firmly to cells which present ICAM-1 (right).

TO THE RESEARCH GROUP PAGE

False malaria

BIOMARKER TO DIFFERENTIATE BETWEEN SEVERE MALARIA AND SEPSIS

The clinical symptoms of severe malaria and blood poisoning (bacterial sepsis) are often difficult to distinguish. Malaria rapid tests are able to detect the parasites and result in a diagnosis of “malaria”, but in Africa the result not infrequently conceals additional co-infections with bacteria. Detecting bacteria in the blood is time-consuming and expensive, and in resource-poor countries can rarely be used routinely and only in large hospitals. As a result, supplementary treatment with antibiotics to counter bacterial infections is often given as a precaution. This in turn promotes the development and spread of antibiotic-resistant bacteria.

In order to counteract this danger, we are working on an easy to use rapid test which is intended to distinguish between malaria and sepsis on the basis of so-called “biomarkers”. In various preliminary studies, the concentration of a large number of molecules in the serum of children in Africa was analyzed. A combination of biomarker molecules with which it is possible to distinguish between “malaria” and “sepsis” and which are suitable for use in a rapid test was found.

Struck NS, et al., J Infect Dis 2020, 221:1098-1106
Krumkamp R, et al., Sci Rep. 2020;10(1):21168

Nicole Gilberger (geb. Struck), Daniel Eibach, Eva Lorenz, Ralf Krumkamp, Wibke Loag, Toni Rieger, Stephanie Wurr, Marlow Zimmermann, Thomas Jacobs, Kwabena Oppong, John Amuasi, Stephan Günther, Jürgen May and external cooperation partner (see publication)

Figure: Blood testing of children in Ghana

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Sleeping Beauty

A SMALL PRICK OF THE FINGER IS ENOUGH

Malaria is typically diagnosed using blood tests, since the corresponding parasites infect red blood cells. But it was previously unclear whether capillary or venous blood was more suitable for diagnostics. Capillary blood can be obtained easily via a small prick, similar to blood sugar testing. Unlike venous blood, which requires puncturing a larger blood vessel for example in the crook of the arm.

In a study we completed in Gabon in Central Africa, we were able to show that capillary blood has a higher parasite density than venous blood. This results in significantly greater sensitivity of malaria diagnostics, especially when parasite levels in the blood are low. These results are important, since they can help improve both clinical diagnostics as well as scientific studies and malaria elimination campaigns.

Mischlinger J, et al., J Infect Dis. 2018;218(8):1296-1305

Johannes Mischlinger, Mirjam Groger, Luzia Veletzky, Rella Zoleko-Manego, Ghyslain Mombo-Ngoma, Egbert Tannich, Michael Ramharter and external cooperation partner (see publication)

Figure: Drawing capillary blood

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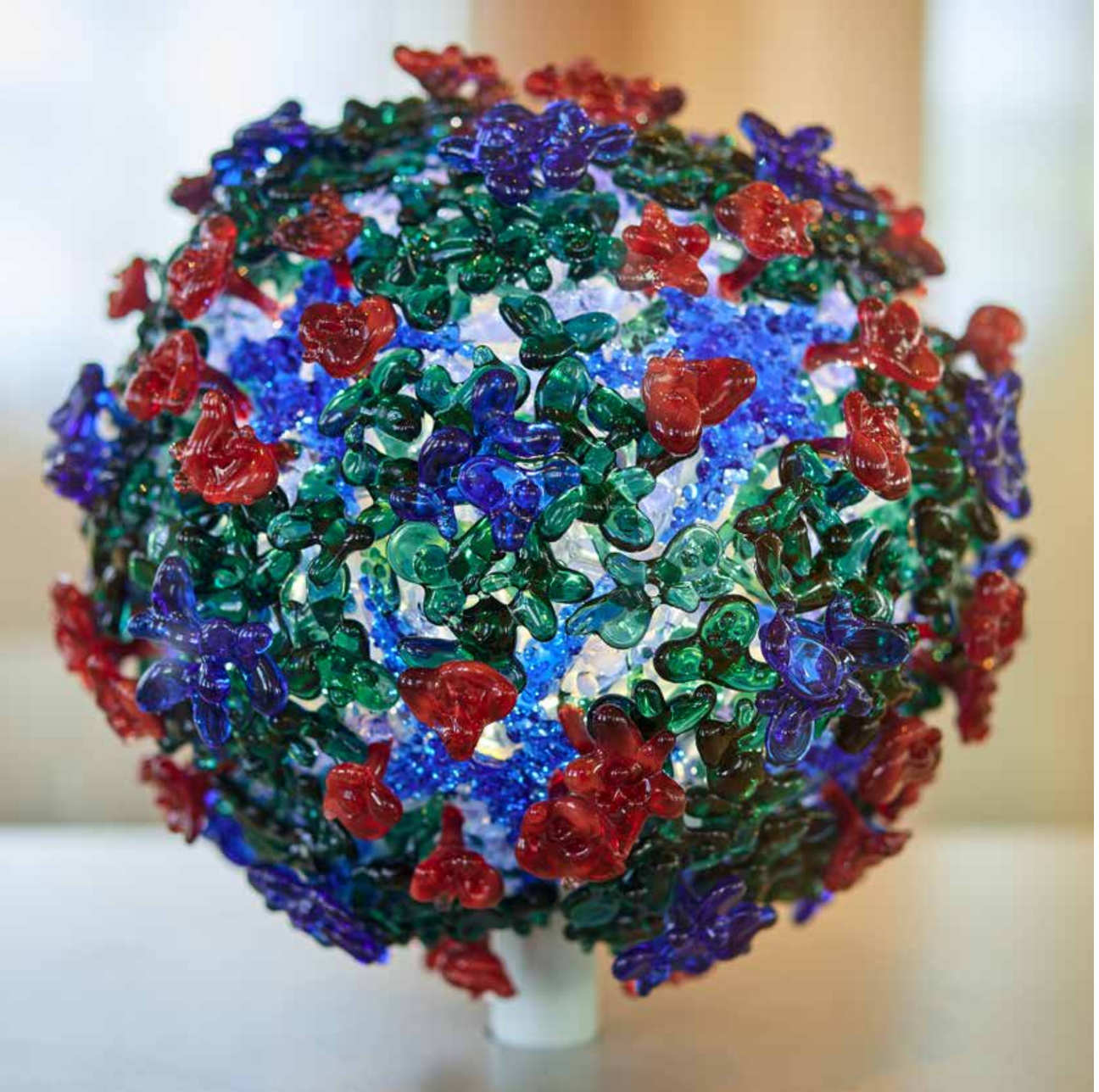

EMERGING INFECTIOUS DISEASES

It was foreseeable, and we warned about it early on. Then, in 2018, the time had come. Infections with the West Nile virus were detected for the first time in Germany. In the meantime it appears to have established itself, since infections with West Nile virus were diagnosed on a regular basis in people as well as horses and birds during the summer months in all subsequent years.

We should probably be prepared for further surprises in the coming years. This has various reasons: Due to the increase in global temperatures, heat-loving mosquito species such as Asian tiger mosquitoes can colonize new habitats, and viruses can multiply more readily in the carrier insects. At the same time, exotic pathogens are introduced from remote regions through the global trade in goods and animals. Infections with tropical viruses are already occurring more frequently in Europe. There were several outbreaks of chikungunya and dengue fever in Southern Europe in the past few years. In addition to the West Nile virus, infections with the Usutu virus were also registered repeatedly in Germany. As the national reference center for tropical diseases, the BNITM is involved in detection and control of these “new infections”.

The cool virus

CHIKUNGUNYA VIRUS INFECTION ALSO POSSIBLE IN GERMANY

For some time now, researchers at the BNITM have been looking into the question of whether current changes to the climate or the establishing of new insect species such as the Asian tiger mosquito can lead to outbreaks of exotic diseases in Germany.

To study this, native mosquitoes are collected at various locations in Germany and fed with virus-containing blood in the BNITM high-security insectarium. After an incubation period of about two weeks at temperatures between 18 and 27 degrees Celsius, the animals' salivary gland fluid is examined for virus particles.

The results showed that most exotic viruses such as the Zika virus don't present a danger, since these species require relatively high temperatures in order to multiply efficiently in the mosquitoes. One exception is the chikungunya virus, which can be transmitted effectively by the Asian tiger mosquito at ambient temperatures as low as 18 degrees Celsius. If this species of mosquito spreads further, there will be a risk of chikungunya fever outbreaks in Germany similar to those in Italy.

Heitmann A, et al., Euro Surveill. 2018 Jul; 23(29): 1800033

Jansen S, et al., Emerg Microbes Infect. 2018 Nov 28; 7(1): 192

Anna Heitmann, Michelle Helms, Stephanie Jansen, Hanna Jöst, Renke Lühken, Jonas Schmidt-Chanasit, Egbert Tannich and external cooperation partner (see publication)

Figure: Native mosquitoes having a blood meal

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It was foreseeable

TROPICAL WEST NILE VIRUS ARRIVES IN GERMANY

Infections with the West Nile virus were first detected in Germany in a few birds and horses in 2018. The number of infected animals increased in the following year. Subsequently, we and other laboratories diagnosed several human West Nile virus infections acquired in Germany. Some of the patients exhibited severe meningitis. Since about 80 percent of infections with the West Nile virus in humans are asymptomatic, a high number of undiagnosed cases must be expected.

The West Nile virus has its origin in Africa. In Germany, it is transmitted by native mosquito species of the genus Culex. Apparently the unusually warm summers in cause of climate warming allowed the local establishment of the virus.

Ziegler U, et al., Viruses 2020, 12(4):448

Carolin Hattendorf, Philip Eisermann, Daniel Cádar, Renke Lühken, Jonas-Schmidt-Chanasit and external cooperation partner (see publication)

Figure: A dead song thrush is examined for tropical viruses at the institute.

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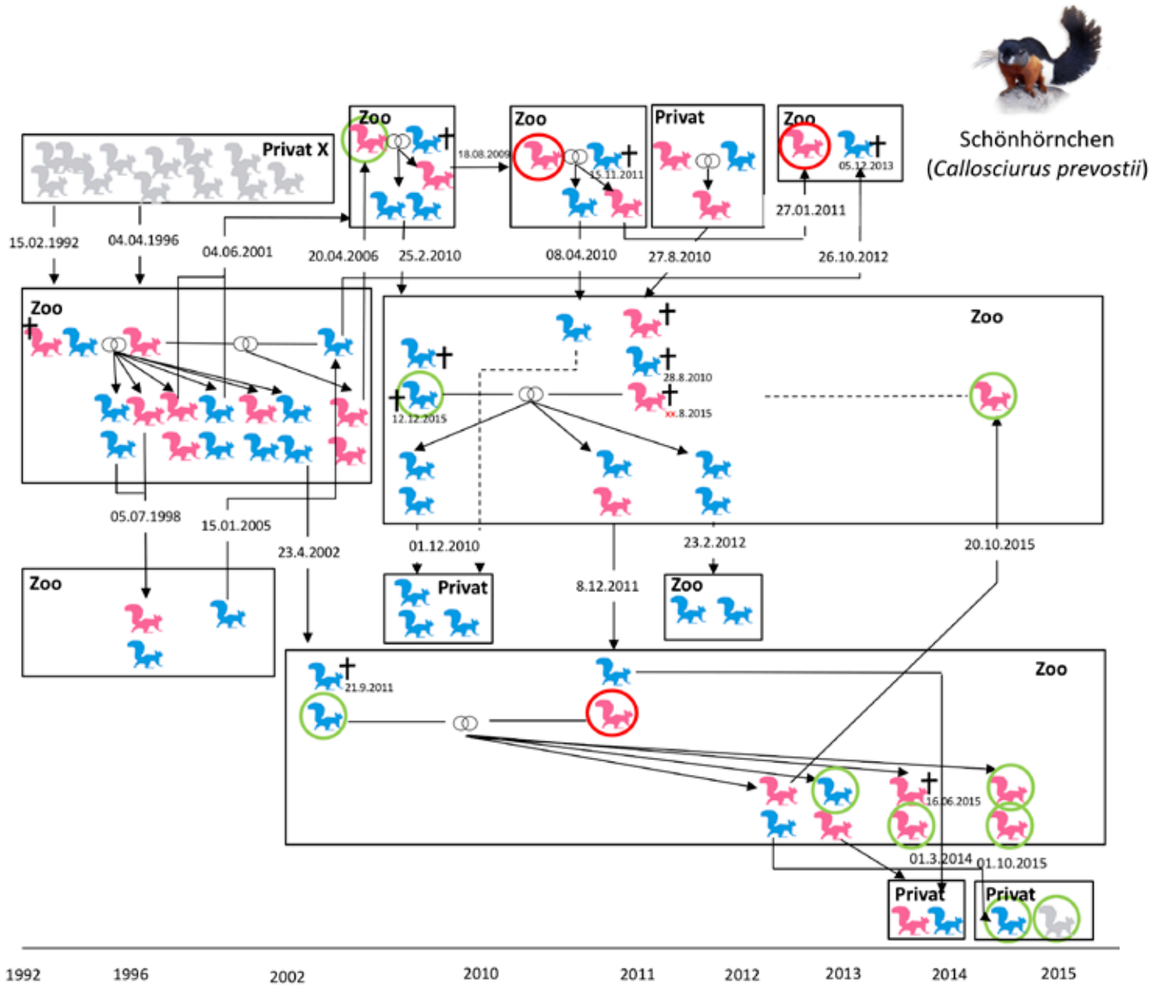
FROM ANIMALS TO HUMANS: DEADLY ENCEPHALITIS DUE TO BORNAVIRUSES



In 2015 the institute was already involved in shedding light on cases of deadly encephalitis among animal breeders, caused by a new bornavirus. In the course of the investigation, additional deaths due to encephalitis in this context were uncovered, also among caretakers of zoo animals. It quickly became clear that all persons had close contact with exotic tree squirrel species, which the researchers identified as the actual carriers. The pathogen was named *Variegated Squirrel Bornavirus 1* (VSBV-1).

The analyses are ongoing. To determine the origin of the virus, our researchers are attempting to trace trade routes through which the animals entered Germany back to their source. But not only imported rodents carry the potentially deadly danger. A well-known bornavirus (BoDV-1), which is found in native shrews, has also recently been associated with cases of encephalitis in humans. Some of these cases also had deadly outcomes. Unusually, there were also cases of transmission in the course of organ transplants.

Tappe D, et al., Euro Surveill. 2019; 24(8)
Schlottau K, et al., N Engl J Med. 2018, 379(14).

Jonas Schmidt-Chanasit, César Muñoz-Fontela, Monika Rottstegge, Julia R. Port, Dennis Tappe and external cooperation partner (see publication)

Figure: Partial reconstruction of trade routes of exotic tree squirrels.

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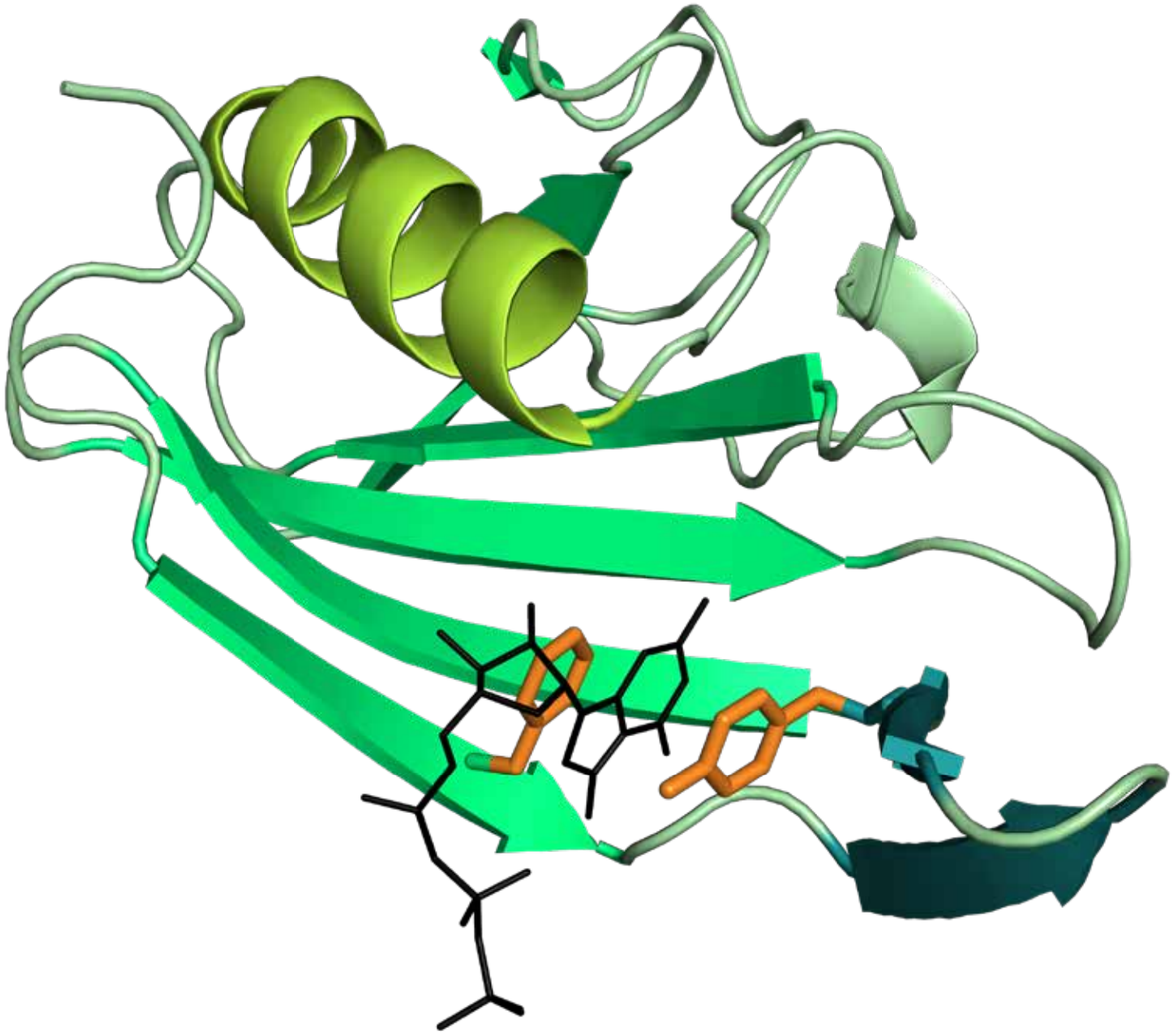
HEMORRHAGIC FEVER VIRUSES

Since a high percentage of cases result in death, hemorrhagic fever viruses such as Ebola or Lassa virus are among the most dangerous pathogens. With its specialized highest biological safety level (BSL-4) laboratory, the BNITM is involved in studying such viruses and sheds light on their structure and workings. This information is needed in order to develop new therapeutic agents and vaccines. The institute also conducts studies in African endemic regions on the immunology and pathophysiology of the diseases as well as the transmission pathways and improved diagnostics.



Exposing the thief

ATOMIC STRUCTURE OF A VIRAL KEY FACTOR

Viruses use the cell metabolism for their amplification. Therefore, they need to access the cellular protein production machinery, which requires specific recognition molecules. Tropical viruses like Rift Valley fever virus cannot produce these recognition molecules themselves but snatch them from the host cell. We identified the protein of Rift Valley fever virus responsible for this snatching process and analyzed its atomic structure by X-ray crystallography. The structure reveals a specific binding pocket for the recognition molecule. The detailed information about this binding pocket provides a basis for the design of tailored inhibitors against Rift Valley fever virus.

Gogrefe N, et al., PLoS Pathog. 2019; 15(5):e1007829

Nadja Gogrefe, Sophia Reindl, Stephan Günther, Maria Rosenthal

Picture: Structure of a key protein of Rift Valley fever virus: The figure displays the atomic structure (shown as cartoon) of the viral protein responsible for binding of the recognition molecule. The recognition molecule is depicted as black lines and the specific binding pocket of the protein is colored in orange.

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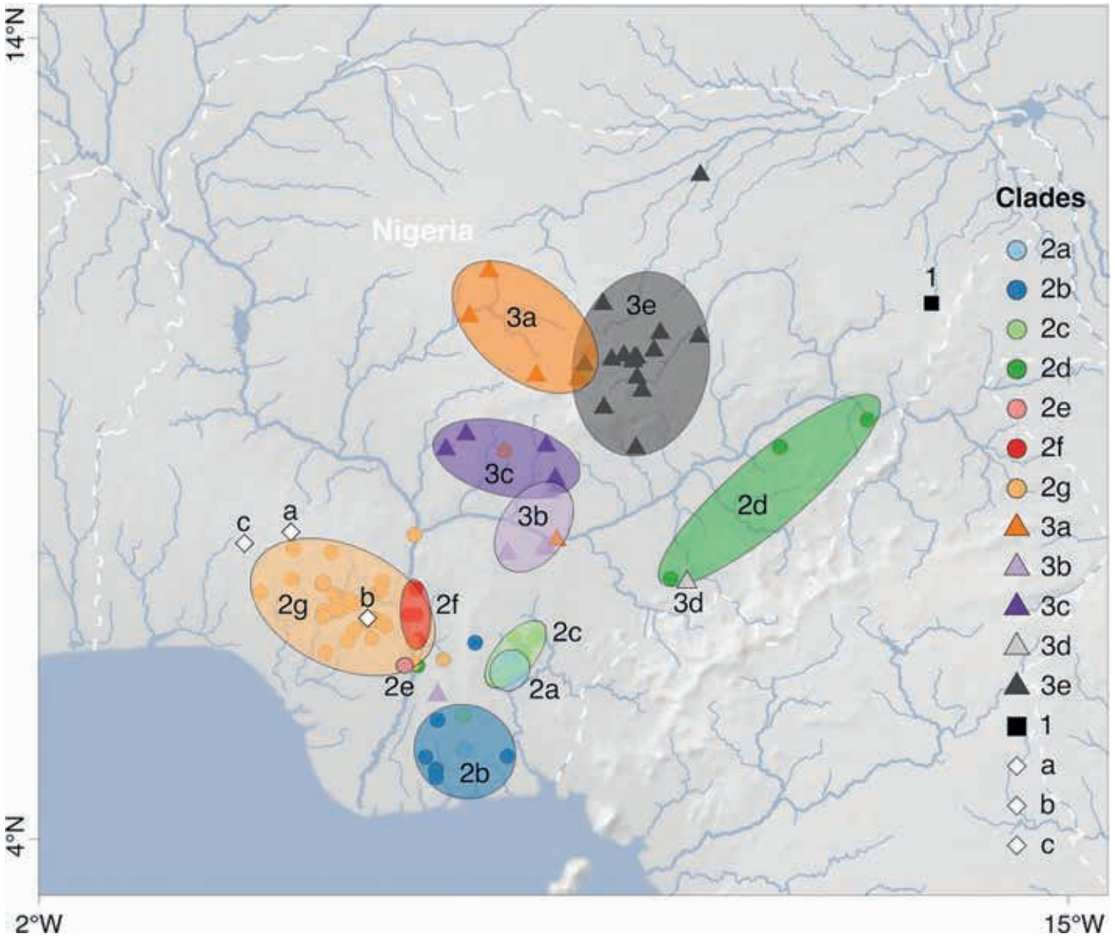
DEGREE OF RELATION OF LASSA VIRUS LINEAGES IN NIGERIA



Lassa virus has a high degree of genetic variability. Several lineages circulate simultaneously in West Africa. In order to study the diversity and evolution of Lassa virus in Nigeria, we have analyzed the genomes of 219 unique Lassa virus strains from patients in 16 Nigerian states.

This large-scale study provided a very accurate geographic map of Lassa virus lineages in Nigeria and their degree of relation. Both the isolates and the sequences are very important for the development of drugs and vaccines and for improving diagnostic tests. We were also able to create models and make predictions about how the virus spreads in the country. This information could be used in order to identify regions which should be prioritized for Lassa fever monitoring.

Ehichioya D, et al., J Virol. 2019;93(21):e00929-19

Deborah U Ehichioya, Meike Pahlmann, Toni Rieger, Lisa Oestereich, Beate Becker-Ziaja, Daniel Cadar, Elisa Pallasch, Sabrina Bockholt, Liana E Kafetzopoulou, Sophie Duraffour, Stephan Günther and external cooperation partner (see publication)

Figure: Distribution of Lassa virus strains in Nigeria. Regions in which Lassa viruses belonging to a particular genetic lineage are circulating are circled and colored accordingly. The genetic lineages (clades) are listed on the right. Every symbol on the map indicates an individual virus strain or several strains with the same coordinates.

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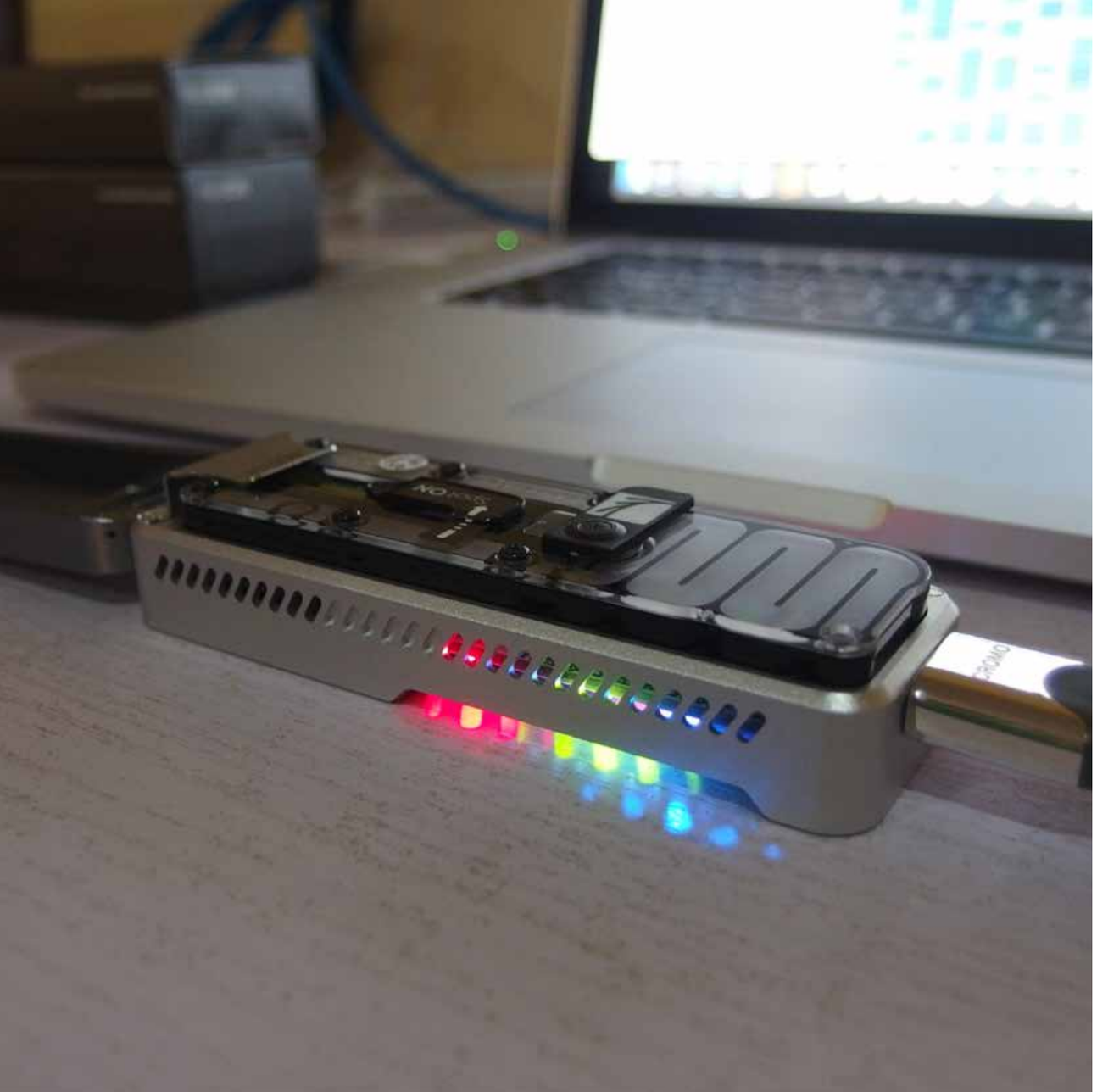

SMART TECHNOLOGY SUPPORTS LASSA FEVER DIAGNOSTICS

Lassa virus occurs in various West African countries and is typically transmitted to humans via the excretions of rodents. Infection in humans can involve fever, bleeding and kidney failure and results in death in about 20 percent of cases. In early 2018 the authorities in Nigeria registered an unusually large number of new cases within a few weeks. This raised concerns of a new virus variant which is transmitted directly from person to person.

To support the Nigeria Federal Ministry of Health and the WHO, we performed detailed characterization of the viruses in the outbreak region. This was the first time an innovative mobile sequencing device (Oxford Nanopore Technologies, MinION) that has the size of a small smartphone was used during a Lassa fever outbreak. It allowed the virus genomes to be analyzed quickly on site. This real-time analysis of the samples revealed a large diversity of Lassa viruses with no evidence of person-to-person transmission of a specific variant. The outbreak was likely triggered by a significant increase in virus transmission from rodents to people.

Kafetzopoulou LE, et al., Science 2019;363(6422):74-77

Liana E. Kafetzopoulou, Deborah U. Ehichioya, Meike Pahlmann, Anke Thielebein, Jule Hinzmann, Lisa Oestereich, David M. Wozniak, Stephan Lorenzen, Sophie Duraffour, Stephan Günther and external cooperation partner (see publication)

Figure: "High-tech sequencing": The innovative sequencer MinION is smaller than a smartphone and can therefore be used easily even in remote regions. (see https://nanoporetech.com/how-nanopore-sequencing-works)

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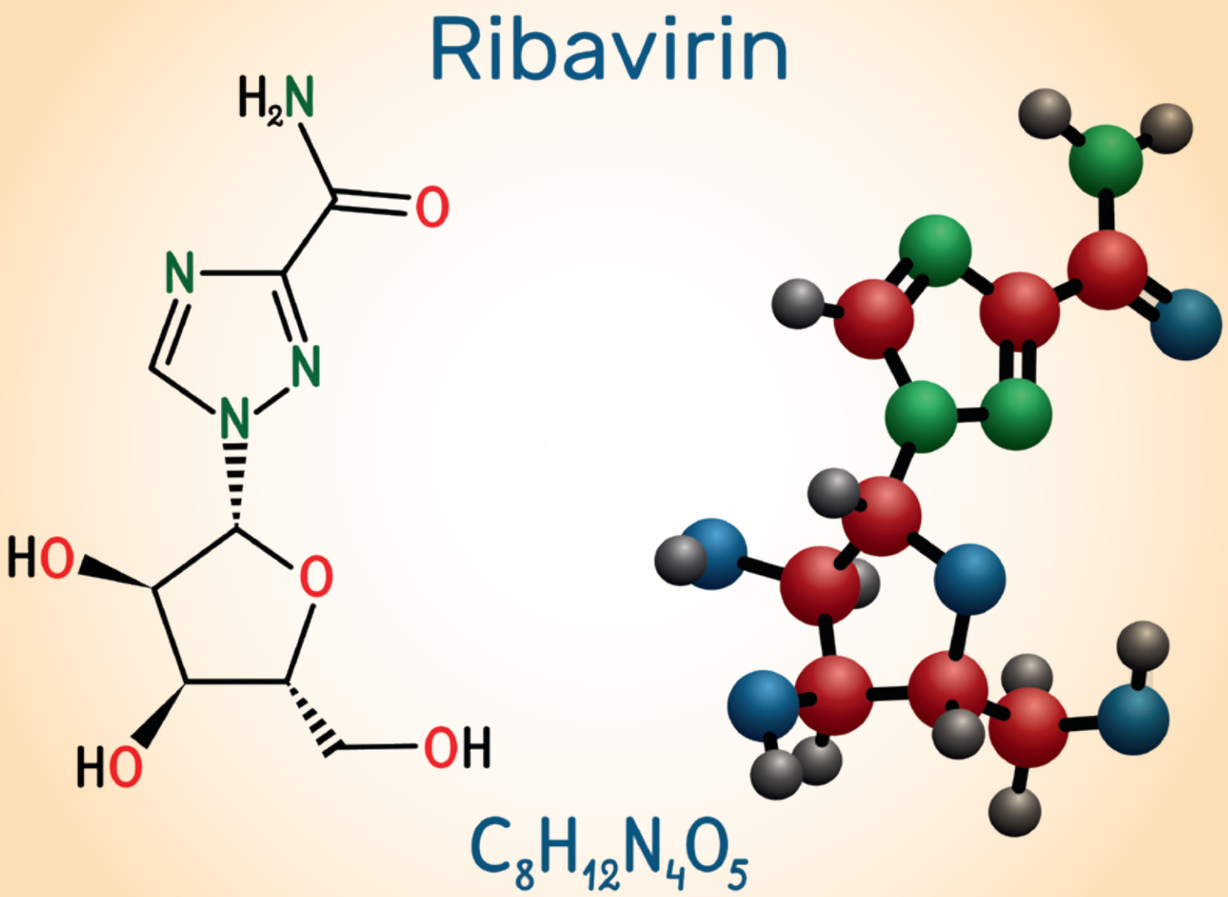

LASSA FEVER DRUG FOR IMPROVED PATIENT CARE

Lassa fever is a dangerous infectious disease in West Africa with a mortality rate of up to 20 percent in humans. The sole recommended therapeutic agent is the antiviral drug Ribavirin. However, the evidence for the effectiveness and optimal dosing of Ribavirin to treat Lassa fever has not been studied sufficiently.

The Irrua Specialist Teaching Hospital (ISTH) in Nigeria developed a modified intravenous treatment regimen with Ribavirin, which differs from the WHO recommended regimens. One particular advantage of this alternate treatment regimen is the reduced number of injections. This leads to both a higher acceptance by patients and to a reduced risk of infection for the hospital staff due to a reduction in direct patient contact. The pharmacokinetic properties of the Irrua-Ribavirin-regimen are being reviewed in a prospective clinical study in cooperation with partners from the Institute for Lassa Fever Research and Control at the ISTH. The results of the study form the basis for future dose optimizations of Ribavirin to improve patient care.

Erameh C, et al., BMJ Open. 2020 Apr 16;10(4): e036936

Meike Pahlmann, Julia Hinzmann, Jonas Müller, Mette Hinrichs, Lisa Oestereich, Sophie Duraffour, Stephan Günther, Christine Wagner, Francisca Sarpong, Mirjam Groger, Michael Ramharter and external cooperation partner (see publication)

Figure: Structural formula of Ribavirin

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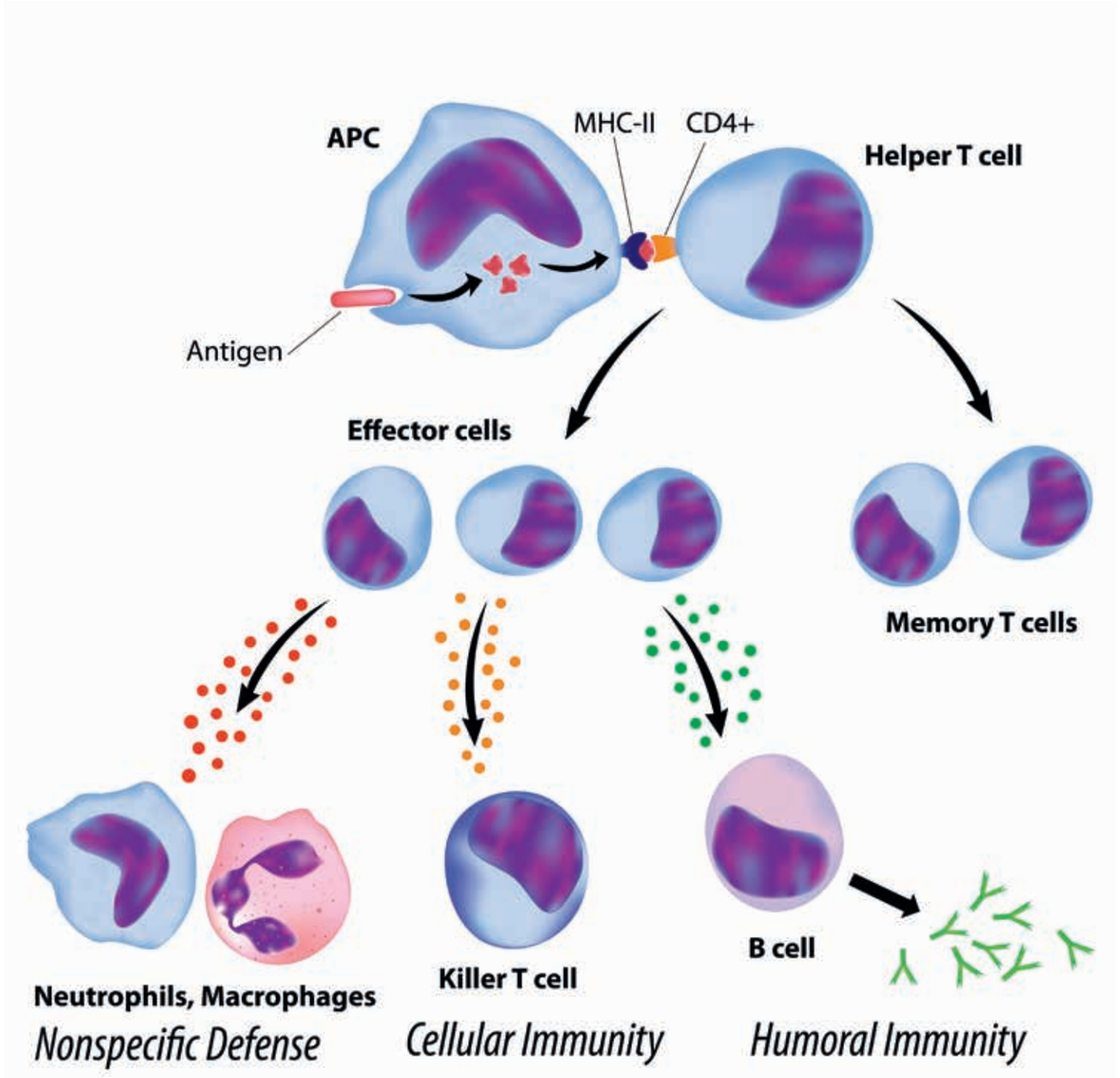
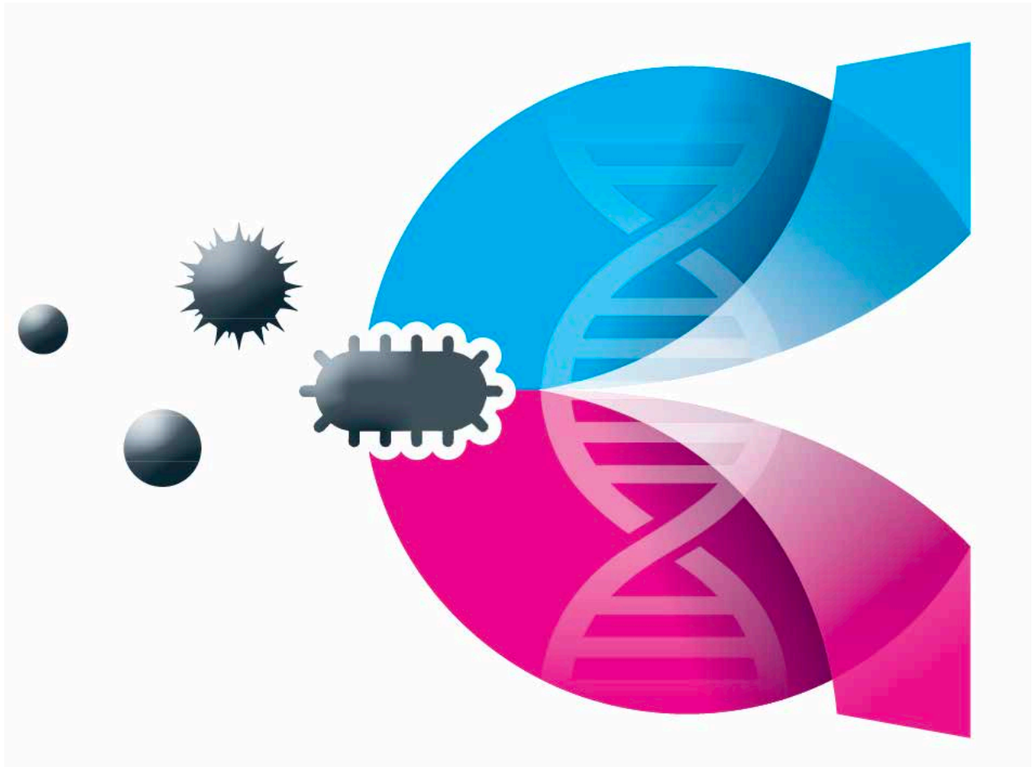


IMMUNOLOGY

The detailed understanding of the sometimes very multi-faceted immune response to infections is the basis for understanding the difficult to predict progression of diseases in order to provide targeted treatment. Therefore the BNITM maintains several research groups which look at the highly varied questions regarding immunology of infectious diseases. For example, they study the question of the degree to which hormones or other gender-specific factors affect the occurrence of infection. Or how chronic worm infections, which very many people in tropical countries suffer from, compromise the success of vaccinations against viral infections.



TESTOSTERONE AFFECTS THE INNATE IMMUNE SYSTEM

Women and men don't just differ anatomically, but also in their immune responses. Men are more susceptible to various infectious diseases, for example, while women have a greater tendency to develop autoimmune diseases. This also becomes apparent in infections with the parasite *Entamoeba histolytica*, which can cause severe liver damage and occurs primarily in men.

We have now shown for the first time that certain immune system cells which circulate in the bloodstream, so-called monocytes, play a significant role in liver damage due to *Entamoeba* infections. These immune cells exhibit a different surface pattern in men than in women and produce more of certain chemical messengers which destroy liver cells. More of these cell-damaging chemical messengers are also found in women who undergo testosterone therapy in the course of a sex change. Male sex hormones obviously have a direct effect on monocytes and thus influence the sex-specific immune response against parasite infections.

In partnership with the Leibniz Institute for Experimental Virology (HPI) and the Medical Center Hamburg-Eppendorf, we have founded a DFG-funded research unit which studies sex differences in immunity.

Sellau J, et al., Nat Commun. 2020;11(1):3459

Julie Sellau, Marie Groneberg, Helena Fehling, Stefan Hoenow, Claudia Marggraff, Charlotte Hansen, Hanna Lotter and external cooperation partner (see publication)

Figure: Logo of the research unit "Sex Differences in Immunity"

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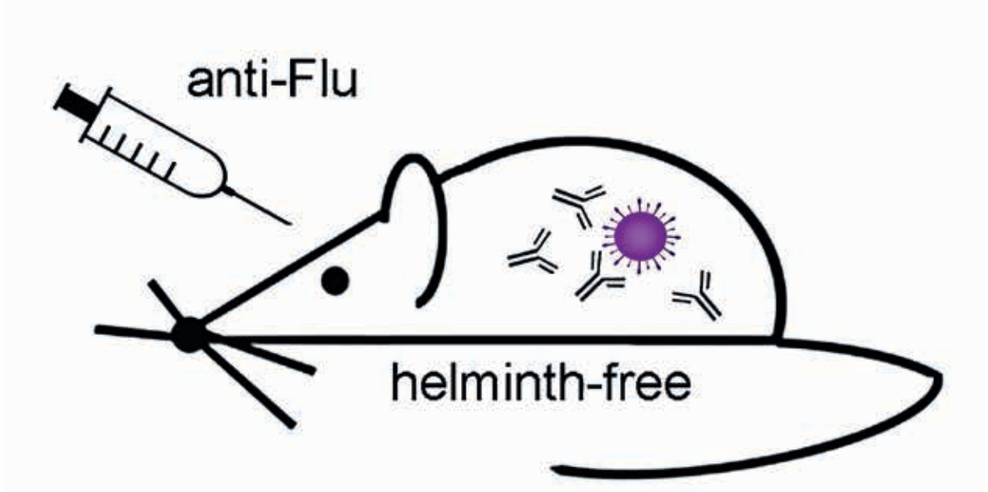

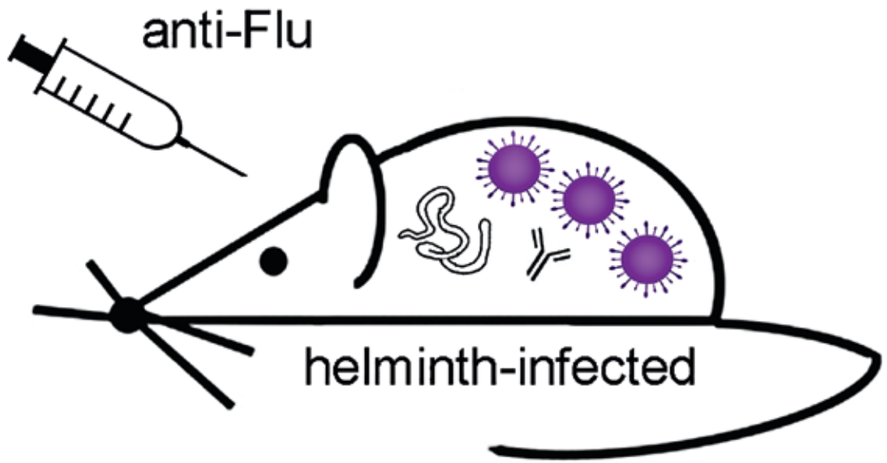

WORM INFECTIONS WEAKEN FLU VACCINE PROTECTION

Even in the 21st century, a quarter of the world's population is still infected with worms. Many of these colonize the gut. It's known that worms weaken our immune system. However, the ultimate effect of this is controversial.

We have shown that a worm infection substantially reduces the protection against influenza viruses provided by the flu vaccine. Even if the worm infection was already treated and cured at the time point of flu vaccination. In order to elude the human immune response, worms trigger expansion of lymphocytes with regulatory functions that produce a regulatory messenger (interleukin-10). This interleukin-10 reduces the activity of the white blood cells which normally fight the parasite. At the same time, interleukin-10 also reduces the production of antibodies following a flu vaccine. These results raise the possibility that other vaccines developed in the "worm free" western world aren't as effective in countries where a lot of people suffer from worm infections. The knowledge gained here could form the basis for developing "worm resistant" vaccine programs for global health in the future.

Hartmann W, et al., Cell Reports 2019; 29,2243-2256

Wiebke Hartmann, Marie-Luise Brunn, Nadine Stetter, Minka Breloer and external cooperation partner (see publication)

Figure: Worm infected mice produce fewer protective antibodies after receiving a flu vaccine and fight off a flu infection less effectively than vaccinated healthy mice.

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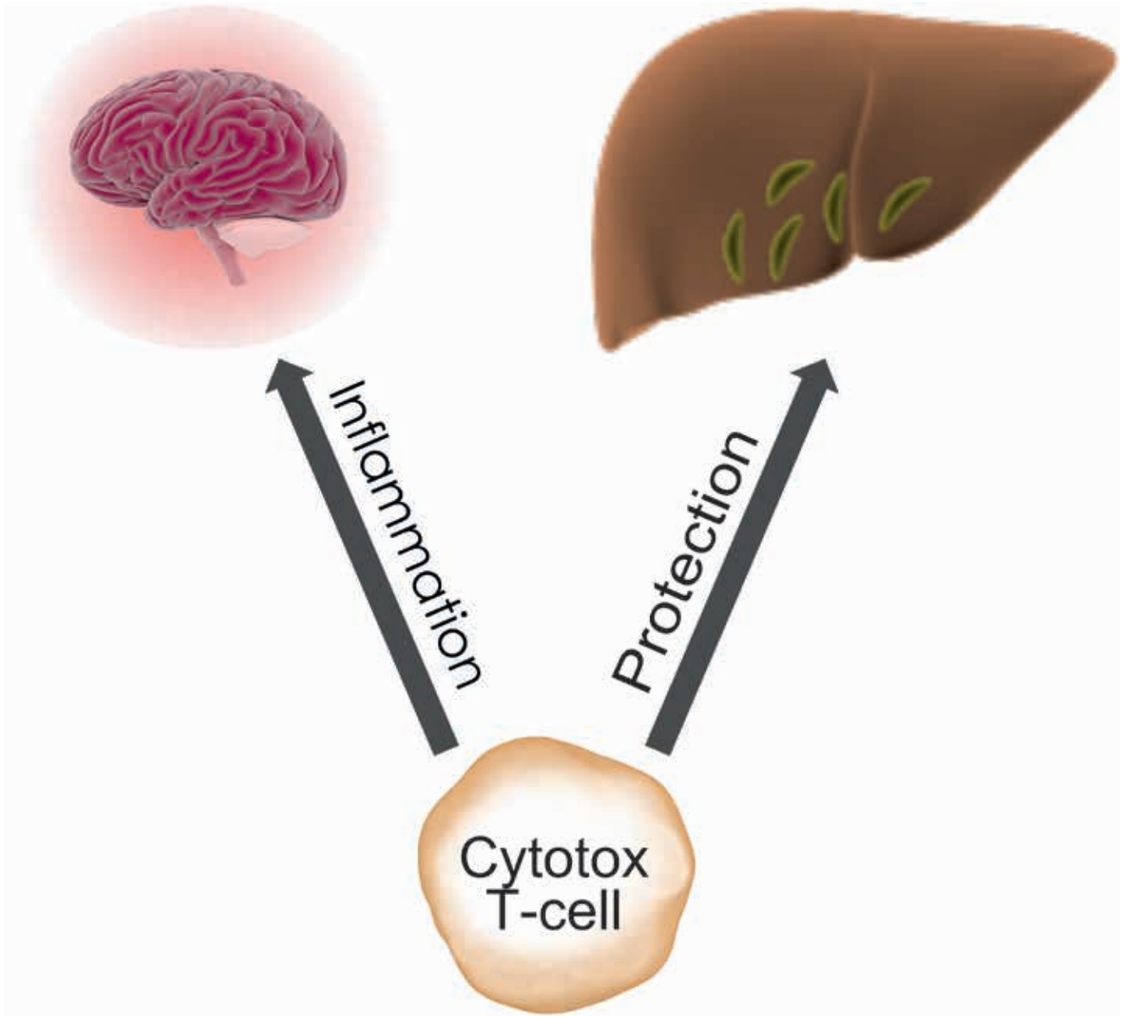

Double-edged sword

T-CELLS IN MALARIA WITHOUT COMPLICATIONS VS SEVERE MALARIA

In infectious diseases with intracellular pathogens such as malaria, so-called cytotoxic T-cells are formed as a result of the immune response. These recognize affected cells and eliminate them with the help of molecules such as granzyme B.

Unfortunately the army of T-cells only guards effectively against parasites in the early phase of the infection if the parasites infest liver cells. Elimination by cytotoxic T-cells is no longer possible during the later blood phase. Unfortunately the T-cells which are normally protective can trigger severe malaria in some people during the blood phase. They damage blood vessel cells (endothelial cells) in particular, in the brain and in other organs, and subsequently lead to severe progression of the disease.

In order to recognize severe disease progression early on, we have patented a diagnostic procedure: Unlike mild disease progression, in complex malaria the cytotoxic T-cells produce more granzyme B molecules, the blood concentration of which we can easily measure. Together with other markers, this allows for better predictions about the progression of malaria and early adjustment of the treatment.

Kaminsiki LC, et al., Front Immunol. 2019;10:2917

Lea Christina Kaminski, Mathias Riehn, Christiane, Steeg Maria Sophia Mackroth, Thomas Jacobs and external cooperation partner (see publication)

Figure: Cytotoxic T-cells can have a protective effect in the early stages of malaria, but can cause inflammation in a later phase.

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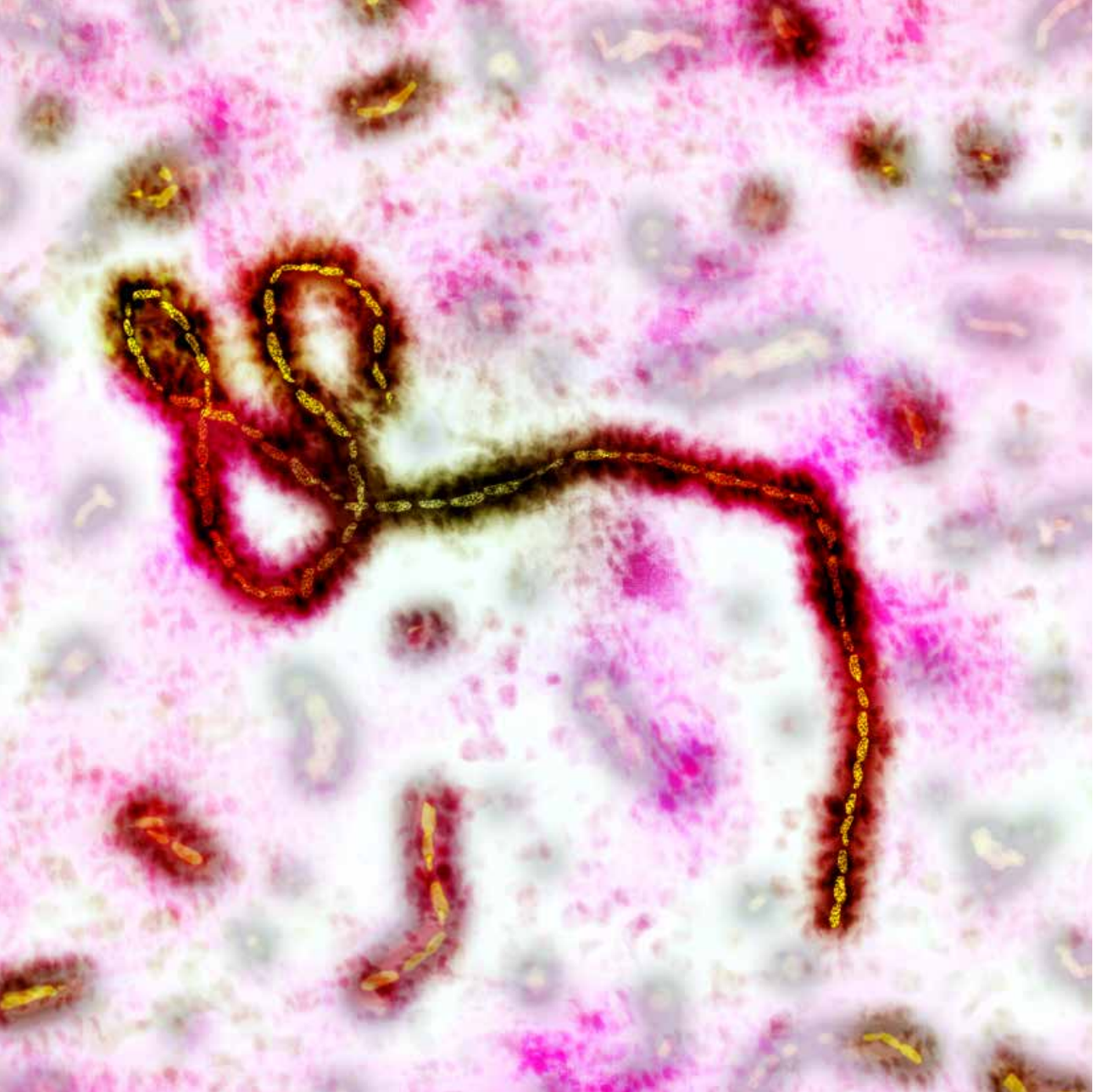

Diversity is the key

IMMUNE SYSTEM CELLS OF EBOLA SURVIVORS ANALYZED

In Guéckédou, Guinea, only a few kilometers from the epicenter of the large Ebola epidemic in the years 2013-2016 in West Africa, we have examined a large number of people who survived an Ebola infection at the time. Our primary focus was on the immune response through so-called T-cells. By sequencing the T-cell receptor region, we were able to illustrate the diversity of the various T-cells.

It turned out that the people in the study had developed a very wide range of different T-cell responses to the Ebola virus. It is obviously advantageous for survival to form very many different T-cells against a wide range of molecular structures (antigens) of the Ebola virus. The results may be significant for developing vaccines.

Separanza E, et al., J Infect Dis. 218, S508-518.

Paula Ruibal, Julia R. Port, Monika Rottstegge, Emily Nelson, Lisa Oestereich, Stephan Günther, César Muñoz-Fontela) and external cooperation partner (see publication)

Figure: Electron microscope image of a filovirus. The Ebola virus also belongs to this virus family.

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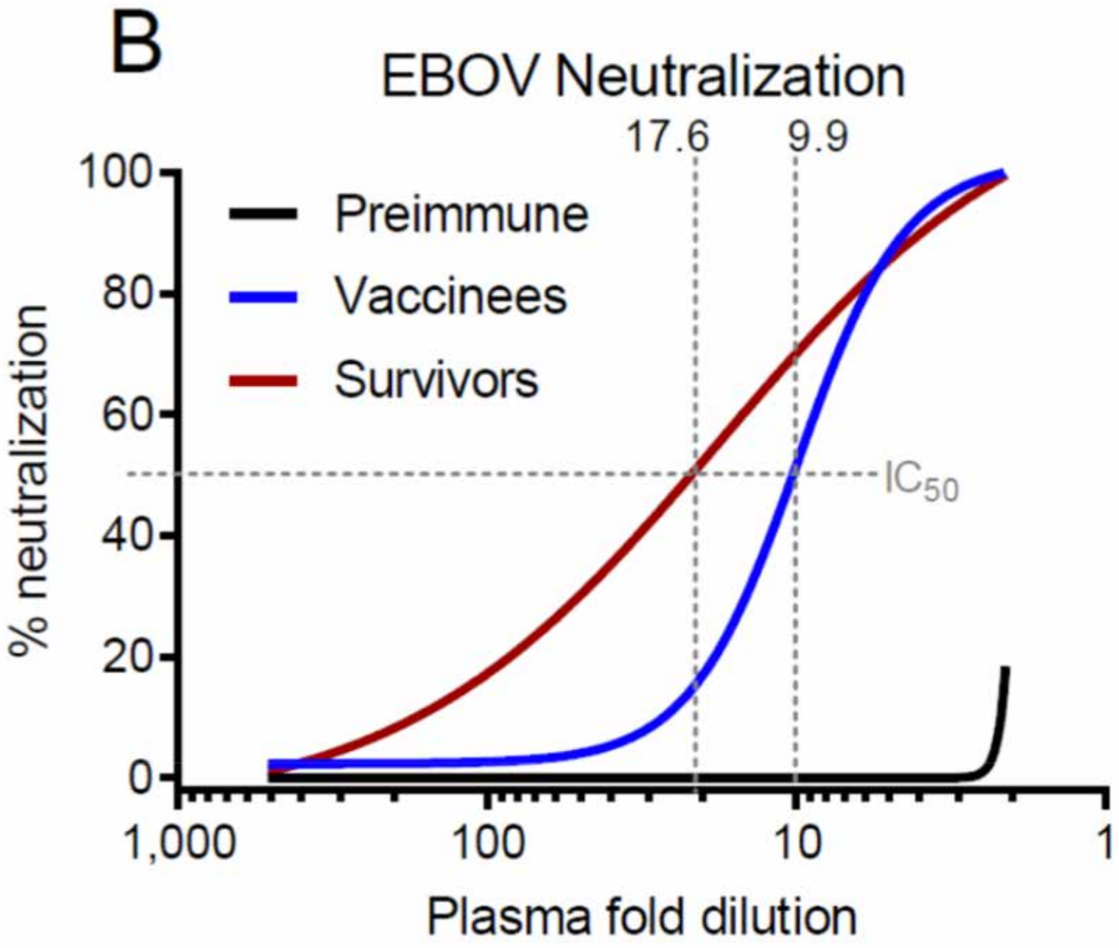

AIMING FOR AN EBOLA VACCINE: NOT ALL ANTIBODIES ARE CREATED EQUAL

Between 2013 and 2016 the to date largest Ebola epidemic in West Africa occurred, with a death toll of over 10,000. The virus causes a so-called hemorrhagic fever, which is frequently accompanied by severe internal bleeding. Numerous vaccine studies have been carried out in Africa since 2014. Today follow-up studies allow for a comparison of the immune response of Ebola survivors and vaccinated persons.

We have studied blood samples of study participants at our BSL4 high security laboratory. The results show that an Ebola vaccine doesn't protect as effectively as having had the disease. Vaccinated persons and Ebola survivors did have similar blood antibody titer levels. However, the concentration of the important neutralizing antibody which prevents the Ebola virus from invading cells was significantly higher in survivors.

Koch T, et al., Viruses 2020;12(9),915

Till Koch, Monika Rottstegge, Paula Ruibal, Sergio Gómez-Medina, Emily Nelson, Beatriz Escudero-Pérez, Stephan Günther, Marylyn Addo, César Muñoz-Fontela and external cooperation partner (see publication)

Figure: Better neutralizing of the Ebola virus by plasma from survivors in comparison to the plasma of vaccinated persons.

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SARS-CoV-2

DIAGNOSTICS AND SEQUENCING CAPACITY

Diagnostics & cooperation with industry: The BNITM responded early on to developments in China and was the first laboratory to establish SARS-CoV-2 diagnostics in Hamburg. The Institute also developed a commercial test kit jointly with the company altona diagnostics©.

Patented test procedure for detecting antibodies: Gaging the actual incidence and prevalence of infection outbreaks requires detection of antibodies the blood serum: BNITM staff have developed a patented test procedure with a very high sensitivity and specificity. The group further developed this procedure in order to detect the new Corona virus with great accuracy in blood samples.

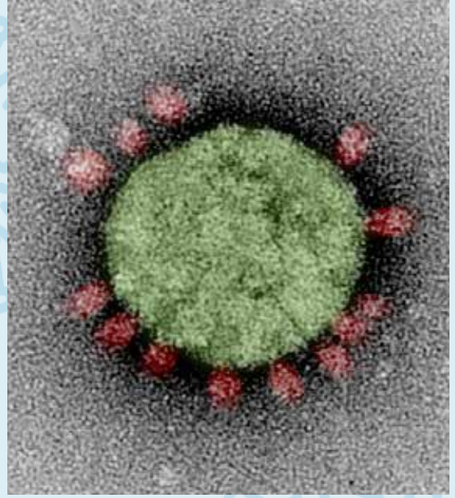
Mobile laboratories nationally and abroad: The Department of Virology coordinates the European Mobile Laboratories (EMLab). These provide diagnostics support during infection outbreaks around the world. At the very beginning of the COVID-19 pandemic a team was deployed to Weiden in der Oberpfalz, Germany, and another EMLab team was later deployed on the Greek island of Lesbos. These mobile laboratories had previously proven their worth in various epidemics such as the large Ebola outbreak of 2014 to 2016 in West Africa.

The Department Infectious Disease Epidemiology coordinates the implementation and deployment of mobile laboratories in the six states of the East African Community (EAC). The nine mobile laboratories (EAC Labs) were quickly expanded for use in coronavirus diagnostics.

THE SEARCH FOR COMPOUNDS AND DRUGS

Compounds with antiviral properties: Using the special X-ray radiation source PETRA III at the German Electron Synchrotron (DESY), research groups supported by the BNITM are looking for candidate compounds against COVID-19. Using so-called X-ray screening, researchers quickly test thousands of compounds which are already approved to treat other diseases. In this manner they hope to identify compounds which inhibit SARS-CoV-2. They have identified 37 compounds in total, two of which are being researched in pre-clinical studies.

In-vivo validation of drugs: In this project, the BNITM is working with the Fraunhofer IME ScreeningPort to develop mouse models of infection. These will help to evaluate the in-vivo effectiveness of newly identified IME-substances against COVID-19.



Learning to understand the disease and save lives

COVID-19 animal models: The BNITM has developed various mouse models which have an immune system similar to that of humans. This allows for studies on the effectiveness of drugs, the immune response and the pathogenesis of the COVID-19 disease.

A complete overview and further details on our Corona research projects are available on our website:
https://www.bnitm.de/en/news/information-on-sars-cov-2/

OUR CORONA RESEARCH PROJECTS

KUMASI CENTER FOR COLLABORATIVE RESEARCH (KCCR) IN FOCUS

The KCCR is a joint project of the Ghana Ministry of Health, The Kwame Nkrumah University of Science and Technology (KNUST) and the BNITM. The research center was founded in 1997 and serves as a platform for joint research, teaching and multi-disciplinary collaboration with local and international partners. The main building is located on the KNUST campus and is associated with the College of Health Sciences as a research center.

The KCCR is equipped with laboratories up to biosafety level 3 (BSL-3). Scientists can perform state-of-the-art molecular, immunology and microbiology work here. An entomology wing was added to the KCCR in 2020.

The new laboratory building of KCCR and BNITM in the Agogo Presbyterian Hospital

Entomology at the KCCR and a new research facility in Agogo

Inauguration ceremony on 17 August 2019: The newly established entomology wing at the KCCR features offices and additional well-equipped research laboratories. A new research facility was also opened on the grounds of the Agogo hospital, located about two hours by car from Kumasi. Clinical research can now be performed locally in rural regions as well, and health care will be provided even closer to the patient. The Krontihene of the Agogo Traditional National Council (Nana Kwame Nti) with a delegation as well as the professors Jürgen May and Daniel Ansong attended the official reception on the occasion of the inauguration.

Current projects and research topics

The KCCR was very successful in its work during the reporting period, resulting in its research portfolio growing from 35 to 59 active projects. They include projects in the fields of parasitology, immunology, bacteriology, virology, global health, teaching and research networking. Six clinical studies are also being performed.

There are currently four main research groups which are managed by a senior researcher: The research focus is on **onchocerciasis** and **lymphatic filariasis** (research group under Alex Debrah), **Buruli ulcer** and skin neglected tropical diseases (research group under Richard Phillips), **infection epidemiology** (research group under Jürgen May) and global health and infectious disease (research group under John Amuasi).

There are also five postdocs, which study the following fields together with their research teams: **Viruses** and **zoonotic diseases** (Dr. Augustina Sylverken and Michael Owusu), **Filariasis** (Dr. Alex Kwarteng), **Malaria** (Dr. Oumou Maiga Ascofare), human African **Trypanosomiasis** (Dr. Kingsley Badu) and **Bioinformatics** (Dr. Salifu Pandam).

Mosquito breeding in the newly established entomology

COVID-19

The KCCR is an important partner for the health care system in Ghana and the Ghana Ministry of Health. It is the second-largest laboratory and has performed over 100,000 COVID-19 tests in 2020 in order to support the public health measures in Ghana. With the help of the KCCR, PCR tests were performed for patients and close contacts in 13 out of 16 regions in Ghana. The research center was officially recognized for its role: In May 2020 the president, His Excellency Nana Addo Dankwa Akufo-Addo, visited the KCCR. This visit was a special honor for the staff and also a great motivator for upcoming tasks.

The Ghanaian President's visit to the KCCR

Diagnostic demonstration as part of the presidential visit

Together with its partners, the research group "Global Health" is working on characterizing clinical progressions of COVID-19 in Ghana, Cameroon, Uganda, Kenya and Senegal. It is studying the effectiveness of various treatment options at the same time. The goal is to understand the specific characteristics of the disease in Africa and to make optimal treatment available.
In addition, the clinical study ANTICOV is aiming to determine how effective and safe various treatment approaches are in COVID-19 patients with mild to moderately severe progression. This is intended to prevent severe disease progression and the need for intensive care.

The research group is also offering a series of workshops under the title "Skills for Excellence In Science Series", in order to help scientists gain a better understanding of areas such as statistics, data management, good clinical practice or preparing manuscripts.

Training young researchers

Training and capacity development are an essential aspect of KCCR activities. In the period from 2018 to 2020 eight PhDs graduated, and 14 MPhil/Masters completed their training. A study which followed former PhD and Master's students showed that most of the KCCR graduates are employed at tertiary Ghanaian facilities. Some of them are working in postdoc positions in Ghana or in other places.

Best research center award

The KCCR is very proud to have received the Best Research Center Award from the Kwame Nkrumah University of Science and Technology (KNUST) in the 2018/2019 academic year. The academic areas which were distinguished include academic qualifications, diversity of international students, industry participation, scientific publications, patents, technical qualifications, research results and their significance, international competitiveness, scholarships, awards, online presence and partnerships. The KCCR will continue to work hard in order to keep this position.

The premises of the KCCR

Award ceremony

KCCR - Celebration for the award of the best research center

Third-party funding

The KCCR scientists can hold their own against the competition. As a result, it was possible to attract considerable third-party funding over the past few years. The largest projects are "TakeOff", funded by the BMBF with 2,771,987 Euros and "ASAAP", funded by the European & Developing Countries Clinical Trials Partnership (EDCTP) with a total budget of 7,642,364 Euros. Currently eight projects are funded by the German Research Foundation (DFG), nine by the EDCTP, five by the BMBF / DZIF, seven by the BNITM and two respectively by the Wellcome Trust and the Taskforce for Global Health.

KCCR research groups received additional funding from the German Federal Ministry of Health (BMG), from the VW-Foundation, from the National Institute of Health Research in Great Britain, from the American Leprosy Missions, the National Institute of Health (NIH), the Drugs for Neglected Diseases initiative (DNDi), the Hamish Ogston Foundation in Oxford, the WHO/TDR and the ANESVAD-Foundation. The universities of Oxford, Liverpool, Edinburgh, Napier, Minnesota, British Columbia and Notre-Dame were involved in raising funds. The KCCR received donations and financial support for COVID-19 research from Ghanaian organizations as well as the government of Ghana.

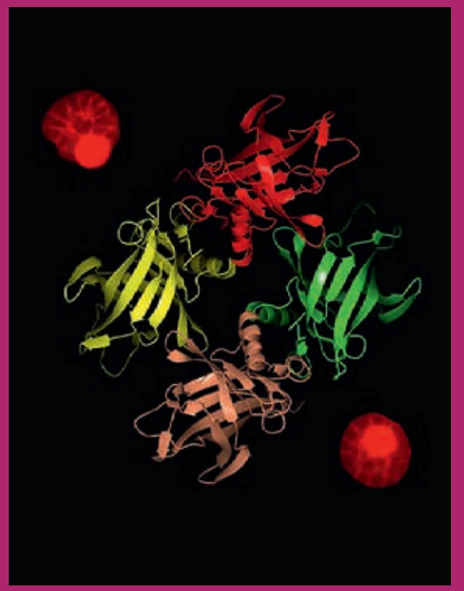
CSSB
Centre for Structural
Systems Biology

CSSB – Hightech for infection biology

Since 2018, BNITM research groups have been working in the laboratories of the Centre for Structural Systems Biology (CSSB). This center is located on the German Electron Synchrotron (DESY) campus in Hamburg-Bahrenfeld, Germany. Designed by the architectural firm "Hammeskrause", the high-tech institute with more than 2,000 m2 of laboratory space was completed in 2017. With its galleries and communication areas on every floor, CSSB pursues an open and modern research institute concept.

CSSB flight of stairs

The research focus of this multi-institutional center is infection biology, which investigates the structure and function of pathogens and its interaction with the host at the molecular level. CSSB aims to contribute to the development of novel therapeutics and to improve treatment options for infectious diseases. Unique in the German research landscape, CSSB brings together research groups from three university institutions* and seven non-university institutions** under one roof. These research groups have access to core facilities such as cryo-electron microscopy, light microscopy, protein production and protein crystallization. The facilities help CSSB researchers to elucidate the molecular interplay between pathogens and their host cells. CSSB's close connection to its partner institutions and the unique infrastructure of the DESY campus help support this process.



Malaria protein

An example of this fruitful interaction is a paper recently published from the Department of "Cellular Parasitology" (Burda et al., 2020). With the help of CSSB's special microscopes and EMBL's beamlines at DESY's X-ray light source PETRA III, Prof. Tim Gilberger's group identified a protein from the group of lipocalins in malaria parasites and characterized it further using molecular genetic methods. Lipocalins support the transport of lipids and steroids into the cell. Until now, it was not known that malaria parasites also possess such a protein. Among other things, the research group discovered that lipocalin is vital for the parasite and that it cannot reproduce without the molecule. The discovery helps to understand, at the molecular level, how the parasite ensures its survival within red blood cells.

* *Universität Hamburg (UHH), Universitätsklinikum Hamburg-Eppendorf (UKE), Medizinische Hochschule Hannover (MHH)*
** *Bernhard-Nocht-Institut für Tropenmedizin (BNITM), Deutsches Elektronensynchrotron (DESY), Leibniz-Institut für experimentelle Virologie (HPI), Forschungszentrum Borstel (FZB), Forschungszentrum Jülich (FZJ), Helmholzzentrum für Infektionsforschung (HZI) und Europäisches Molekularbiologie-Labor (EMBL)*

Tropical Medicine at the Bundeswehr Joint Medical Service

During the reporting period and following the major reorganization and restructuring in 2017, the Faculty of Tropical Medicine and Infectiology of the Bundeswehr Hospital Hamburg at the Bernhard-Nocht Institute (FbTropMedInf) was initially focused on teaching and continuing education. The demand for paramedics trained in tropical medicine and infectiology is at an ongoing high level due to the deployment and treaty obligations of the Bundeswehr Hospital Hamburg all over the world.

In 2019 the Commander of the Japanese Self Defense Forces Medical Service and the Commander of the German Armed Forces Medical Service Headquarters and Surgeon General, Bundeswehr, Dr. Ulrich Baumgärtner, paid a formal visit to the BNITM and FBTropMedInf. Both parties affirmed the ongoing interest in continuing the active cooperative partnership.

The *"Second symposium on tropical medicine and infectious diseases in an international military context 2019"*, a lecture program for civil and military doctors and scientists from all over the world on infectiology and tropical medicine topics related to deployments, was the first of many farewell events for transferring command of our Commander, Bundeswehr Hospital Hamburg, Dr. Hoitz, who officially handed over leadership of the Bundeswehr Hospital Hamburg to Rear Admiral (lower half) Dr. Reuter on 26 September 2019 and began his well-earned retirement.

After the BNITM had canceled the previous FBTropMedInf rental agreement in preparation for upcoming renovation work, planning for the move started in 2020. It was possible to rent new rooms on the Bernhard-Nocht-Straße opposite the BNITM, which allowed effective partnerships to be maintained with the clinic and research..

Visit of the inspector of the medical service of the Japanese self-defense forces and of the inspector of the Bundeswehr Joint Medical Service at the BNITM (from left: General Oberstabsarzt Dr. Baumgärtner, the inspector of the medical service of the Japanese self-defense forces Dr. Katsushi Tahara, Prof. Tannich, General Doctor Dr. Hoitz, Senior Field Physician Dr. Wiemer)

Speakers and participants in the 2019 symposium

Specialized diagnostics and infection epidemiology for tropical disease

The cooperation activities between the **tropical medicine microbiology** and the BNITM were focused on continuing diagnostic evaluations which had been started previously. The focus was on molecular techniques such as PCR and LAMP (loop-mediated isothermal amplification) for pathogen detection in malaria, typhoidal salmonella and enteric parasitosis. In the meantime a duplex-PCR for differentiating Plasmodium ovale curtisi and P. ovale wallikeri was added to the diagnostics portfolio at the BNITM. Furthermore, the Bundeswehr Joint Medical Service faculty has continued to expand the range of molecular diagnostics for tropical medicine microbiology in the area of detecting parasite infestations in stool samples from soldiers returning from the tropics, with a particular emphasis on helminths.

The activities of the **tropical medicine entomology** subfield were focused on the evaluation of longer-term international cooperation projects on the topics of sand flies, ticks, and other ectoparasites especially in Africa. While "leishmaniasis without vector" is presenting in Cameroon despite a high diversity of sand flies, scientists are finding that ticks have high levels of endemic infection with rickettsia, the pathogen responsible for causing African spotted fever. In addition, this subfield has performed studies during the reporting period about the relationship of impacts on the spread of vector-borne pathogens and political instability and migration out of Africa.

Diploma Course on Tropical Medicine

The Institute for Marine Health and Tropical Diseases was founded on 1 October 1900 under the direction of Bernhard Nocht. This institute was tasked with treating patients with tropical medicine, researching the corresponding diseases and passing the acquired knowledge on to medical professional groups. Teaching was centered on the Diploma Course for Tropical Medicine, which has been held annually since 1905 and to this day only had to be canceled a mere five times due to war or pandemics. Over the past 15 years alone, around 700 people received a diploma in Tropical Medicine.

Training continues to be an important endeavor at the institute, and the courses offered have grown steadily. Tropical medicine was added to the training program in 2001 and over 800 physicians took part in over 40 courses over the next 15 years to further their education. We present the curriculum of our diploma course in this chapter. Further courses can be found here: **https://www.bnitm.de/en/training**.

Historic photo: course hall of the institute around 1930

FURTHER COURSES
CAN BE FOUND HERE

Course for physicians – from 03.04. to 29.06.18 and 01.04. to 28.06.19.
In 2020 the course had to be canceled on short notice due to the pandemic.

DIPLOMA COURSE ON TROPICAL MEDICINE

The objective of the diploma course is to prepare physicians for work in the tropics and subtropics in accordance with the continuing education rules of the German Medical Associations. Participants should gain the knowledge required to recognize and treat diseases imported from the tropics and subtropics in travelers and migrants and to provide preventive medical consulting to travelers before their trip.

The central topic of the course is the presentation of human diseases typically found in the tropics. Teaching focuses on the pathogenesis, diagnosis, clinical presentation, treatment, epidemiology and prophylaxis of parasitic, bacterial, viral and non-communicable tropical and travel-related diseases. The biology, epidemiology and control of the pathogens as well as the vectors and reservoirs are addressed as well. Further content includes the specifics of the individual clinical specialties in the tropics, problems providing health care in poor countries as well as methods of medical development cooperation and disaster relief. Migrant and/or refugee medicine topics as well as the fundamentals of occupational health and occupational medicine in the tropics are taught as well.

The curriculum is divided into twelve sections. It is structured based on the taxonomy of the pathogens and is complemented by insights into the working fields of travel and migrant medicine, occupational health and public health sector topics. The curriculum includes approx. 360 lecture hours as well as 40 hours of practical, primarily microscope-based exercises. The German Reference Library for tropical medicine is available for the duration of the course for private study of tropical medicine literature. The Diploma Course on Tropical Medicine is accredited by the German Medical Association as part of continuous education for the “tropical medicine” specialty and by the American Society of Tropical Medicine and Hygiene (ASTMH) and was accredited with 455 (2018)/428 (2019) continuing education points by the Medical Association Hamburg.

Scientific Director:
Prof. Dr. Gerd Burchard,
since 2020 Dr. Benno Kreuels

Contents

DIPLOMA COURSE ON TROPICAL MEDICINE

General overview
Emerging infectious diseases, climate and infectious diseases, global epidemic situation, clinical trials in the tropics, vaccinology, Digital Health in tropical medicine etc.

Introduction and fundamentals
Virology, bacteriology, mycology, protozoology, helminthology, entomology, immunology, principles of immune diagnostics, introduction to microscopy, introduction to epidemiology

Virology and viral diseases
Virological diagnostics, HIV + HTLV-1, flaviviral diseases, arenaviruses, filoviruses, bunyaviruses, pox viruses, rabies, MERS etc.

Bacteriology and bacterial diseases
Systemic bacterial infections, rickettsial disease, relapsing fever, leptospirosis, brucellosis, typhoid fever and other types of salmonelloses, plague, melioidosis, anthrax, cholera etc.; antibiotic resistance in the tropics; mycobacterial diseases: Tuberculosis, leprosy, Buruli ulcer etc.

Mycology and fungal diseases
Systemic mycoses, subcutaneous mycoses

Protozoology and protozoal diseases
Malaria, leishmaniases, trypanosomiasis, amoebiasis, protozoal diseases of the intestinal tract, toxoplasmosis

Helminthology and helminthic diseases
Immunology, molecular diagnostics, cestoda and cestode larva, schistosomiasis, liver and intestinal flukes, lung fluke, nematodes and nematode larvae, especially filariae, pentastomidae

Ectoparasitoses, venomous animals
Myiasis, tungiasis, scabies, venomous animals, snakebite management

Medicine in the tropics
Dermatology in the tropics, STDs in the tropics, ophthalmology in the tropics, anesthesia in the tropics, surgery in the tropics, radiology in the tropics, sonography in the tropics, neurology in the tropics, transcultural psychiatry, pediatrics in the tropics, dietary problems in the tropics, mother-child health, gynecology and obstetrics, encephalitis and meningitis in the tropics, pneumonia in the tropics, hepatitis and HCC in the tropics

Non-communicable diseases
Hemoglobinopathies in the tropics, tropical oncology incl. Burkitt's lymphoma, diabetes in the tropics, hypertension in the tropics, cardiology in the tropics, kidney diseases in the tropics, FMF and Behçet's disease, toxicology in the tropics

Travel medicine and migrant medicine
Risks in travel medicine, malaria prophylaxis, travel vaccinations, travelers with pre-existing conditions, aviation medicine, high-altitude medicine, wilderness medicine, migration, dealing with disease in other cultures, medicine and Islam, screening investigations in asylum seekers, unaccompanied minor refugees, intercultural communication

Occupational medicine
Occupational medicine checks, occupational disease and workplace-associated diseases, environmental medicine abroad, risk assessment of workplaces in the tropics, particular risks in special occupational groups, fitness for service in the tropics

Public Health
Infection epidemiology, general hygiene, hospital hygiene in the tropics, acute disaster intervention, health and culture, health systems and funding, medical development cooperation and international organizations, vaccination programs, reproductive health, Sustainable Development Goals, district health systems, project management

DIPLOMA COURSE IN TROPICAL MEDICINE

Participants 2018

Participants 2019

COURSE FOR HEALTHCARE PROFESSIONALS

Participants 2018

Participants 2019

In 2020 the courses were canceled due to corona.

Facts and Figures

STAFF

287, comprising 132 scientists, including doctoral students (status 12/31/2020)

FUNDING

	2018	2019	2020
	million EUR	million EUR	million EUR
Public core funding	**15,3**	**15,9**	**17,6**
Third-party funding	**8,9**	**9,2**	**14,2**
Amount passed through to collaborating partners	*0,8*	*1,0*	*0.9*
Amount retained at BNITM	*8,1*	*8,2*	*13,3*
Additional in-house resources	**3,0**	**3,1**	**3,7**
Total funds	26,4	27,2	34,6

Third-party funding has been received from the following organizations:

(public funding from DFG, federal, state and EU sources; finding from foundations, private donors, and other research funding sources, as well as income from services and licensing fees)

Alexander von Humboldt-Stiftung, Auswärtiges Amt, Behörde für Wissenschaft, Forschung, Gleichstellung und Bezirke (BWFGB), Bio-X-Change , Bundesanstalt für Landwirtschaft und Ernährung (BLE), Bundesministerium für Bildung und Forschung (BMBF), Bundesministerium für Ernährung und Landwirtschaft (BMEL), Centre for Structural Systems Biology (CSSB), Claussen-Simon-Stiftung, Coalition for Operational Research on NTDs (COR-NTD), DAHW - Deutsche Lepra- und Tuberkulosehilfe e.V., Deutschen Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Deutscher Akademischer Austauschdienst (DAAD), Deutsche Forschungsgemeinschaft (DFG), Drugs for Neglected Diseases initiative / DNDi ANTICOV, Else Kröner-Fresenius-Stiftung, European Commission, European Developing Countries Clinical Trials (EDCTP), European Federation of Immunological Societies, Foundation for the National Institutes of Health, Freie und Hansestadt Hamburg, GeoSentinel-Netzwerk, Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Gilead Sciences GmbH, Helmholz-Zentrum für Infektionsforschung GmbH / BMBF/DLR, Instand e.V., Institute of Tropical Medicine Antwerp ITM, International Society of Travel Medicine, International Vaccine Institute, ISGlobal - Barcelona Institute for Global Health, Joachim Herz Stiftung, Jürgen Manchot Stiftung, Kirmser-Stiftung, La Caixa‘ Banking Foundation, Leibniz-Gemeinschaft, Nationale Agentur Bildung für Europa beim Bundesinstitut für Berufsbildung, Projektträger Jülich/ Bundesministerium für Wirtschaft und Energie, PT-VDI/VDE/BMBF, Robert Koch-Institut (RKI), The Foundation for Innovative New Diagnostics (FIND), The German-Israeli Foundation for Scientific Research and Development (GIF), The Hospital for Sick Children, THEMIS Bioscience GmbH, Umweltbundesamt (UBA), Universily of Oxford, Universitätsklinikum Tübingen (UKT), VW-Stiftung, WERNER OTTO STIFTUNG, Wiley-Backwell, World Health Organization (WHO)

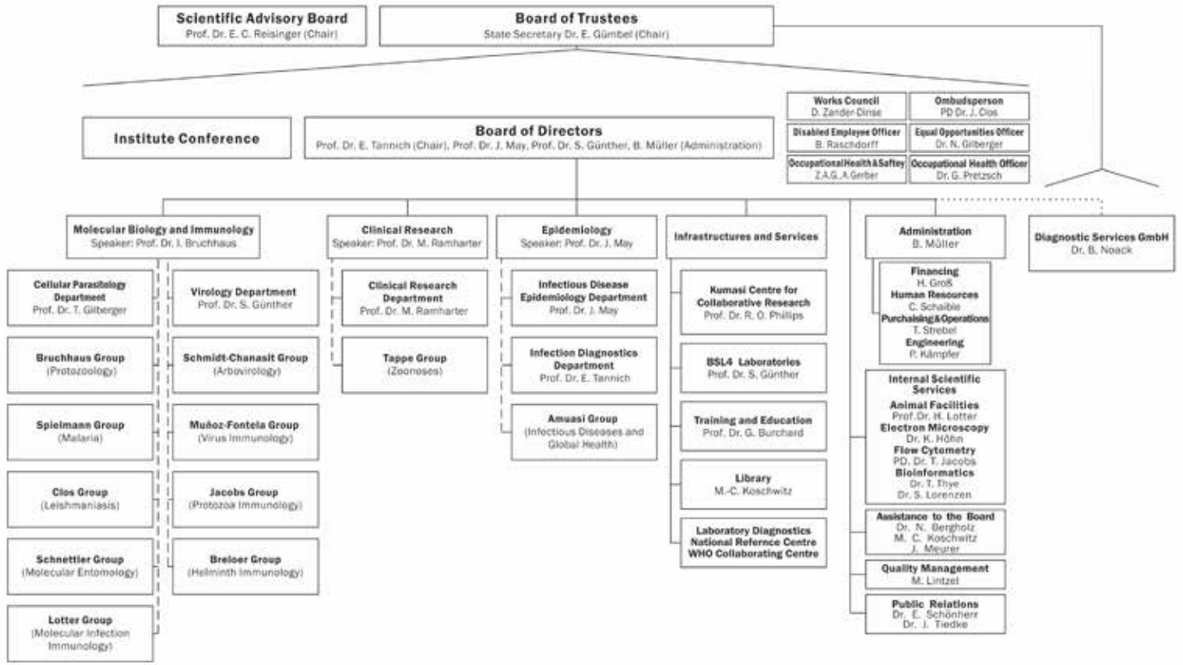
Performance Indicators	2018	2019	2020
Publications	**142**	**144**	**230**
in peer-reviewed journals	137	137	212
average impact factors	*5,8*	*6,15*	*6,38*
in others	5	7	18
Qualifactions			
Bachelor / Master thesis	21	11	17
Dissertations	11	11	17
Teaching and Training			
University (SWS*)	703	635	609
Education and Training events (days)	80	84	16
Technology transfer (ongoing)			
Patents and Licenses	24	23	21
Inventions	4	7	1
Laboratory Diagnostics[1]			
Number of cases	32.976	31.380	14.722
Number of tests	84.106	77.567	39.313
International cooperations			
Jointly funded third-party projects	43	27	41
KCCR[2]			
total projects at KCCR	48	46	47
including external projects	32	27	25

*Lessons per semester week

[1] **Laboratory Diagnostics of the Diagnostics Services GmbH (MVZ-BNITM GmbH)**
Number of cases: Number recordes submission of samples.
Number of tests: Number of performed tests.

[2] **KCCR**
Kumasi Centre for Collaborative Research in Tropical Medicine. A joint venture of the Ministry of Health, Republic of Ghana, Kwame Nkrumah University, Kumas, Ghana, and BNITM.

BERNHARD NOCHT INSTITUTE FOR TROPICAL MEDICINE (BNITM)



Status: 12.2020

Appendix

SEMINARS

02/27/2018
Dr. Thomas Hanke
Head of Academic Partnerships, Evotec, Hamburg, Germany
"From bench to bedside: Accelerating drug discovery by Evotec's Academic BRIDGE approach: Lessons learned from the LAB282 paradigm"

03/27/2018
Prof. Dr. Robert H. Gilman
Department of International Health, Johns Hopkins University, Baltimore, Maryland
„Chagas Infection, What predictors determine? Who will go on to disease and who will stay unaffected?"

04/19/2018
Prof. Dr. Thomas Lavstsen
Department of Immunology and Microbiology,
University of Copenhagen, Denmark
"Towards a PfEMP1 variant surface antigen based vaccine against severe malaria"

04/24/2018
Dr. Chong Chin Heo
Department of Microbiology and Parasitology, Faculty of Medicine, Universiti Teknologi MARA, Selangor, Malaysia
„Tropical entomology: not always about vectors, but sometimes about forensics"

05/22/2018
Prof. Dr. Mark Brönstrup
Department of Chemical Biology, Helmholtz Centre for Infection Research, Braunschweig, Germany
"On chip-based peptide arrays to characterize infections and natural products to treat them"

05/28/2018
„Rezidive von Plasmodium ovale spp. und Konzepte zur Erklärung von Malariarückfällen":
Prof. Dott. Univ. Pisa Joachim Richter
Institut für Tropenmedizin und Internationale Gesundheit Charité – Universitätsmedizin Berlin, Campus Virchow-Klinikum, Germany

"Clinical observations implicate a gradual dormancy concept in malaria"
Dr. Hans-Peter Führer
Institut für Parasitologie, Vetmeduni Vienna, Austria

"Molecular diagnostic tools for detection, specification and genotyping of *Plasmodium ovale wallikeri* and *Plasmodium ovale curtisi* in humans and great apes"
Dr. med. univ. Mirjam Groger
Department of Tropical Medicine, Bernhard Nocht Institute for Tropical Medicine & I. Dep. of Medicine, University Medical Center Hamburg-Eppendorf, Germany
"Recurrence behaviour and relapse characteristics of *Plasmodium ovale spp.* in Gabon"

05/29/2018
Dr. Carola Schäfer
Center for Infectious Disease Research, Seattle, USA
"Liver- and blood-humanized mice for the study of human malaria parasites"

06/01/2018
Sharon Bloom, MD
Executive Associate Editor Emerging Infectious Diseases, Atlanta, USA
"Tips for Avoiding Questionable Journals and Conferences in Infectious Diseases"

06/25/2018
Dr. Matthew Dixon
Department of Biochemistry and Molecular Biology,
University of Melbourne, Melbourne, Australia
"Nano-scale imaging of malaria parasite architecture"

08/17/2018
Neglected Diseases initiative (DNDi), Geneva, Switzerland
Dr. Graeme Bilbe
Senior Advisor at DNDi
Dr. Charles Mowbray
Director of Drug Discovery DNDi
"Drug Discovery and Open Innovation at DNDi"
Dr. François Franceschi
Project Leader for the Antimicrobial Memory Recovery and Exploratory Programme (AMREP) "GARDP"

09/11/2018
Prof. Dr. Admar Verschoor
Institut für Systemische Entzündungsforschung,
Universität Lübeck, Germany
"Complement-facilitated antigen transport and its directive roles in adaptive immunity"

09/25/2018
Prof. Dr. Stefan Bonn
Zentrum für Molekulare Neurobiologie (ZMNH), Institut für Medizinische Systembiologie, Hamburg, Germany
"Using Deep Learning to unravel disease-pathogen interactions"

10/09/2018
Prof. Dr. Hermann Feldmeier
Institut für Mikrobiologie und Hygiene, Charité Universitätsmedizin Berlin, Germany
"Tungiasis - New insights into epidemiology, morbidity, treatment, and control"

10/23/2018
Dr. Britta Urban
Liverpool School of Tropical Medicine, Liverpool University, Liverpool, UK
"Cellular immune responses to PfEMP1"

11/06/2018
Prof. Dr. Michael Hust
Institut für Biochemie, Biotechnologie und Bioinformatik, Abteilung Biotechnologie, Technische Universität Braunschweig, Germany
"Fighting pathogens and toxins with human and human-like recombinant antibodies"

11/13/2018
Prof. Alain Kohl
MRC-University of Glasgow, Centre for Virus Research, Glasgow, UK
"Zika virus: interactions with innate immune responses and tropism"

11/20/2018
Prof. Dr. Ger van Zandbergen
Immunology, Paul-Ehrlich-Institut, Langen, Germany
"Magic bullets against Leishmania"

11/27/2018
Prof. Dr. Andreas J. Müller
Institute of Molecular and Clinical Immunology, Otto-von-Guericke University Magdeburg, Germany
"In vivo biosensors for functional analysis of host-pathogen interactions during Leishmania infection"

12/11/2018
Thomas Greiber
Fachgebiet FG 1.3
„Vollzug Nagoya-Protokoll",
Bundesamt für Naturschutz, Bonn, Germany
"Implementation of the Nagoya Protocol and the EU Regulation No 511/2014 in Germany"

12/18/2018
Prof. Dr. Nicole Joller
Institute of Experimental Immunology – Immune Regulation,
University of Zurich, Switzerland
"Specialisation of regulatory T cells in Th1 responses"

12/20/2018
Björn F. C. Kafsack, PhD, MHS
Department of Microbiology and Immunology, Weill Cornell Medicine, New York, USA
"How do malaria parasites decide to have sex?"

01/15/2019
Prof. Dr. Luka Cicin-Sain
Helmholtz-Zentrum für Infektionsforschung, Braunschweig, Germany
"The Potential of Cytomegalovirus as Vaccine Vector"

01/22/2019
Dr. Sandra Myriam Cordo
School of Sciences – Institute for Biological Chemistry,
Buenos Aires University, Argentina
"Junín virus entry into host cells"

03/28/2019
Prof. Dr. Richard Odame Phillips
Kumasi Center for Collaborative Research (KCCR), Ghana
"Update on Mycobacterium ulcerans disease (Buruli ulcer)"

04/09/2019
Dr. Moritz Treeck
Signaling in Apicomplexan Parasites Laboratory,
Francis Crick Institute, London, UK
"Remote control: How apicomplexan parasites modify your cells to their benefit"

04/11/2019
Dr. Guillermo Martínez Pérez
Department of Physiatrics and Nursing, Zaragoza University, Spain
"Transversalization of sex and gender approaches under a feminist perspective in qualitative research on infectious diseases in sub-Saharan Africa"

06/04/2019
Prof. Dr. Carsten Lüder
Institut für Medizinische Mikrobiologie, Georg-August-Universität Göttingen, Germany
"Finding its niche – *Toxoplasma gondii-host* interactions in diverse cell types"

06/06/2019
Prof. Dr. Xiao-Nong Zhou
National Institute of Parasitic Diseases (NIPD) at the Chinese Center for Disease Control and Prevention, CDC Shanghai, China
"Driving Force for Schistosomiasis Elimination in China"

06/24/2019
Prof. Dr. med. Clarissa Prazeres da Costa
Center for Global Health,
Institut für Medizinische Mikrobiologie, Immunologie und Hygiene,
Technische Universität München, Germany
"Introducing the Parasite Immunology group at TUM: From transmaternal immuneregulation to antihelminthic drug discovery"

07/22/2019
Prof. Dr. Jacob Golenser
Dept. of Microbiology and Molecular Genetics,
The Hebrew University of Jerusalem, Israel
"Etiology and treatment of cerebral malaria"

10/02/2019
Dr. Juliana Idoyaga
Department of Microbiology and Immunology, Stanford University School of Medicine, Stanford, California, USA
"Human Dendritic Cell Subsets in the High-Dimensional Era"

10/15/2019
Prof. Dr. Julius Fobil
Ghana School of Public Health,
University of Ghana
"Expanding Ghanaian-German Scientific Networks: Opportunities for collaborative research at the University of Ghana School of Public Health"

10/22/2019
Dr. Tobias Lenz
Max Planck Institute for Evolutionary Biology, Plön, Germany
"Evolutionary genomics of an optimal adaptive immune response: Trade-offs between pathogen resistance and autoimmunity"

11/12/2019
Dr. Kevin Maringer
Dept. of Microbial Sciences,
Faculty of Health and Medical Sciences,
University of Surrey, UK
"Dengue virus: how interactions with the human host, mosquito vector, and microbiome affect transmission and pathogenesis"

11/21/2019
PD Dr. Frank Pessler
TWINCORE, Zentrum für experimentelle Infektionsforschung,
Arbeitsgruppe Biomarker, Hannover, Germany
"Metabolic profiling of infectious diseases – For biomarker discovery and insights into pathogenesis"

12/20/2019
Prof. Ebenezer Owusu
University of Ghana
"Enhancing University of Ghana's Partnerships with German Institutions for Sustainable Collaborative Research"

01/08/2020
Prof. Dr. Cornelia Betsch
Psychology and Infectious Diseases Lab (PIDI Lab), Universität Erfurt, Germany
"Improving vaccine uptake with behavioural insights"

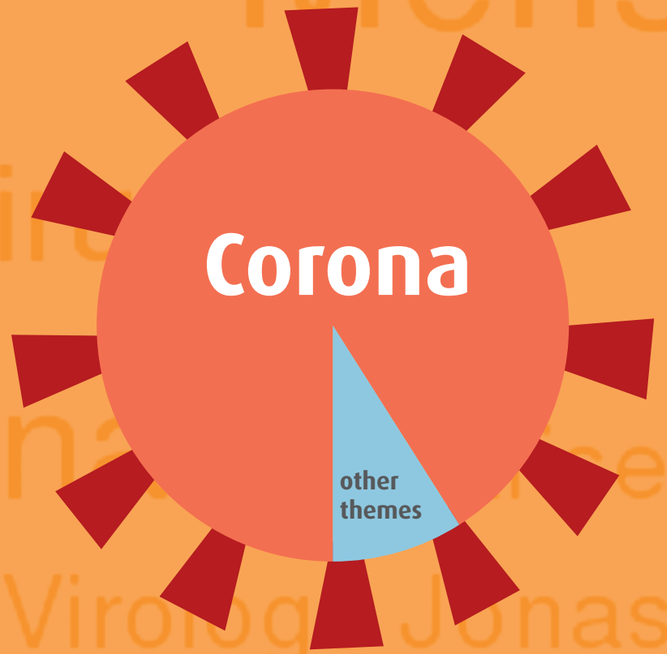
01/14/2020
Prof. Dr. Sabine Oertelt-Prigione
Department of Primary and Community Care, Radboud University Medical Center, Nijmegen, Netherlands
"Sexual harassment in academia in the #metoo era – From speaking up to changing the system"

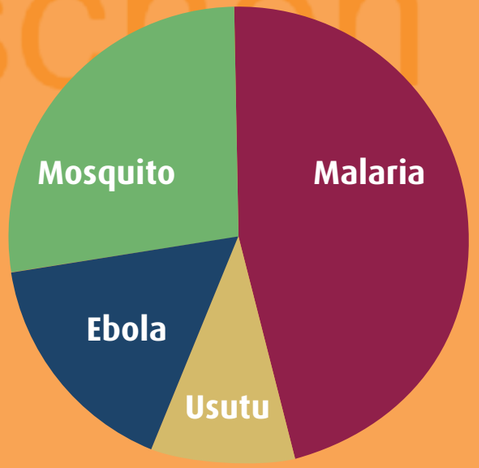
02/25/2020
Dr. Jutta Reinhard-Rupp
Merck Global Health Institute, Eysins, Switzerland
"Industry perspective: Global Health and the importance of partnerships"

BNITM IN THE MEDIA

PRINT/TV

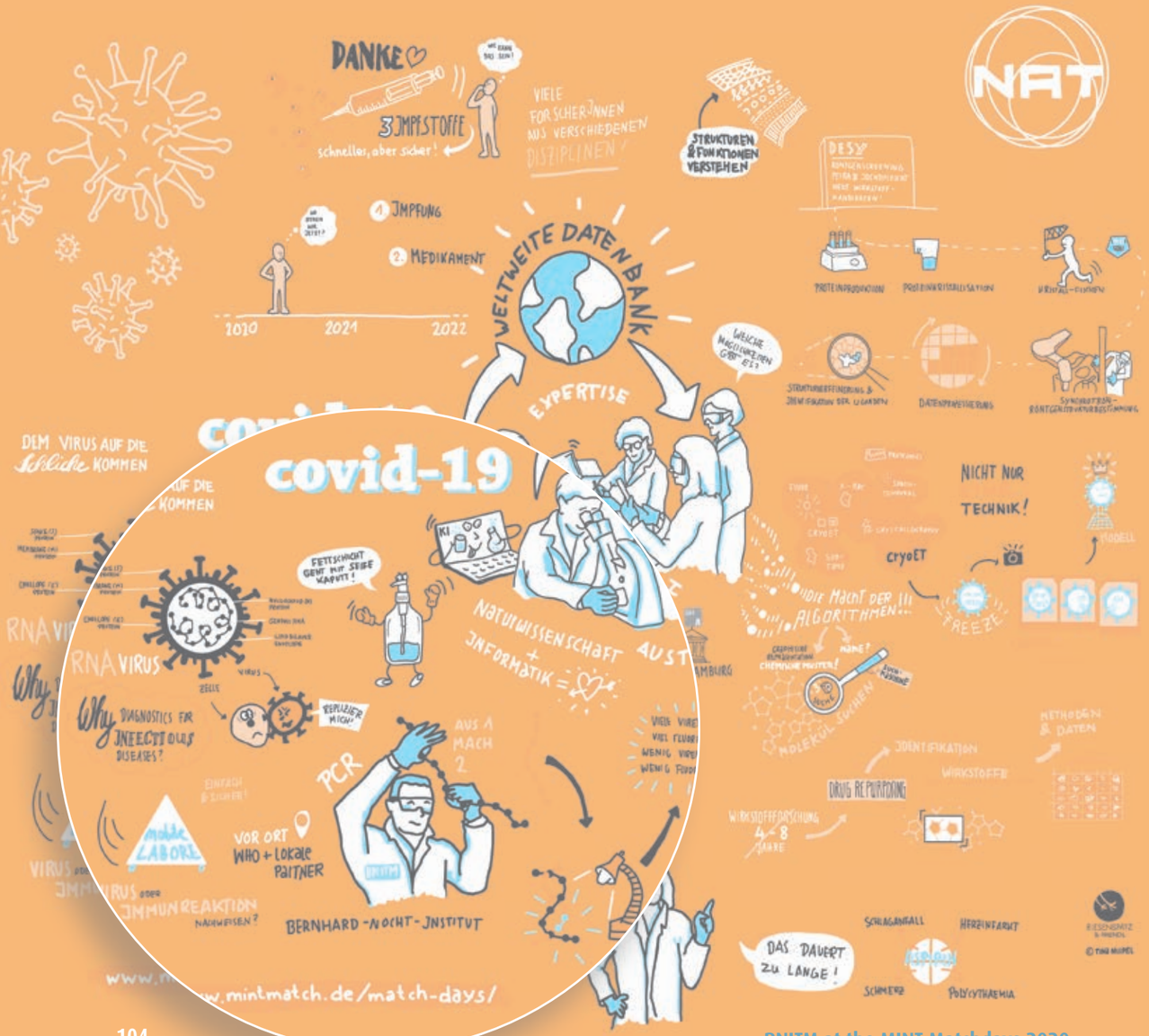
2019*
2020





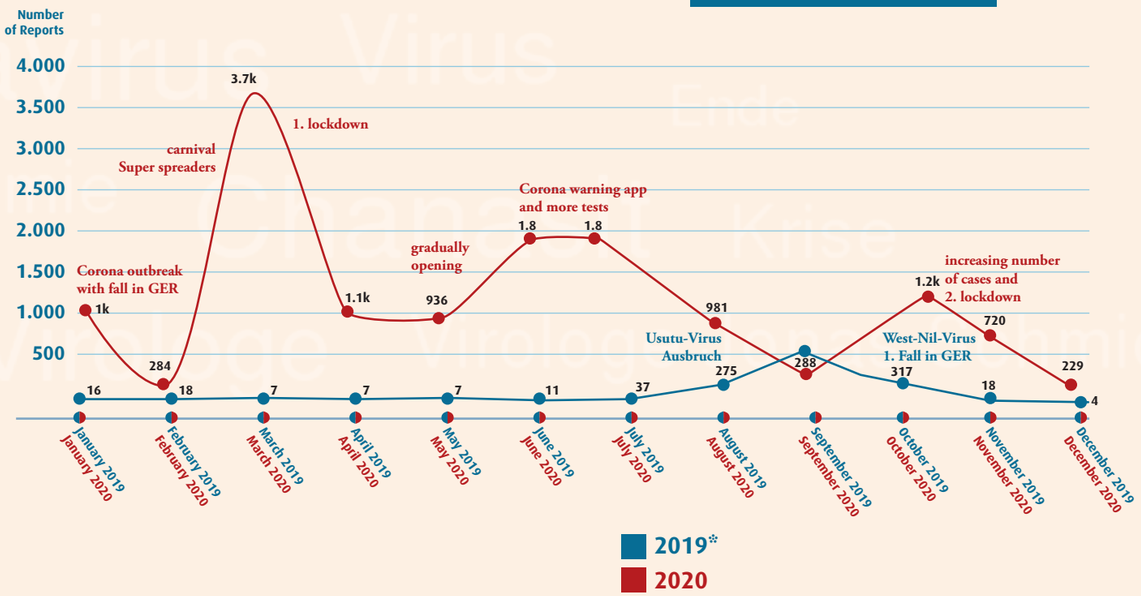
Main themes Print 2019

*representative also for 2018



BNITM at the MINT Matchdays 2020:
Hamburg institutions together against COVID-19

ONLINE



*representative also for 2018

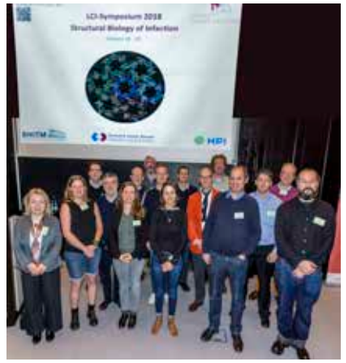
CHRONICLE 2018-2020

2018

01.01.2018
The new Board of Directors begins its work at the start of the year. The Board of Directors is made up of Prof. Egbert Tannich as Chair and Birgit Müller as Managing Director, as well as Prof. Jürgen May and Prof. Stephan Günther. Egbert Tannich also assumes responsibility for establishing an "Infection Diagnostics" department. Also, Prof. Michael Ramharter is appointed to the vacant W3 professorship "Clinical Tropical Medicine" at the UKE and moves into space at the BNITM with his "Clinical Research" department. Three new research groups are established as well: Protozoology Group (Prof. Iris Bruchhaus), Molecular Infection Immunology Group (Prof. Hanna Lotter), Virus Immunology Group (Prof. César Muñoz-Fontela).

Directors Egbert Tannich, Birgit Müller, Jürgen May, Stephan Günther (from left to right)

18.-19.01.2018
The LCI Symposium, this year with 160 international researchers, will be held for the first time at two different locations. In keeping with the topic of "Structural Biology of Infection", day one will take place at the BNITM and day two at the Centre for Structural Systems Biology (CSSB) in the future Science City in Hamburg Bahrenfeld, Germany.



LCI speakers in the BNITM historical lecture hall

Opportunity to exchange ideas in the CSSB foyer

29.01-16.02.2018
The "Medicine in the Tropics" course is once again well attended with 41 participants. The medical professionals are preparing for deployments in tropical regions.

Participants of the course "Medicine in the Tropics"

Februar 2018
The RKI organizes the deployment of the German Epidemic Preparedness Team (SEEG) in Colombo, Sri Lanka, to help control a Dengue fever outbreak. The delegation includes the BNITM staff member Dr. Anna Heitmann. Her task is to provide training in compliance with the required safety standards (S3 conditions) on site. A second mission in the framework of SEEG deployed to Benin republic to strengthen the diagnostic capacities at the national reference laboratory in Cotonou, and hands on training of laboratory staff to ensure safe laboratory practices and sample processing. The mission was supported by BNITM staff Beate Becker-Ziaja and Dr. Meike Pahlmann.

Quickly deployable health expert group

A SEEG duo at work

17.02.2018
Prof. Gerd Burchard organizes the "Tag der Reisegesundheit" (Day of Travel Health).155 physicians take part in professional development.

03.03.-30.06.2018
The three-month "Diploma Course on Tropical Medicine" trains 52 doctors from Germany and other countries in all aspects of travel and tropical medicine.

Participants of the diploma course tropical medicine 2018

10.04.2018
On the way to Global Health! In Berlin the study head Prof. Jürgen May (Head of the Department Infectious Disease Epidemiology) presents the contribution German institutes are making to research on neglected tropical diseases. In a follow-up strategic discussion, the participants discuss political action and funding opportunities with staff from the Federal Ministries BMBF, BMG and BMZ.

Presentation of the collected contributions of German institutes to research on neglected tropical diseases

26.04.2018
43 students learn about the Institute at Girls' and respectively Boys' Day. Several BNITM scientists supervise the excited children and youth as mentors: "I thought it was super interesting and super cool. Everyone was very nice."

05.-06.06.2018
Scientists visit the Bundestag. In the course of "Leibniz in Parliament", scientists have one-on-one discussions with members of the German Parliament; BNITM is also represented.

21.06.2018
Large Ebola epidemic in the Democratic Republic of Congo (DRC): The BNITM is deployed with the RKI and the Gesellschaft für internationale Zusammenarbeit (GIZ) through a mission of the German Epidemic Preparedness Team (SEEG) in Brazzaville, Congo, directly at the border with the DRC. The goal of the mission is to train local medical personnel in biosecurity measures and in reliable and fast diagnostics.

07.-09.06.2018
The Junior Scientist Zoonoses Meeting (JSZM) is being hosted by the BNITM for the first time. With almost 60 participants from various institutes and different disciplines, it is the largest meeting of its kind to date. The program offers a lot of variety, with lectures, discussion groups and career advice as well as an introduction to the "Science Slam" as a new presentation format.

Participants Junior Scientist Zoonoses Meeting

29.06.2018
Dr. Nahla Metwally (Protozoology Group) and Dr. Jakob Birnbaum (Malaria Group) receive the postdoctoral prize from the Vereinigung der Freunde des Tropeninstituts. This is followed by a celebration of BNITM staff, alumni, members of the friend's association and diploma course graduates at the annual summer party.

Dr. Nahla Metwally

Dr. Jakob Birnbaum

30.07.-03.08.2018
The BNITM hosts the "11th Summer School for Young Parasitologists" of the German Society for Parasitology. The international Masters and PhD students receive practical insights into scientific methods such as cell biology, immunology or imaging methods.

14.09.2018
Prof. Dennis Tappe (Zoonoses Group) is awarded the science prize "Klinische Virologie 2018" from the DVV and Society for Virology (Gesellschaft für Virologie - GfV) for his work in discovering a bornavirus as the cause of unexplained deaths among variegated squirrel breeders.

Dr. Dennis Tappe

Variegated squirrels

01.12.2018
Prof. Jonas Schmidt-Chanasit accepts the nomination for a W3 professorship for Arbovirology at the UHH Department of Biology.

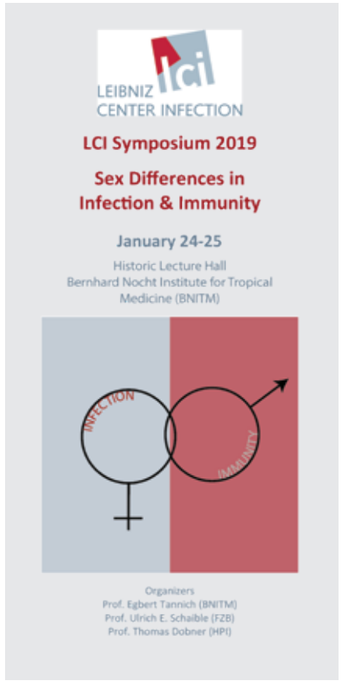
Prof. Jonas Schmidt-Chanasit

04.12.2018
The German Center for Infection Research (DZIF) honors Prof. Marylyn Addo (associated UKE Group at the BNITM) with the award for excellency in clinical-translational research and recognizes her clinical and immunology work for a vaccine study on Ebola infections.

Honor for Prof. Marylyn Addo with associated UKE group at the BNITM

2019

24.-25.01.2019
Over 100 scientists participate in the LCI Symposium in the BNITM lecture hall on the topic of "Sex Differences in Infection & Immunity".



28.01. - 15.02.2019
32 medical professionals participate in the "Medicine in the Tropics" course.

Participants of the course "Medicine in the Tropics"

13.02.2019
Dr. Johannes Mischlinger (Clinical Research Department, BNITM/UKE) receives the UKE Dr.-Martini Award for his work on the sensitivity of microscopic malaria diagnostics as it relates to the method of blood collection.

Dr. Johannes Mischlinger

20.02.2019
Prof. Jürgen May (Head of Infectious Disease Epidemiology Department) receives the "Memento Research Award for Neglected Diseases". The jury honors his longstanding commitment to researching life-threatening infectious diseases in children in Sub-Saharan Africa.

Prof. Jürgen May

12.03.2019

Dr. Oumou Maiga-Ascofaré

Dr. Oumou Maiga-Ascofaré (Infectious Disease Epidemiology Department) coordinates one of the largest current studies on treating malaria, together with the KCCR in Ghana. The study will test a treatment for malaria using a

combination of three next-generation drugs. The project is funded with 7.6 million Euros by the European & Developing Countries Clinical Trials Partnership and the BMBF.

27.03.2019
The cooperation agreement with the University of Antananarivo, Madagascar, is renewed after ten years of successful collaboration. Epidemiological and clinical studies on schistosomiasis in pregnant women and newborns are slated to begin soon.

28.03 .2019
Girls' Day and Boys' Day: 38 young, knowledge-hungry junior researchers storm the historic lecture hall in the early hours of the morning and listen attentively to what follows over the next few hours. Not only do they like the "great atmosphere", but also "that one can do so many things here".

Girls' Day and Boys' Day at BNITM

01.04.-28.06.2019
This year 44 doctors are participating in the Diploma Course on Tropical Medicine.

Participants of the diploma course Tropical Medicine 2019

01.04.2019
The Leibniz Association allocates funding of 500,000 Euros over three years to the BNITM Infection Diagnostics Department in the "Leibniz-Transfer" category, in order to improve the quality of parasite diagnostics together with the Fraunhofer Institute for Integrated Circuits. In the "Junior Research Groups" category, Dr. Lisa Oestereich (Virology Department) also receives half a million Euros for her research work on the immunology of Lassa fever in Nigeria.

Dr. Lisa Oestereich

05.04.2019
Dr. Sophie Duraffour (Virology Department) receives this year's German Society for Tropical Medicine, Travel Medicine and Global Health (DTG) award for her dedicated work during the large Ebola epidemic in West Africa and her research on the persistence of the Ebola virus.

Dr. Sophie Duraffour

15.04.2019
Inaugural lectures by Prof. Jürgen May and Prof. Michael Ramharter for the professorships they assumed, to which the BNITM and the UKE have jointly appointed them. The guests of the event in the historical BNITM lecture hall included the Dean of the Faculty of Medicine at the University of Hamburg, Prof. Dr. Dr. Uwe Koch-Gromus, and the Vice Dean for Research, Prof. Dr. Martin Aepfelbacher.

Prof. Jürgen May and Prof. Michael Ramharter

25.04.2019
Animated discussion on the topic of research, diagnostics and treatment of malaria takes place in the Körber-Forum on World Malaria Day. Prof. Egbert Tannich, Prof. Michael Ramharter and Prof. Jürgen May (left to right) spoke with the science journalist Marion Förster and the over 100 guests.

Marion Förster with Prof. Tannich, Prof. Ramharter and Prof. May (left to right)

10.05.2019
Dr. Renke Lühken and Dr. Anna Heitmann are interviewed by reporter Philipp Abresch for the three-part feature "NDR Wetterextrem – der Norden im Klimawandel" (NDR Extreme Weather – Climate Change in the North).

NDR report on extreme weather - Philipp Abresch interviews Dr. Renke Lühken and Dr. Anna Heitmann

22.06.2019
The one hundred year anniversary of the University of Hamburg is celebrated by 50,000 Hamburg citizens during the "Sommer des Wissens" (Summer of Knowledge) on the Rathausplatz. The BNITM also provides insights into the world of science and presents its mobile laboratories as well as selected research areas.

22.06.2019
Eleven colleagues and the potential future researchers on the balance bike during the Hamburg Commercial Bank Run through the Hafencity.

BNITM participants at RUN 2019

28.06.2019

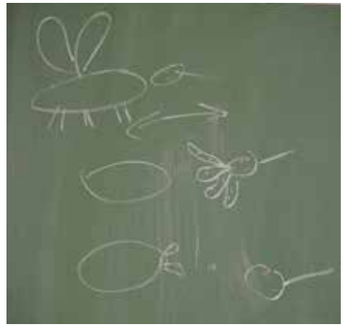
The Vereinigung der Freunde des Tropeninstituts (VdF) issues research awards to Dr. Franziska Muscate (AG Jacobs) for her research on immunology in malaria and to Dr. Mirjam Groger (Clinical Research Department) for her work on treating malaria in Lambaréné, Gabon. The annual summer party takes place at "moderately tropical" temperatures in the institute garden. Graduates of the tropics course as well as BNITM staff and friends enjoy a get-together with good music and great food.

Research awards from the Association „Vereinigung der Freunde des Tropeninstituts e.V." (VdF) to Dr. Franziska Muscate and Dr. Mirjam Groger

15.-19.07.2019

The "Summer School for Young Parasitologists" takes place at the BNITM for what is already the twelve time. A total of 16 international MSc and PhD students were able to participate in the four-day immersion course.

Summer School for Young Parasitologists



Break art or teaching material?

07.08.2019

The First Mayor of the Free and Hanseatic City of Hamburg, Dr. med. Peter Tschentscher, makes his first visit to the BNITM. As a doctor and clinical pathologist, he is a very interesting and well-versed conversational partner on the various fields the institute works in. In addition to current research highlights, the Board of Directors also presents the mobile laboratories and the medium-term research strategy.

Hamburg's First Mayor Dr. med. Peter Tschentscher visits the BNITM for the first time.

26.09.2019

The first suspected case of mosquito-borne infection with the West-Nile-Virus (WNV) in Germany occurs in a patient with encephalitis. The BNITM National Reference Center for Tropical Pathogens confirms the suspected diagnosis.

01.-26.10.2019

The institute supports the six countries of the East African Community (EAC) in establishing a network of mobile laboratories for diagnostics of transnational epidemics. The first training session with twelve participants from the EAC states takes place in October. The participants subsequently pass the skills they acquired on to colleagues in their home countries.

24.-25.10.2019

The first LCI Summer School takes place in Ahrensburg, Germany, within the framework of structured post-graduate training. Around 70 PhD students from the BNITM, the HPI and the Research Center Borstel participate. The event topic: "Immune Control of Pathogen Infections". Johannes Brandi and Lea Kaminski hold a short presentation in the style of the Science Slam and win 1st prize in the Speed Talks 2019.

LCI award for Johannes Brandi and Lea Kaminski

01.11.2019

Prof. Jonas Schmidt-Chanasit (Virus Diagnostics) is appointed to the STIKO "Travel Vaccinations" research group of the German Federal Ministry of Health (BMG) at the Robert Koch Institute.

13.-15.11.2019

After a hiatus of several years, the institute took the initiative and revived the Malaria Meeting. The 14th edition of this international conference in the historic lecture hall was well received. This year the renowned keynote speakers are Jean Langhorne (UK), Matthias Marti (Scotland), Till Voss and Tim Wells (both from Switzerland).

Malaria meeting in the historic lecture hall

22.11.2019

Prof. Stephan Günther and Dr. Johannes Mischlinger participate in the Hamburg conference Horizonte. With a view on "Science and Society", they delve into the question of "Unlimited health?" and present their work on pandemics and malaria diagnostics to a wide audience.

Prof. Stephan Günther in a lively discussion

Dr. Johannes Mischling inspires with his lecture

23.11.2019
Dr. Till Omansen (Clinical Research Department, BNITM/UKE) receives the award "DZIF-Doktorandenpreis der DGI 2019". The goal of his research work is to improve antimicrobial treatment options against the neglected bacterial infectious disease Buruli ulcer.

Dr. Till Omansen

25.11.2019
Prof. Marylyn Addo (associated UKE Group at the BNITM) receives the Pettenkofer Award from the German Society for Virology.

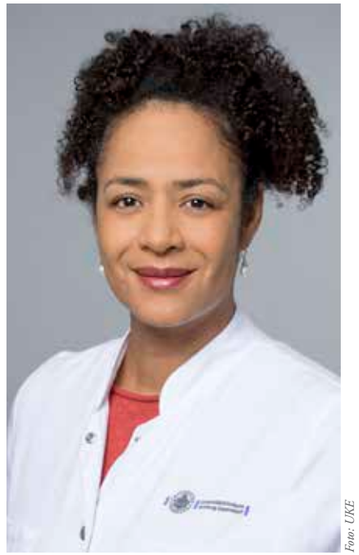


Foto: UKE

Prof. Marylyn Addo

2020

This year was characterized by the COVID-19 pandemic. A new Coronavirus (SARS-CoV-2) began spreading from China in December 2019. The first case in the world was detected on 1 December 2019. In mid-May the German Parliament declared an "epidemische Lage von nationaler Tragweite" (epidemic situation of national scope). The German Federal Government decided on a "lockdown" with the first restrictions on public life in order to keep SARS-CoV-2 in check in Germany. Due to the dynamic development of infections in Europa and Germany the BNITM canceled most of its planned in-person events, such as the Girls' & Boys' Day, Tropics Course, LCI Summer School, etc. Other courses are held virtually for the first time this year. In the course of the pandemic the BNITM is also involved in various cooperation projects for SARS-CoV-2 virus studies and diagnostics and to keep COVID-19 illnesses in check.

First BNITM mouth and nose protection

13.01.2020
Major achievement right at the beginning of the year: The core funding of the BNITM is increased permanently to 4.5 million Euros by the state and federal governments. Thus the BNITM begins establishing a new research area "Implementation Research" in January 2020. It is dedicated to the question of what is the best way to fight infectious diseases even in challenging conditions. The objective of disciplines such as e-Health, health economy or modern methods of health communication is to improve the effectiveness of disease fighting measures and to permanently strengthen health care systems.

Press conference at BNITM

Interview with Dr. John Amuasi from the KCCR

23.01. – 24.01.2020
In this year's international LCI Symposium "Future strategies to overcome antimicrobial resistance", around 125 international researchers discuss current developments and new treatment approaches to overcoming drug resistance.

Speakers at the LCI Symposium 2020

23.01. – 24.01.2020
Together with the German Epidemic Prepardness Team, a team of BNITM (Dr. Meike Pahlmann) and RKI (Beate Becker-Ziaja) travelled to Benin Republic to establish Lassa virus serology (ELISA) at the national reference laboratory for viral hemorrhagic fevers in Cotonou.

27.01.2020
First person infected with SARS-CoV-2 is identified in Germany. The Hamburg authorities request rapid SARS-Virus diagnostics from the Board of Directors. At the same time the media increasingly contacts the BNITM Public Relations Office; the beginning of comprehensive public relations work with doctors, virologists and epidemiologists at the BNITM/UKE. Most media inquiries are initially fielded by Prof. Jonas Schmidt-Chanasit (Virus Diagnostics). He is valued as a discussion partner in newspapers, radio, television, as a studio guest, discussion partner in podcasts and is also invited to minister conferences.

Newspaper from December 7th, 2020

Prof. Schmidt-Chanasit in an interview with the Shanghai Media Group

Touching fan mail is welcome in these times:

Dear Mr. Professor Schmidt-Chanasit, thank you for your admirable engagement, I would like to become a researcher myself. I hope that school starts again soon.
Sincerely Lena M.

27.01 – 14.02.2020
Dr. Benno Kreuels takes over from Prof. Gerd Burchard and organizes the course for medical professionals. 35 participants are prepared for deployments in the tropics.


Dr. Benno Kreuels

25.03.2020
The BNITM receives an urgent request: The City of Weiden in der Oberpfalz, Germany, requests support for SARS-CoV-2 diagnostics at the Klinikum Weiden. In response, the BNITM sends one of its mobile laboratories to Weiden with the support of the THW. Institute staff perform additional diagnostics on site and train the clinic personnel.




EMLab Weiden

06.04.2020
The Infectious Disease Epidemiology Department starts a BNITM-internal antibody study "CoKo" on the new coronavirus. Over 250 colleagues participate.

Mai 2020
Children have lots of questions in corona times. The lovingly illustrated Pixi and Lesemaus stories by the Carlsen Verlag help families through extraordinary times. They were both created with expert advice from the institute.

Pixi book with corona rules for the youngest

Foto: Sozialbehörde

A new styrofoam Streetart Installation by the artist group PUSH appears on the institute building overnight. "We were delighted with the support from the arts scene and are highly motivated to accept the challenge." (Board of Directors)


PUSH art on the institute building

10.06.2020
Go-ahead for the "Joachim-Herz-Graduiertenschule": The new post-graduate program complements the existing program at the BNITM and is headed by professors Iris Bruchhaus and Minka Breloer. Seven new post-doctoral projects funded with about 1.3 million Euros by the Joachim Herz Stiftung start in the spring of 2020. The research focus is on the interaction of tropical pathogens with their hosts.

The new graduate program "Joachim Herz Graduate School"

14.09.2020
Prof. Dr. Jonas Schmidt-Chanasit becomes head of the Arbovirology Department at the BNITM.


Prof. Dr. Jonas Schmidt-Chanasit

01.10.2020
120 years BNITM – An anniversary in the middle of a pandemic: These are also turbulent times for the institute. Due to the spread of the SARS-CoV-2 virus, the BNITM is subject to many restrictions and the Board of Directors has to cancel the planned celebrations. Nevertheless the staff take a look back together – but mostly they look forward!

On 1 October 1900 the "Institute for Ship and Tropical Diseases" began its work with a staff of 24. Under the direction of the Hamburg Hafenarzt (port health officer) Bernhard Nocht, it primarily dealt with exotic pathogens which sailors brought back from the colonies. To this day the Leibniz Institute studies exotic pathogens and newly arising infections above the wharf. The main focus is on neglected tropical diseases.

BNITM building

20.10.2020
Another deployment to fight the pandemic: A mobile laboratory from the BNITM expands testing capacity and treatment options on the Island of Lesbos in Greece. The laboratory was dispatched at the request of Greek authorities within the framework of the WHO "Global Outbreak Alert and Response Network" (GOARN) and with financial support of the WHO Regional Office for Europe.

EMLab team departure

24.-25.10.2020 sowie 7.-8.11.2020
Dr. Benno Kreuels and Dr. Sabine Jordan organize the first virtual "Basic Seminar Travel Medicine" with 55 participants.

02.11.2020

Dr. Maria Rosenthal

The junior researchers Dr. Maria Rosenthal (Virology Department) and Dr. Renke Lühken (Arbovirology Department) each attract around two million Euros in funding for their innovative research approaches in the field of prevention and treatment of newly arising infectious diseases. They will establish their own research groups over the next few years with the BMBF-funded projects.

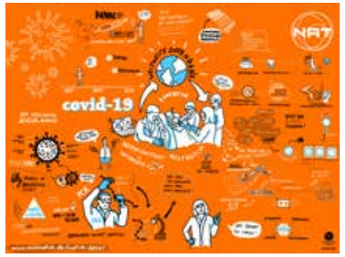
Dr. Renke Lühken

13.11.2020
Interdisciplinary expert discussion in the Rathaus (city hall) with the First Mayor Dr. Peter Tschentscher, to which scientists from the UKE and the HZI are invited in addition to Prof. Schmidt-Chanasit. This is followed by a news conference.

Zoom press conference

14.12.-17.12.2020
The institute is for the first time involved in setting the program for the "Match Days", a sort of student convention by the NAT Initiative, which networks outstanding experts with young people. Topics include clean technologies, mobility, infection research and algorithms as well as occupational profiles, study paths and career opportunities.

On the key topic of "Covid-19", Prof. Marylyn Addo (associated UKE Group at the BNITM) discusses vaccines and Dr. Martin Gabriel (Virology Department) discusses SARS-CoV-2 diagnostics and the use of mobile laboratories during the pandemic. Later Jeannette Meurer (Human Resources Department) presents various occupational fields at the BNITM. A very successful event with around 400 students online.



Graphic COVID-19 from NAT

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