

BERNHARD NOCHT INSTITUTE FOR TROPICAL MEDICINE



Holistic One-Health-Infectious Disease Research considers humans, animals, habitats, climate and environmental conditions as a unit.

Cover photo: Increased density of interactions between human and animal habitats – Motorcyclist with ducks in Vietnam.

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CONTENTS

Introduction	04
Management and Boards	07
Research	11
Scientific units	13
Pathogen	15
Interface	25
Patient	35
Population	43
Implementation	53
Cooperations	61
National	62
Worldwide	69
Education and capacity reinforcement	81
National medical training and further education	83
International education and training	87
Outbreak control	90
Mobile Laboratories	93
Data and facts	97
Organizational chart	98
Performance overview	100
EU research projects	102
Appendix	105
Institute seminars	106
In the media	108
Chronicle	110
Imprint	119



INTRODUCTION



Prof. Jürgen May

Dear Readers,

The coronavirus pandemic has once again shown us that we have to look jointly at humans, animals and the environment during infection research in a global and interdisciplinary way.

This annual report focuses on **Global Health** and **One Health**. The picture on the cover of a woman selling geese in Vietnam shows what it is all about: the human and animal living space is becoming more densely populated, and environmental changes such as global warming and globalization are also having a growing impact on the spread of infectious diseases. This is shown by the presence of highly pathogenic causative agents such as the Ebola and Marburg viruses and the spread of the West Nile virus and the MERS coronavirus.

Together, we have therefore strategically developed the topic of *One Health* in the context of our work, among other things by establishing the **Global One Health** and **One Health Bacteriology** research

groups. The BMBF **Arbovirus Ecology Junior Research Group** is investigating the influence of climate change on the spatio-temporal distribution of vectors and the associated pathogens. In a new EU Horizon project, a **mobile One Health laboratory** is set to be constructed. The Institute has now established one of the world's largest civilian networks of mobile diagnostic laboratories.

We have also improved the **Implementation Research section**. It now comprises over nine research groups. We are particularly pleased that, together with the University Medical Center Hamburg-Eppendorf (UKE), we could establish two professorships based in our African partner countries, by Prof. John Amuasi and Prof. Ghyslain Mombo-Ngoma. In this way, we are intensifying our long-standing cooperation with the Kumasi Centre for Collaborative Research (KCCR) in Ghana and the Centre de Recherches Médicales de Lambaréné (CERMEL) in Gabon.

Overall, the number of employees has increased significantly, from 280 before the pandemic to around 400 now. Space has become a rare commodity. **The "New Institute Building" project** is thus very much at the top of the Executive Board's agenda.

I would like to thank every BNITM employee for their productive work, tireless efforts and continuous

cooperation, especially over the past two difficult years. **This success would not have been possible without their commitment and expertise.** I would also like to thank the members of the Scientific Advisory Board and the Board of Trustees for taking the time to assess the work of the BNITM on an ongoing basis and providing valuable feedback.

It is a pleasure to once again be working face-to-face without any social distancing or masks. We are working every day to detect new infectious agents and prevent new epidemics.

Jürgen May, June 2023



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Birgit Müller, Jürgen May, Iris Bruchhaus, and Stephan Günther

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RESEARCH



RESEARCH SECTIONS

What are the starting points for interventions?



PATHOGEN

Virology***
S. Günther

Lassa Pathophysiology*
T. Omansen

Lassa Immunology*
L. Oestereich

Structural Virology**
M. Rosenthal

Cellular Parasitology
T. Gilberger

Molecular Parasitology**
J. Matz

Malaria Cell Biology
T. Spielmann

Leishmania Genetics
J. Clos

How does the infected human body react?



INTERFACE

Molecular Infection Immunology
H. Lotter

Protozoa Immunology
T. Jacobs

Helminth Immunology
M. Breloer

Virus Immunology***
C. Muñoz-Fontela

Mosquito-Virus Interactions***
E. Schnettler

Host-Parasite Interaction
I. Bruchhaus

Clinical Infection Immunology
M. Addo, *associated UKE Department*

Is an intervention safe and efficient?



PATIENT

Clinical Research
M. Ramharter

Lassa Pathophysiology*
T. Omansen

Zoonoses
D. Tappe

Diagnostic Development
N.N.

Which infections are relevant and where?



POPULATION

Infectious Disease Epidemiology**
J. May

Arbovirus and Entomology
J. Schmidt-Chanasit

Arbovirus Ecology**
R. Lühken

How does it work in practice?



IMPLEMENTATION

Implementation Research
N.N.

Health Communication
C. Betsch

Health Economics
J. Priebe

Zoonoses Control
E. Fichet-Calvet

Vector Control
R. Lühken

Medical Anthropology
S. Park

Global One Health
J. Amuasi

One Health Bacteriology
D. Dekker

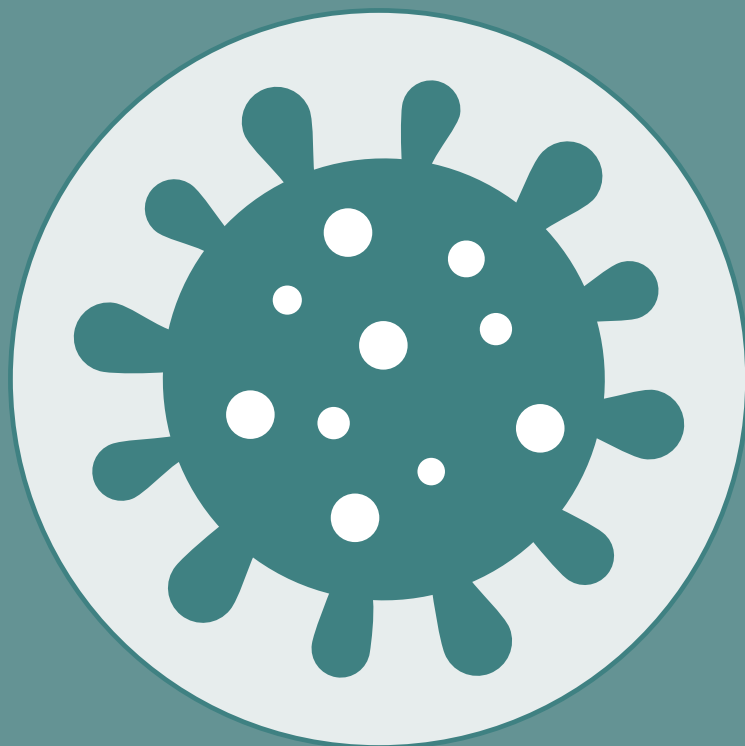
Snakebite Envenoming
J. Blessmann | B. Kreuels

Drug Implementation
G. Mombo-Ngoma

TRANSLATION

WEBSITES OF ALL
THE RESEARCH GROUPS



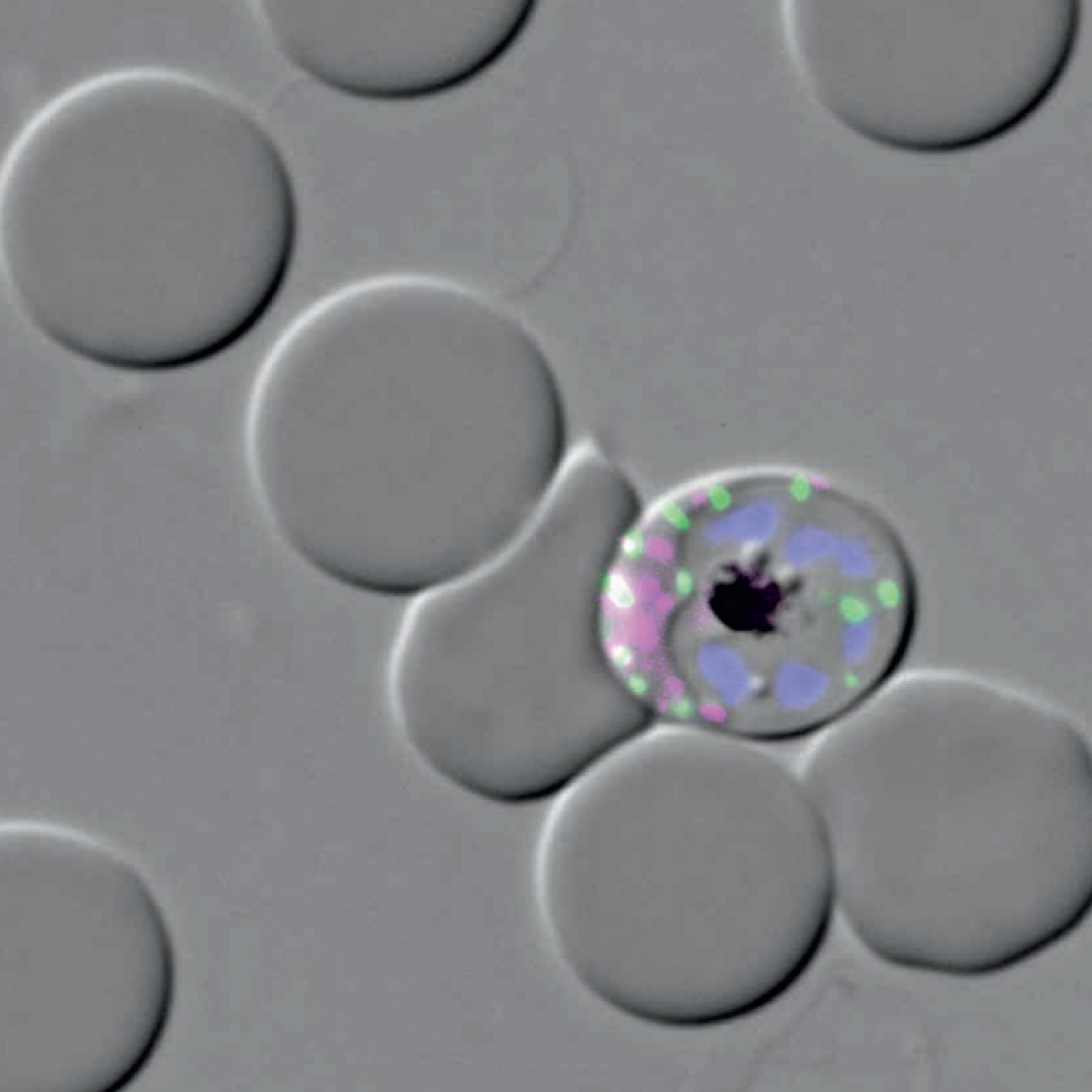


PATHOGEN

What are the starting points for interventions?

The research groups of the PATHOGEN Section investigate newly emerging or rare infectious agents such as malaria parasites and hemorrhagic fever viruses like the Lassa or Ebola virus, which are typical for the tropics. The groups study both the biology and the properties of the pathogens. One focus is on structural research at the "Center for Structural Systems Biology" (CSSB). Using analysis methods that are unique worldwide, research groups can resolve protein components of the pathogen down to their molecular and even atomic structures.

The goal of the research groups is to find new basic approaches for research into active pharmaceutical ingredients – a race against time and against these pathogens that science wants to win. For example, the World Health Organization (WHO) classifies Lassa fever as a major threat to Global Health. This infectious disease has a high epidemic potential; so far no vaccinations or reliably effective medicines exist.



Malaria parasites cause disease when they multiply in human red blood cells. The drug Artemisinin is key for the treatment of malaria. The malaria parasite takes up the blood pigment hemoglobin present in the host red blood cells and breaks it down as a source of amino acids. Artemisinin is activated by the resulting degradation products, and then has a lethal effect on the parasites. Less artemisinin is activated when it “fasts”. The parasite becomes resistant to the drug, but is also less able to survive, resulting in a reduced “fitness”. The reason is an amino acid deficiency caused by the lower hemoglobin intake, which slows down its growth.

Using molecular biological methods, we have analyzed the adapted fitness program of resistant malaria parasites. They compensate for the fitness losses of resistance by increasing the number of nutrient-permeable channels to obtain amino acids from other sources

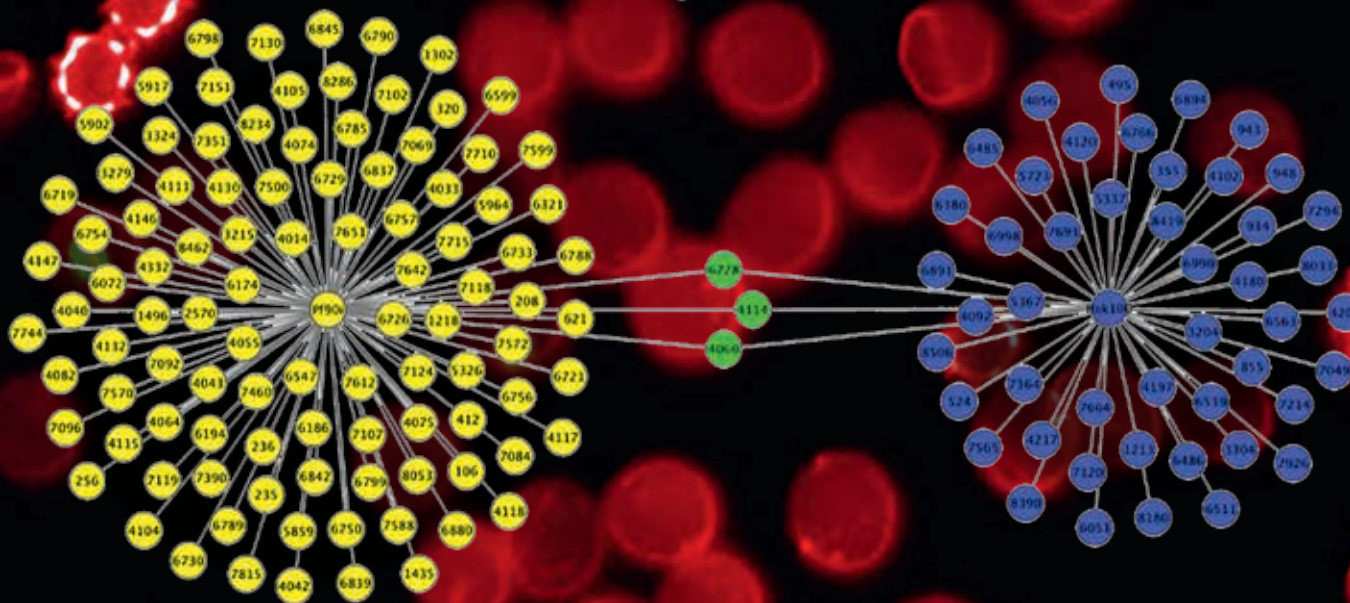
than hemoglobin. Through these portals of entry, however, the parasite absorbs not only important amino acids, but also, in turn, antimalarial drugs. So an extremely complex relationship exists: The more resistant the parasite, the more slowly it will grow. That’s why it tries to compensate for the lack of amino acids with nutrient channels and it becomes fitter – but again more susceptible to drugs.

Mesén-Ramírez P et al., Cell Host Microbe 2021; 29(12):1774-1787.e9

Paolo Mesén-Ramírez, Bärbel Bergmann, Heidrun von Thien, Carolina Castro-Peña, Tim Gilberger, Anna Bachmann and Tobias Spielmann, as well as external cooperation partners (see publication).

Figure: Malaria parasite in a red blood cell. Colored structures show alterations induced by the parasite in the host cell.





A double challenge

RESISTANT MALARIA PATHOGENS AND CLIMATE CHANGE

The increasing global spread of resistance to antimalarial drugs affects a quick and effective treatment of malaria. Climate change could also cause malaria areas to expand. The invasion of the *Anopheles stephensi* mosquito, which can adapt very easily to urban environments, from Asia to Africa is a major risk. A new drug substance against malaria would be helpful, but it is also like looking for a needle in a haystack.

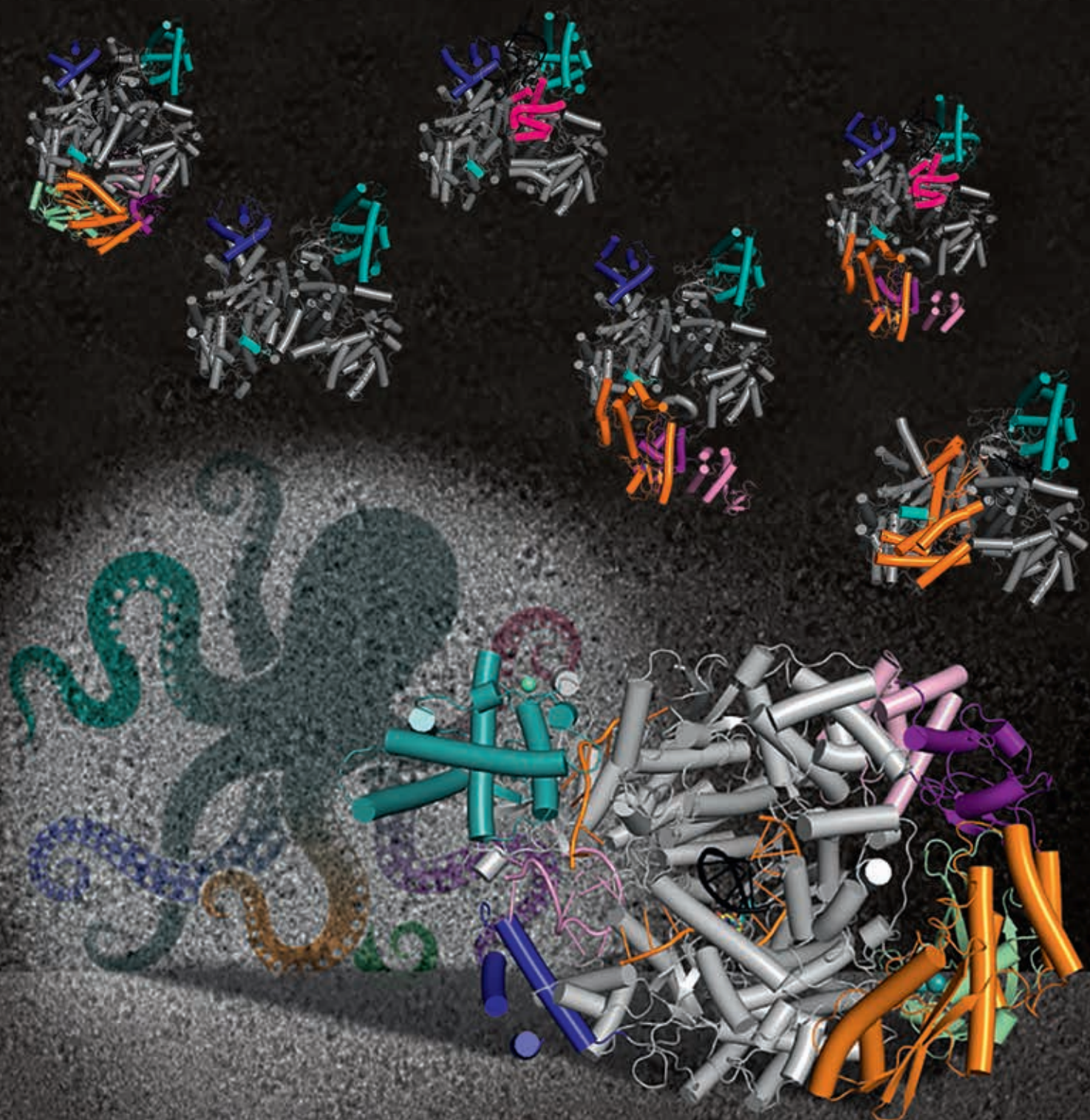
The search for it began in 2011. We analyzed over 4,800 extracts from a variety of soil microbes in a cell culture system to check their activity against the malaria parasite. Now, we have isolated the right molecule; the novel drug substance PDE-12, which kills the malaria parasite extremely selectively and efficiently. It will be exciting to test this natural product for its suitability as an efficient medicine against malaria in further test series and, hopefully, in clinical trials.

Alder A et al., Cell Chem Biol. 2022 May 19;29(5):840-853.e6

Arne Alder, Nicole Struck, Janis Rambow, Sarah Lemcke and Tim Gilberger, as well as external cooperation partners (see publication).

Figure: Identification of a new natural product (NP) against the malaria parasite: By determining the growth inhibition of a total of 4,800 NP extracts from soil bacteria and fungi, those substances were identified (green) that have no effect on human HEK cells (blue), but with a 90 % growth retardation of *P. falciparum* cultures (yellow). Further analyses led to the discovery of the drug substance PDE-12.





A super magnifying glass

THE MOLECULAR OCTOPUS IN LASSA VIRUS

The Lassa virus is found in West African countries. It is transmitted to humans by *Mastomys* mice through contaminated food or household items. Around 20% of people infected with Lassa will develop a severe hemorrhagic fever that can affect vital organs. The WHO classifies Lassa fever as a serious threat to world health because of its high epidemic potential and the lack of vaccines or effective drugs.

This is where structural biology can help. Using the modern technology of cryo-electron microscopy, which can provide millions of images of proteins, we have succeeded in observing, in great detail, a multiplication machinery (polymerase) that is essential for the survival of the virus: The polymerase has a peculiar architecture with a core and flexible outer regions, resembling an octopus. We analyzed this machin-

ery in various functional states and were thus able to decode the mechanism of the octopoidal virus replication machinery, an excellent basis for the development of antiviral agents.

Kouba T, Vogel D, Thorkelsson SR et al., Nat Commun 2021;12(1):7018

Dominik Vogel, Harry Williams, Morlin Milewski, Carola Busch, Stephan Günther and Maria Rosenthal, as well as external cooperation partners (see publication).

Figure: Molecular 'octopus' in the Lassa virus under a super magnifying glass: Visualization of a Lassa virus component.





On the trail of the perpetrators

MODERN LABORATORY DIAGNOSTICS UNMASKS EBOLA AND MARBURG VIRUSES

The Republic of Guinea is a country in West Africa. Outbreaks of viral hemorrhagic fevers are not uncommon there and are fatal in 25 to 90 percent of infected people: a severe Ebola virus disease epidemic raged in West Africa from 2014 to 2016. Marburg virus disease is also on the rise, spreading through large parts of Africa. Until now, this was only known to occur in eastern, central and southern Africa.

In Guinea, we are on the trail of these tiny “perpetrators” using cutting-edge laboratory diagnostics in the most remote areas. In 2021, for example, we fought another Ebola virus outbreak together with many international groups, and also detected and contained Marburg virus disease deep inside the country, before the virus could reach the cities of Guinea.

The keys to rapid detection and containment are an early diagnostic warning system and perfect management. In our case, we were able to diagnose Marburg virus disease in less than twelve hours after the health authorities had first been alerted.

Analysis of the Ebola virus profile by sequencing the viral genome has also revealed a surprising result: Ebola virus can survive in humans for several years. The virus can thus be passed on from one person to another after a long time and be the source of a new epidemic.

Keita AK, Koundouno FR, Faye M, Düx A, Hinzmann J et al., Nature. 2021 Sep;597(7877):539-543

Koundouno FR, Kafetzopoulou LE, Faye M et al., N Engl J Med 2022;386(26):2528-2530

Fara R. Koundouno, Annick Renevey, Kékoura Ifono, Emily V. Nelson, Giuditta Annibaldis, Saa L. Millimono, Karifa Kourouma, Tamba Elie Millimouno, Fernand M’Bemba Tolno, Julia Hinzmann, Hugo Soubrier, Mette Hinrichs, Anke Thielebein, Glauca Herzer, Meike Pahlmann, Nathalie J. Vielle, Liana E. Kafetzopoulou, and Sophie Duraffour, as well as external cooperation partners (see publications).

Figure: Loading a sequencer the size of a cell phone.





INTERFACE

How do pathogens, hosts and vectors interact?

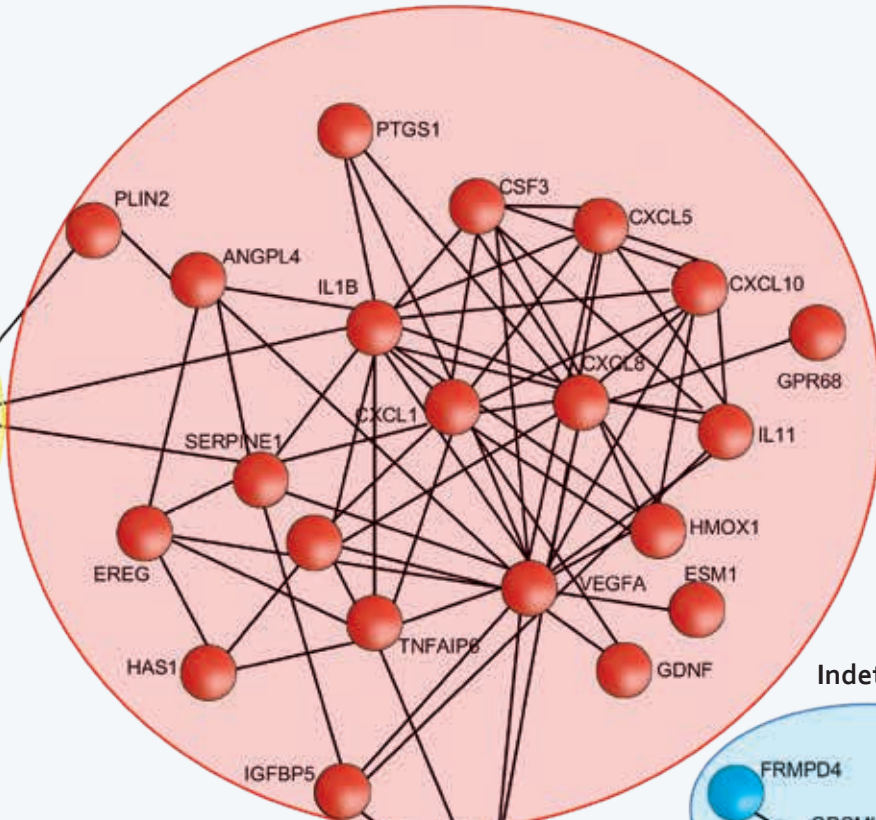
Research groups in this section deal with the question of how infectious pathogens interact with their hosts and the animals transmitting the disease (vectors): For example, how do they trigger immunological processes, i.e. the immune response of their hosts? Which molecular biological mechanisms do they use to evade the immune response? And how do pathogens communicate with the cells in their host organisms?

Many pathogen survival strategies needed to be analyzed here.

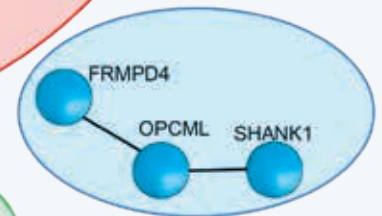
Since 2021, the BNITM has also been dedicated to issues of "personalized medicine": immune responses to pathogens differ between men and women, as well as children and adults. Understanding this is an important objective so that drugs and vaccines can be used as specifically as possible.

Vascular development

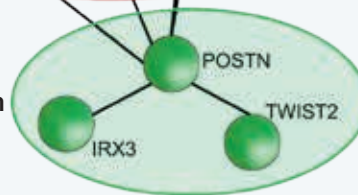
Cholesterol metabolism



Indeterminate cluster



Cell differentiation



Malaria in the immunological network

INFLUENTIAL PLASMA FROM MALARIA PATIENTS

Plasmodium falciparum is the most dangerous malaria pathogen. Infection can lead to severe, life-threatening disease if left untreated. The parasite infects red blood cells, which then attach to the walls of small blood vessels and there to the so-called endothelial cells. This can lead to oxygen deprivation and over-activation of the immune system, which can damage vital organs such as the kidneys, lungs and brain.

The overactivity of the immune system is characterized by an increased concentration of different messenger substances (cytokines) in malaria patients' blood. It had previously been assumed that the release of these messenger substances could only be activated by direct contact between infected red blood cells and the endothelial cells.

In our study, we have been able to show that proteins in the malaria patients' blood plasma also influence the production of inflammatory messengers and growth factors. Using molecu-

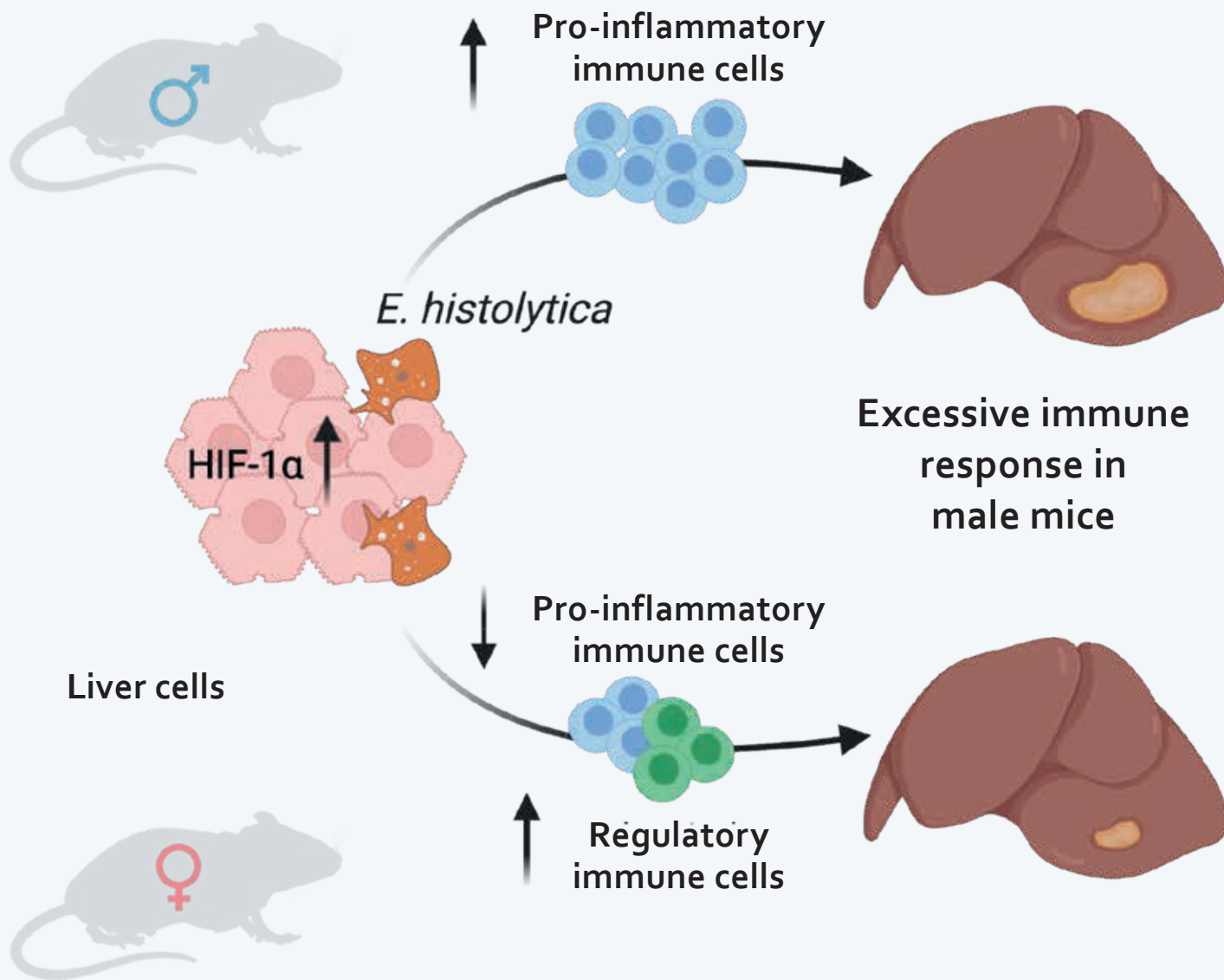
lar biological methods (transcriptome analysis), we verified our observation and identified a network of biological processes that apparently influence blood plasma regulation.

Raacke M et al., Cells 2021 July 1;10(7):1656

Michaela Raacke, Amy Kerr, Michael Dörpinghaus, Jana Brehmer, Yifan Wu, Stephan Lorenzen, Thomas Jacobs, Thomas Roeder, Julie Sellau, Anna Bachmann, Nahla Metwally and Iris Bruchhaus, as well as external cooperation partners (see publication).

Figure: Stimulation of biological processes in endothelial cells, triggered solely by proteins in the blood plasma of malaria patients.





Men are different – so are women.

OXYGEN DEFICIENCY IN AMOEBIC LIVER ABSCESS: CONSEQUENCES FOR MEN AND WOMEN

Many infectious diseases occur more frequently in men and are more severe than in women. The amoebic liver abscess caused by infection by the parasite *Entamoeba histolytica* is a typical example.

Our mouse model for this infectious disease showed that infection leads to a massive accumulation of immune cells in the infected tissue. This leads to a lack of oxygen in the liver. As a result, the so-called “hypoxia-inducible factor-1 α ” (HIF-1 α) is produced in the liver cells.

The increased production of HIF-1 α has different consequences for the immune systems of male and female mice: In males, this increase leads to even greater inflammation as more pro-inflammatory cells enter (such as Th17-positive cells) the affected liver and more pro-

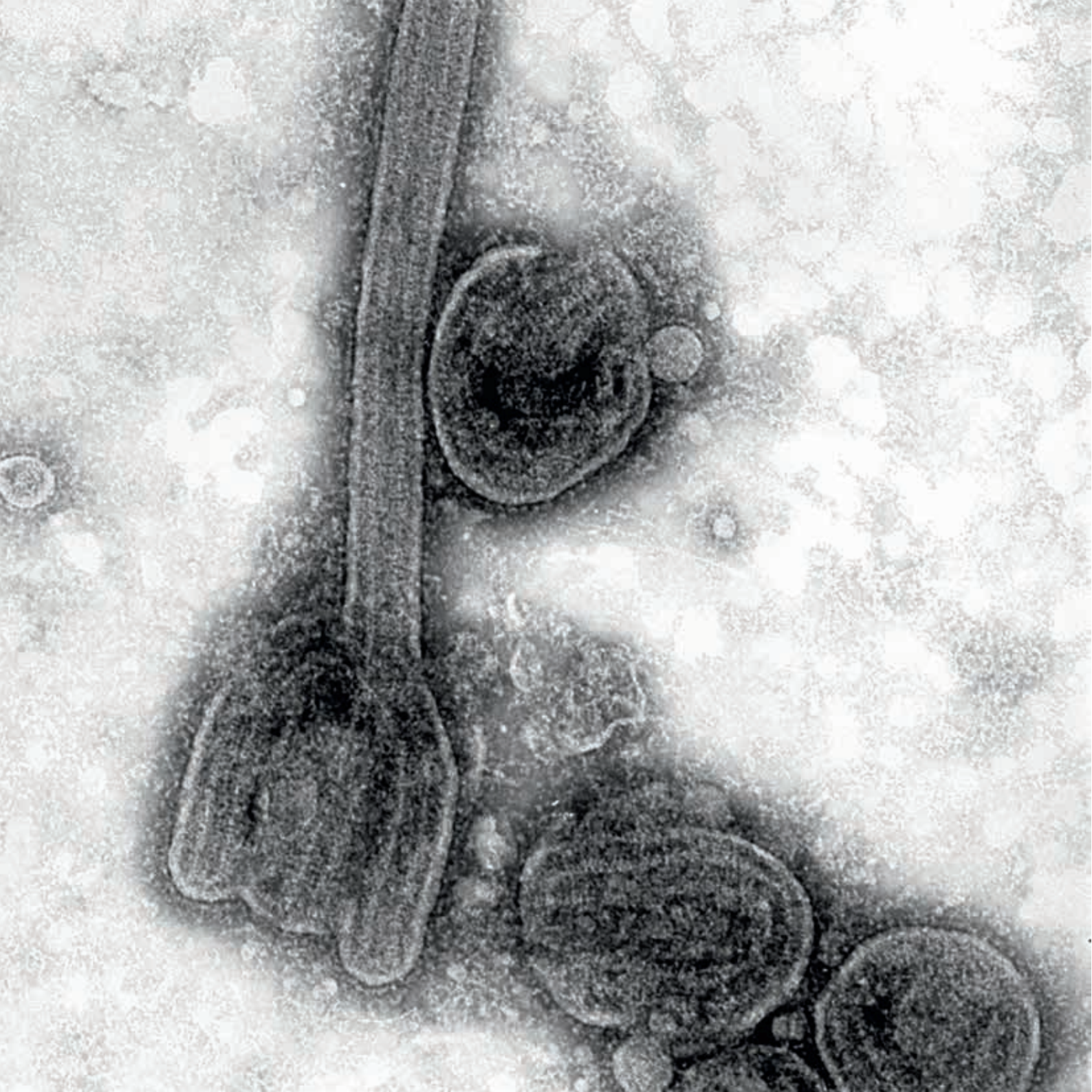
inflammatory messengers (such as IL-17 and IL-2) are produced. In female mice, however, these processes are suppressed. Instead, the immune system produces more regulatory T cells, which help to better control the inflammation and heal the liver damage.

Groneberg M et al., J Hepatol 2022 Jan;76(1):160-173

Marie Groneberg, Stefan Hoenow, Claudia Marggraff, Helena Fehling, Nahla Metwally, Charlotte Hansen, Iris Bruchhaus, Gisa Tiegs, Julie Sellau and Hanna Lotter, as well as external cooperation partners (see publication).

*Figure: Sex-specific immune response to infection with *Entamoeba histolytica*.*





Hemorrhagic fevers are characterized by severe inflammation and an excessive immune response. They are often fatal. One prominent family of viruses that cause hemorrhagic fever are filoviruses such as the Ebola virus.

We are combining research projects using animal models in biosafety level 4 (BSL-4) laboratories with clinical and immunological studies in outbreaks, particularly in endemic countries in Africa. We are learning on our findings from basic research to help develop vaccines and therapeutics.

Since the major Ebola epidemic in West Africa (2014-2016), we have been working with a group of survivors in Guéckédou in the Republic of Guinea. We examined the memory immune response and the duration of immunity following infection. To find out whether certain immune cells (T cells and antibodies) from

survivors can protect against Ebola infection, we developed mice (“avatar mice”) transplanted with human immune cells from specific individuals which protected these mice from infection. This is an important finding, because it could help to develop new therapies against Ebola virus disease.

Rottstegge M et al., J Virol 2022; 96(18):e0057422

Monika Rottstegge, Catherine Olal, Julia Port, Estefania Rodríguez, Beatrice Escudero-Pérez and César Muñoz-Fontela, as well as external cooperation partners (see publication).

Figure: Electron-micrographic image of the Ebola virus.





Immune reaction of infected mosquitoes

HOW ARE MOSQUITOES GETTING ON WITH THEIR VIRUSES?

Mosquitoes are among the creatures that can transmit infectious diseases to humans. These include dengue, chikungunya and West Nile viruses, the so-called “arboviruses”. Recently, however, research groups around the world have also discovered many insect-specific viruses. Many of these are very similar to arboviruses, though they are harmless to humans. Consequently, that makes this group of viruses interesting for arbovirological research.

To find out why mosquitoes transmit certain viruses to humans (arboviruses) and not others (insect-specific viruses), we examined the immune system of mosquitoes:

The so-called RNA interference (RNAi) is an important mechanism of the antiviral immune defense against foreign RNA or foreign virus genomes. The protein “Argonaut-1” plays a

special role in the RNAi-induced defense against the insect-specific alphavirus. It had an antiviral effect against the insect-specific virus, but not against arboviruses. This research helps us to better understand how mosquitoes fight off a “viral infection” and thus do not transmit it to humans.

Altinli M et al., mSphere 2022 Feb 23;7(1):e0100321

Mine Altinli, Mayke Leggewie, Marlis BaShowe, Rashwita Gyanwali, Christina Scherer, Jonny Schulze, Marvin Fegebank, Bernhard Zibrat and Esther Schnettler, as well as external cooperation partners (see publication).

*Figure: A mosquito (*Anopheles stefensi*) full of blood.*





PATIENT

Which interventions are safe and effective?

For most poverty-related tropical diseases such as parasitic worm infections caused by the *Loa loa* nematode or schistosomiasis, but also for outbreak diseases such as Ebola and Lassa fever, there is a lack of sufficiently efficient drugs, vaccines and/or diagnostics. This is true for many other infectious diseases, including the life-threatening encephalitis caused by bornaviruses (Bornaviridae).

The reasons for the low level of attention may be a lack of economic interest in the development of interventions, the complexity of many of these diseases, or a lack of capacity for carrying out tests in clinical studies.

In the PATIENT section, the focus is on sick people. The therapy options must be safe and effective. The research groups conduct clinical studies to evaluate these interventions. In addition, specific methods are being developed and evaluated for the rapid and reliable diagnosis of tropical infectious diseases.



Neglected and underestimated

A DRUG AGAINST RARER MALARIA SPECIES AND MIXED INFECTIONS

High-quality studies on the efficacy of drugs against the malaria pathogens *Plasmodium ovale* spp. and *P. malariae* are rare. Diagnosing these species is more challenging, which makes the actual prevalence difficult to determine. Hence, these forms of malaria remain neglected. If left untreated, these cases can aggravate malaria control and eradication efforts. This emphasizes the importance of effective drugs that can be used to treat all forms of malaria in endemic areas.

We took this as an opportunity to evaluate the efficacy of pryonaridin-artesunate, an important anti-malarial combination therapy, against the neglected forms of malaria parasites in a phase III/IV *Real-World* study. Out of 1,502 randomly selected participants from the Democratic Republic of Congo and Gabon, 192 (12,8 %) had either a mixed *Plasmodium* infection or a mono-infection with one of the neglected forms. The cure rate after 28 days was over 95% for all forms.

Our conclusion: Pyronaridine artesunate can be used to effectively treat acute malaria infections with all *Plasmodium* species. This makes it possible to simplify disease management for malaria patients.

Groger M et al., *Lancet Microbe* 2022 Aug;3(8):e598-e605

Mirjam Groger and Michael Ramharter, as well as external cooperation partners (see publication).

Figure: Clinical study in Africa.





It could catch your eyes

FILARIASIS DIAGNOSTICS MADE EASY

The *Loa loa* nematode is a parasite and also known as the “African eye worm”. The parasite is transmitted to humans in West and Central Africa by horseflies. Filariases like loiasis had received much attention in the context of the treatment of another filariasis, namely onchocerciasis or “river blindness”:

Onchocerciasis sufferers usually receive the drug ivermectin several times for therapy. This is associated with an unacceptably high risk of potentially fatal encephalopathies (brain disorders) if the patients also have a high number of *Loa loa* parasites in their blood. Rapid, reliable filariasis diagnosis prior to ivermectin therapy is therefore extremely important.

In a study with over 700 participants, we showed that around 35% more filarial parasites can be detected in capillary blood (e.g. blood from

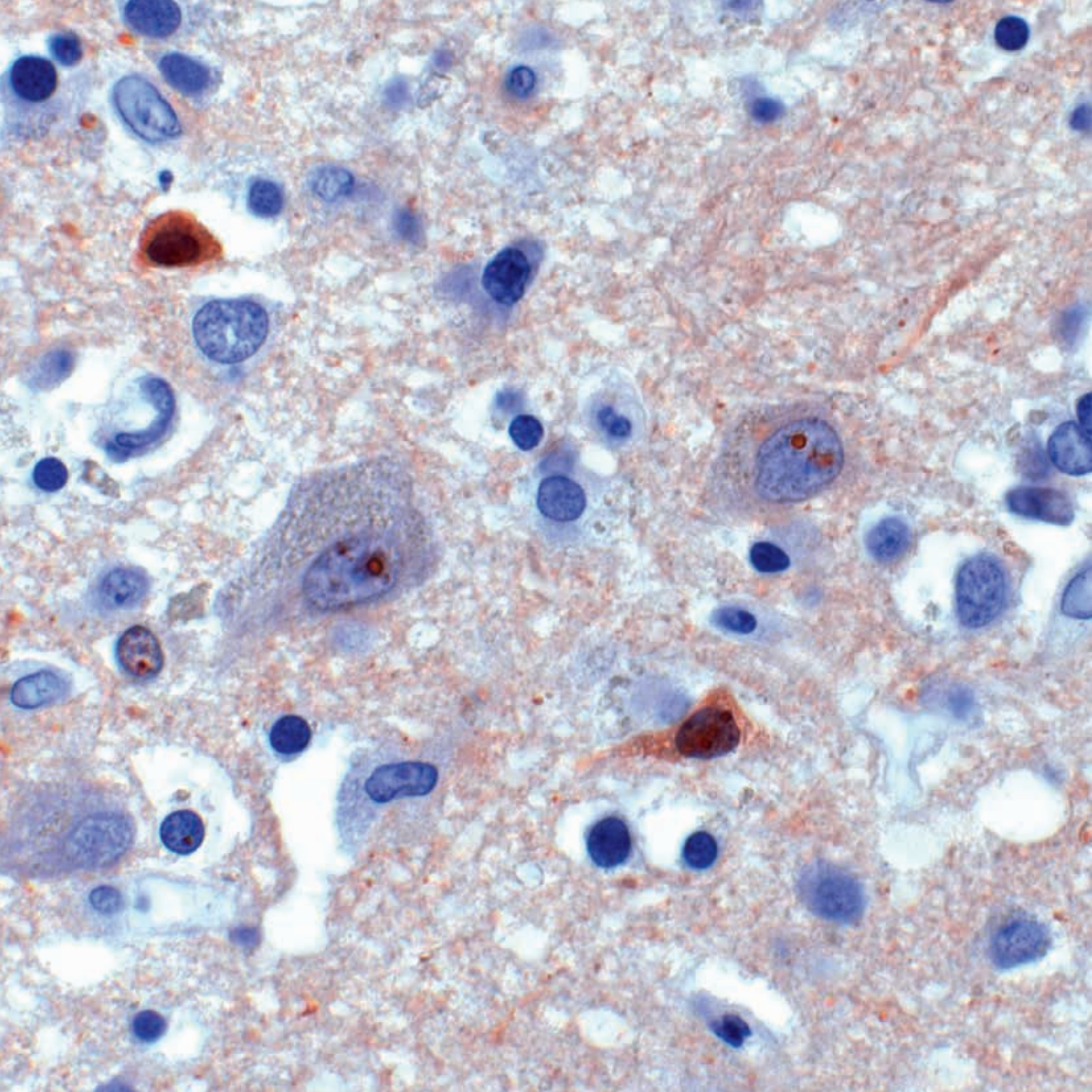
the fingertip) than in venous blood. This not only makes it easier to take blood samples, but also increases sensitivity at the same time. In this respect, this work makes an important contribution to improving the diagnosis of filariae and to the safety of drug therapy for filariasis.

*Mischlinger J et al., PLoS Negl Trop Dis 2021
Aug16;18(8):e0009b23*

Johannes Mischlinger, Rella Zoleko Manego, Ghyslain Mombo-Ngoma, Dorothea Ekoka Mbassi, Nina Hackbarth, Franck-Aurelien Ekoka Mbassi, Saskia Davi, Mirjam Groger and Michael Ramharter, as well as external cooperation partners (see publication).

Figure: Taking blood samples from the fingertip.





The needle in the haystack

THE SEARCH FOR BORNA VIRUS INFECTIONS

Brain inflammation (encephalitis) caused by bornaviruses is a rare but very serious and in most cases fatal infection. The disease is caused by the exotic variegated squirrel borna virus 1 (VSBV-1) and the Borna disease virus (BoDV-1). BoDV-1 is endemic in parts of Germany.

After several awareness and information campaigns, we conducted a nationwide study which investigated bornaviruses as the cause of acute and previously unclear brain inflammations. Out of 103 unclear cases, we detected an infection by VSBV-1 in a north German zoo animal keeper with previous contact to exotic squirrels and three infections by BoDV-1 in an endemic area in southern Germany.

So far, the transmission routes of the viruses and therapeutic approaches are still unclear. However, the laboratory tests – as a basic requirement for future treatment approaches –

are well suited to establish quick and accurate diagnoses. Physicians should employ these laboratory tests if there are clinical and epidemiological suspicions, such as contact with exotic variegated squirrels or staying in areas where the virus is endemic.

Eisermann P et al., Emerg Infect Dis 2021 May;27(5):1371-1379

Philip Eisermann, Dániel Cadar, Corinna Thomé-Bolduan, Petra Eggert, Alexander Schlaphof, Jonas Schmidt-Chanasit and Dennis Tappe, as well as external cooperation partners (see publication).

Figure: Borna viruses in neural tissue (infected cells shown in brown).





POPULATION

Which infections are relevant and where do they occur?

For many infectious diseases, knowledge about the distribution, transmission routes and risk factors of the pathogens is incomplete. This makes it difficult to develop cost-effective, non-drug interventions, which are urgently needed, especially in the countries of the Global South.

In this research section, the groups carry out epidemiological projects and create infection models to study and predict the spread of pathogens or their carriers (vectors such as mosquitoes and ticks) and factors that influence transmission and disease.

Clinical and epidemiological studies are only possible in close collaboration with cooperation partners in African countries, as has long been the case with the *Kumasi Centre for Collaborative Research in Tropical Medicine* (KCCR), the *Irrua Specialist Teaching Hospital* (ISTH) or the *Centre de Recherches Médicales de Lambaréné* (CERMEL). Further research projects are taking place in Tanzania, Madagascar and São Tomé, among other places.



So far, about 50 species of mosquitoes have been found in Germany. Especially the so-called “house mosquitoes” such as *Culex pipiens* biotype *pipiens*, *Culex pipiens* biotype *molestus*, and *Culex torrentium* are widespread. We already know that mosquitoes of the *Culex* genus are transmitting West Nile virus and Usutu virus in Germany.

In another study, we investigated endemic and invasive mosquitoes of the *Aedes* and *Culex* genus in Germany and demonstrated that, in Germany, the Sindbis virus can also be transmitted by mosquitoes. This was possible with all four temperature profiles investigated. Mosquitoes can therefore transmit this virus at tropical but also at moderate temperatures, such as those which prevail in Germany.

The Sindbis virus is zoonotic and circulates mainly between birds and mosquitoes.

However, it is transmissible to humans and can lead to arthritic disease. In order to be able to warn in good time of the possible spread of arbovirus diseases, we must continue investigating the vector competence of native species – i.e. their ability to transmit certain viruses.

Jansen S et al., Viruses 2022 Nov 26;14(12):2644

Stephanie Jansen, Renke Lühken, Michelle Helms, Sandra Oerther, Jonas Schmidt-Chanasit and Anna Heitmann, as well as external cooperation partners (see publication).

Figure: Work in a high security insectary to study vector competence of mosquitoes.





An extensive pedigree

DEGREES OF RELATIONSHIP BETWEEN MOSQUITOES AND TICKS

A variety of arthropods, such as insects and arachnids, are vectors of arboviruses (arthropod-transmitted viruses.) As vectors, they have played a central role in the evolution of these viruses and have influenced the family tree of the viruses.

To better understand the evolutionary history of arboviruses, we sequenced the entire genetic material of certain ticks, including their viruses. The ticks came from mammalian and avian hosts in the Danube delta. We identified a new virus species, the Sulina virus, in *Ixodes ricinus* ticks. The more in-depth phylogenetic analyses allowed us to assign the new virus to the Orthonairovirus genus. The most well-known orthonairovirus is the Crimean-Congo hemorrhagic fever virus (CCHFV), the most dangerous tick-borne arbovirus. We are continuing to investigate the human medical significance of the closely related Sulina virus.

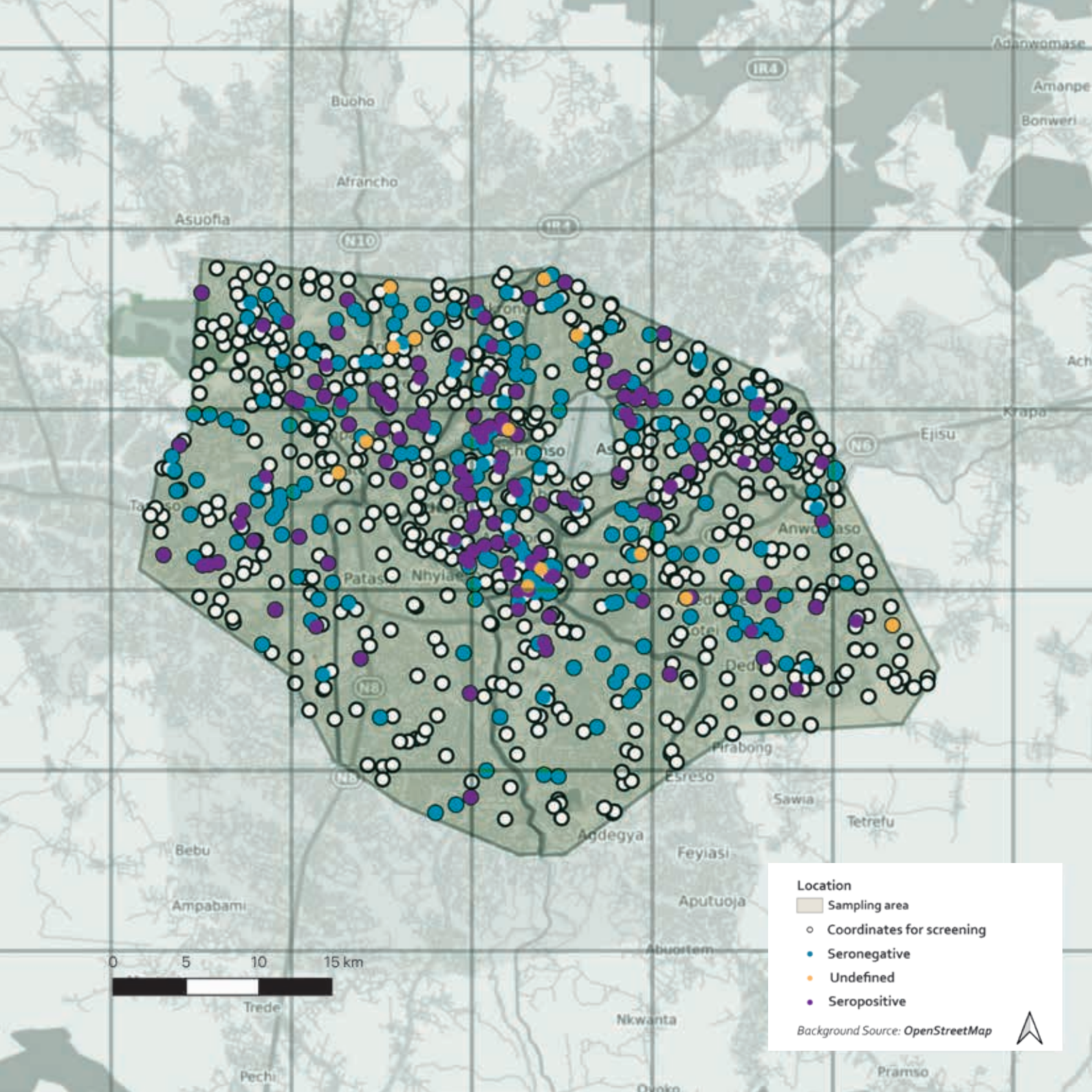
Thus, research into the relationships between novel and known viruses not only answers fundamental questions about evolution, diversity and ecology, but also helps us to better assess the potential of these viruses as relevant pathogens.

Tomazatos A et al., *Infect Genet Evol* 2021
Mar;88:104704

Alexandru Tomazatos, Ronald von Possel, Neele Pekarek, Tobias Holm, Toni Rieger, Heike Baum, Alexandra Bialonski, Iulia Maranda, Renke Lühken, Stephanie Jansen, Petra Emmerich, Dániel Cadar and Jonas Schmidt-Chanasit, as well as external cooperation partners (see publication).

Figure: *Ixodes-ricinus* tick.





Location

- Sampling area
- Coordinates for screening
- Seronegative
- Undefined
- Seropositive

Background Source: *OpenStreetMap*



Truth or deception?

THE SARS-COV-2-INFECTION RATE IN SUB-SAHARAN AFRICA

The direct health consequences of the COVID-19 pandemic appeared to be less severe in much of sub-Saharan Africa than in other regions of the world. Whether fewer people were infected or many infected people remained asymptomatic was difficult to assess. Moreover, there was a lack of reliable data from many countries on the infection rate and incidence of illness.

In order to estimate the frequency of SARS-CoV-2 infections, between February and June 2021 we collected data on the amount of specific antibodies in the blood (seroprevalence) of residents in four regions in Burkina Faso, Madagascar and Ghana in a two-stage, population-based study. In over 2,000 households, we carried out an IgG antibody detection with a specially-developed SARS-CoV-2 test. We then determined the seroprevalence using a logistic Bayesian regression model, taking into account the test performance, age, gender and residential area of the participants.

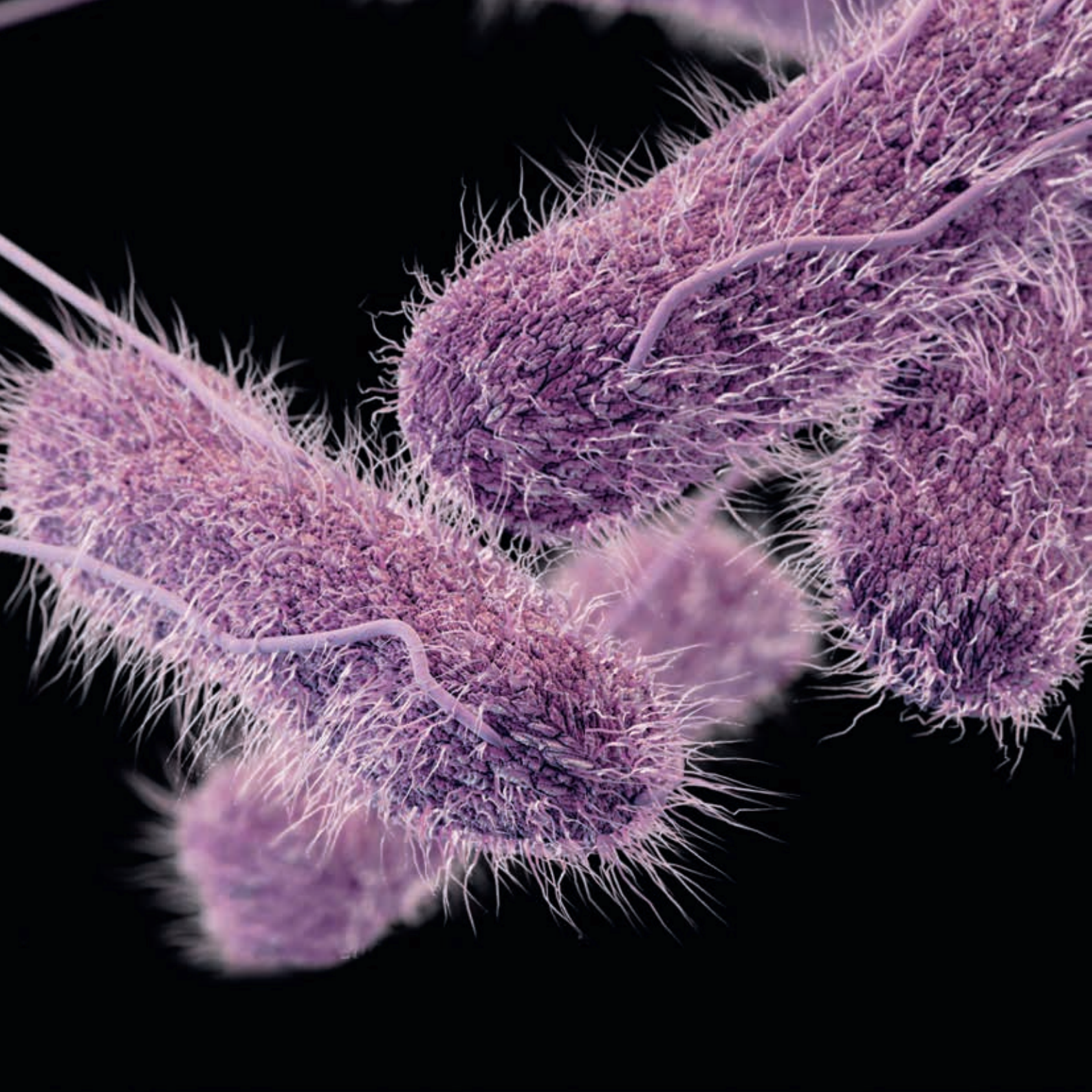
In the areas examined, one-third to one-half of the population had already been infected at least once with SARS-CoV-2 by the beginning of June – so part of the truth lies here. However, herd immunity had not yet been achieved at this point. Surprisingly, very few of those previously infected reported any symptoms.

Struck N et al., BMC Public Health 2022 Sep 5;22(1):1676

Nicole Gilberger, Eva Lorenz, Christina Deschermeier, Wibke Loag, Jenny Kettenbeil, Oumou Maïga-Ascofaré, Christa Ehmen, Ben Ruston, Daniela Fusco, Yannick Höppner, John Amuasi and Jürgen May as well as external cooperation partners (see publication).

Figure: Kumasi study site and seropositivity.





Together we are strong

THE THREAT POSED BY ANTIBIOTIC RESISTANCE IN SUB-SAHARAN AFRICA

Antimicrobial resistance (AMR) is a global health threat. Reliable estimates of global distribution are only possible with data from large networks. In a study by the “*Antimicrobial Resistance Collaborators*”, the most comprehensive systematic analysis to date was conducted.

The loss of disability-adjusted life years (DALYs) attributable to bacterial AMR was analyzed for 2019: for 23 pathogens, 88 pathogen-drug combinations, and 204 countries. In total, the consortium examined 471 million individual data sets or isolates.

The predictive statistical models estimate five million deaths in 2019 related to bacterial AMR. Staphylococci alone with resistance to the simplest antibiotics (methicillin-resistant *Staphylococcus aureus*, MRSA) caused more than 100,000 deaths. The mortality rate from antibiotic resistance was highest in western

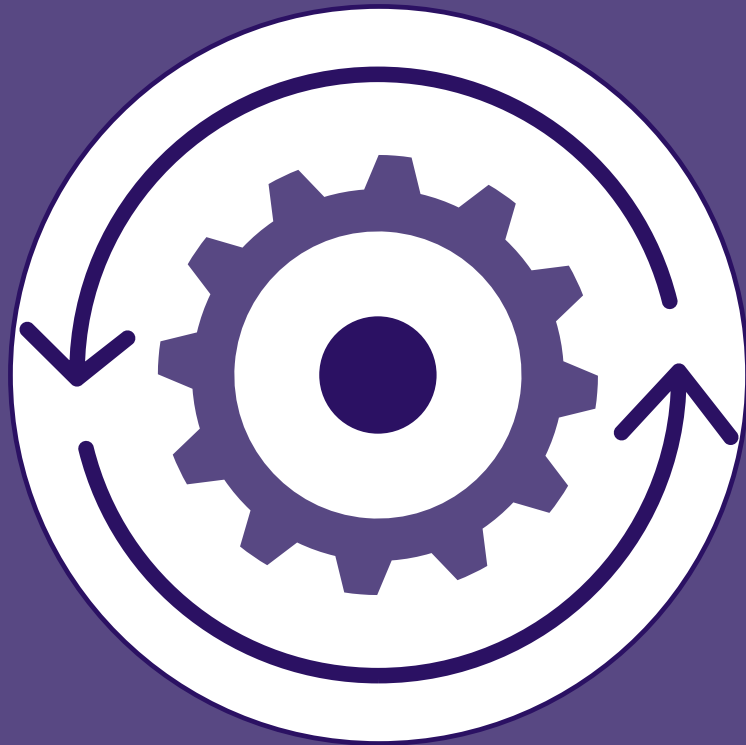
sub-Saharan Africa, with 27 deaths per 100,000. The data show that antibiotic resistance is a leading cause of death worldwide, with the heaviest burden in low-income countries where data collection is also the poorest. Laboratory capacities and data collection must be urgently expanded there.

Antimicrobial Resistance Collaborators, Lancet 2022, Feb12; 399(10325): 629-655

Jürgen May, Denise Dekker, Ralf Krumkamp, Daniel Eibach, John Amuasi and external cooperation partners (see publication).

Figure: Antibiotic-resistant salmonella of the Typhi serotype.





IMPLEMENTATION

How do interventions work under real-world conditions?

The newly created research section investigates how on-site interventions can be applied most efficiently, especially considering economic, communication and social science aspects. For instance, the healthcare system can only successfully contain or – at best – prevent Ebola outbreaks with the help of the acceptance and trust of its own population, supported by effective drug developments.

This also applies to the increasing anti-microbial resistance (AMR) worldwide. The research groups at the BNITM are working here in a highly interdisciplinary way to optimize the implementation of measures for promoting health and combatting infectious diseases.



Globally, bacteria of the genus *Campylobacter* are widespread and among the most common pathogens of diarrhea, particularly in small children and immunocompromised individuals. *Campylobacteriosis* can lead to serious infections and complications and often requires antibiotic treatment. However, antibiotic resistance to commonly used antibiotics is increasing worldwide.

This is also the case with *Campylobacter*: Farm animals (such as poultry, cattle and pigs), along with wild birds, are the main reservoirs of *Campylobacter*. Transmission to humans usually occurs through contaminated food such as inadequately cooked chicken.

In a study in rural Ghana, we showed that in livestock, 20% of the animals tested were *Campylobacter* positive. Up to 23% of the bacterial isolates were resistant to three or more groups of antibiotics (multidrug-resistance). The highest resistance seen was to

ciprofloxacin (67%), the drug of choice in Ghana. Hence, ciprofloxacin is not recommended any longer for the treatment of such infections in this part of the world. This study is an example of many resistant pathogens that are becoming increasingly dangerous in Africa. Therefore, it is crucial to include One-Health concepts in research and prevention efforts in the future. Because the health of the environment, animals, and humans is equally significant

*Paintsil E et al., Front. Microbiol. 2022.10.3389/
fmicb.2022.983047*

Anna Jaeger, Ralf Krumkamp, Maike Lamshöft, Denise Dekker and Jürgen May, as well as external cooperation partners (see publication).

Figure: Chickens are being screened for resistant bacteria in rural Ghana by researchers from BNITM and KCCR.





がしウマ抗毒素

平成11年度の厚生科学研究費「健康
の開発・備蓄システムの開発に
試験製造したものである。製
市販品の「乾燥まむしウマ抗毒
素」等と同様に生物学的製剤基
本剤は研究班で試験製造したも
やむを得ない場合を除きそ
なお、緊急時などで本剤を
用いても、その使用にかかる
費用は医師において取られるもの
とする。

製造年月日 2000. 9. 11

Shelf life is relative

EXPIRED ANTIVENOM SAVES LIVES OF SNAKEBITE VICTIMS

Antiveniom is the essential medicine for treatment of snakebite envenoming. Production is complex and expensive. Several publications from Japan, the US and Australia have shown that antivenom remains stable and effective in freeze-dried (lyophilized) form for up to 20 years and probably even longer. However, the shelf-life is usually limited to five years.

In 2020, there was an acute shortage of antivenom in Laos due to production and supply problems in Thailand. In this emergency situation, only lyophilized antivenom that had exceeded the expiry date by two to sixty months was available. After their use had been approved, 31 patients with life-threatening envenoming by vipers who had been accordingly informed were treated with these antivenoms. Efficacy and tolerability were very good and no unexpected adverse reactions occurred.

Lyophilized antivenoms are therefore stable, effective and safe to use for much longer than indicated by the expiry date. The shelf-life of these expensive and limited drugs needs to be reconsidered and extended in case of life-threatening envenoming.

Blessmann J et al., Trop Med Int Health 2023 Jan;28(1):64-70 (Epub 2022 Dec)

Jörg Blessmann and Benno Kreuels, as well as external cooperation partners (see publication).

Figure: Lyophilized antivenom manufactured in Japan in 2000. It has no expiration date and can still be used effectively and safely today



Stop Ebola !

**J'accepte
la vaccination
pour stopper Ebola**



airtel
money

airtel
money



The recent Ebola outbreaks in West Africa (2021) and eastern Congo (2022) appear to be linked to previous outbreaks in the region. Contrary to what is assumed, the Ebola virus can persist in the bodies of survivors for years and even give rise to a resurgence of Ebola outbreaks (see page 23). Resurgences constitute a paradigm shift in Ebola research with far-reaching consequences: survivors have to reckon with stigmatization and exclusion even more than before, something which is also fueled by a deep-seated distrust of aid organizations.

Using medical anthropological research methods, our research group has researched how the prevailing atmosphere (of mistrust of aid organizations) originated: The spread of the slogan *“Ebola is a business”* fueled this. Do the organizations only look at the profits? The mistrust divided the community that was supposed to be protecting the people affected.

Any commitment to social engagement will be ineffective if there is a lack of good information. To create an atmosphere of trust, it is important to learn from those affected and from their experiences. Which participatory approaches strengthen society’s resilience so that a sustainable contribution is made to pandemic preparedness? In the new *“Motile Outbreaks”* research project, we will be addressing this very issue.

Park S-J et al., Critical Public Health, 33:3, 297-307

Kennedy Muhindo Wema, Sung-Joon Park, and external cooperation partners (see publication).

Figure: Vaccination poster in Goma during the 2019 Ebola epidemic in eastern Congo.





NATIONAL COLLABORATIONS



German Center for Infection Research

The German Center for Infection Research (DZIF) brings together 35 research institutions and has the overarching goal of pooling expertise throughout Germany to transfer results from basic infectiology research through clinical research to patient therapy.

The BNITM is a founding member and remains an active partner. The BNITM focuses on the DZIF research areas of “Emerging infectious diseases” and “Malaria and neglected tropical diseases”, which the BNITM coordinates. The “African Partner Institutions” infrastructure is also integrated here. The Hamburg-Lübeck-Borstel-Riems location is coordinated jointly with the UKE.

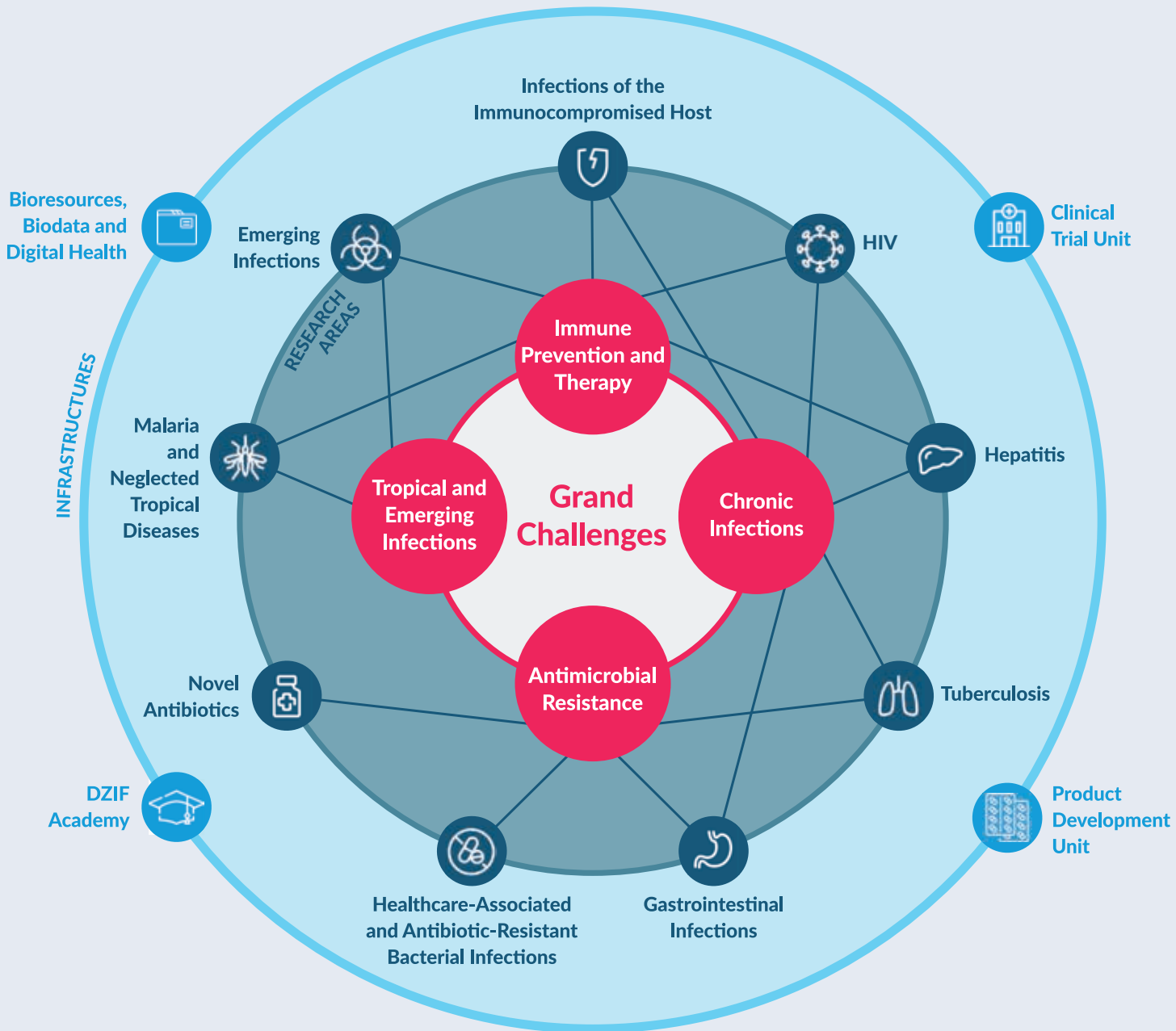
The BNITM hosts three DZIF research groups:

Dr. Beatriz Escudero-Pérez has been leading a DZIF Junior Research Group since 2021 in the field of **“Clinical management, epidemiology and immunology of emerging infections”**. The group investigates the role of the host’s immune reaction upon exposure to emerging zoonotic viruses in relevant animal models and in clinical trials in Africa.

In the field of **“Malaria and Neglected Tropical Diseases”**, Dr. Ralf Krumkamp heads the DZIF Research

Group **“Mathematical Models and Biostatistics”**. The group helps scientists with bioinformatic methods to describe the course of malaria infections, their spread and the human immune reaction in more detail. Mathematical models can estimate transmission dynamics and the effectiveness of control measures.

Professor Esther Schnettler is deputy site spokesperson and has held a DZIF professorship since 2016. She also manages the **“Division for the surveillance of arthropods and arthropod-borne pathogen”** infrastructure. Here, tests are being carried out in collaboration with international groups to determine and contain the risk of outbreaks caused by insect-borne viruses. In addition, vaccine and antiviral drug candidates are to be tested for efficacy in a “natural” transmission model.





CSSB Centre for Structural Systems Biology

The BNITM research groups have been working in the laboratories of the Center for Structural Systems Biology (CSSB) since 2018. This is located on the premises of the German Electron Synchrotron (DESY) in Hamburg-Bahrenfeld. This high-tech institute with more than 2,000 m² of laboratory space was completed in 2017, based on the design of the Hammes and Krause group of architects. It pursues the concept of a modern research institute with galleries and communication areas that can be experienced on every floor.

Infection biology is the focus of research at this multi-institutional center: The causes and effects of pathogens are examined here at the molecular level. The goal is to contribute to the development of novel therapeutics and better treatment options for infectious diseases. Unique in the German research environment, the CSSB brings together research groups from three university institutions* and seven extra-university institutions** under one roof. These research groups have access to central research platforms such as cryo-electron microscopy, optical microscopy, protein production and protein crystallization. They help to elucidate the molecular interplay between pathogens and host cells. The close connec-

tion to the partner institutions and DESY's unique infrastructures is vital.

BNITM and CSSB research highlights:

The research groups led by Prof. Tim Gilberger (CSSB / BNITM) and Prof. Gerry Wright (McMaster University in Hamilton, Canada) succeeded in obtaining an extremely effective malaria parasite inhibitor from soil bacteria: The PDE-I₂ molecule, which is significantly less toxic to human cells than conventional drugs, yet also selectively and efficiently kills malaria parasites (see page 19).

The research groups led by Dr. Maria Rosenthal (BNITM) and EMBL Grenoble, as well as the LIV / UHH laboratory at CSSB succeeded in deciphering the mechanism of an octopus-like virus replication machinery: They examined nine structures of an essential Lassa virus protein in different functional states. The protein is necessary for virus replication and so offers excellent targets for antiviral agents (see page 21).

* University of Hamburg (UHH), the University Medical Center Hamburg-Eppendorf (UKE), and Hannover Medical School (MHH)

** The Bernhard Nocht Institute for Tropical Medicine (BNITM), the German Electron Synchrotron (DESY), the Leibniz Institute of Virology (LIV), the Borstel Research Center (FZB), the Jülich Research Center (FZJ), the Helmholtz Center for Infection Research (HZI) and the European Molecular Biology Laboratory (EMBL)

The BNITM, the Leibniz Institute for Virology (LIV) and the Borstel Research Center, Leibniz Lung Center (FZB) complement each other excellently in terms of research of globally significant infectious diseases like tuberculosis, HIV/AIDS or malaria. In 2005 the three institutes founded the "Leibniz Center Infection" (LCI).

The LCI network strengthens regional competencies and thus the topic of "infection research" in the Hamburg metropolitan region in the long term, especially working together with the University Medical Center Hamburg-Eppendorf (UKE), with the MIN Faculty of the University of Hamburg (UHH) and with other faculties of the UHH.

The research network organizes an annual international symposium dedicated to a current topic in infection research. Furthermore, the LCI maintains its own graduate school (Leibniz Graduate School "Infections") with around 100 doctoral students; including doctoral students with LCI scholarships. Scholarship holders are supervised by two Principal Investigators out of the three LCI institutes, thereby strengthening the cooperation between the LIV, FZB and BNITM.

Scholarships with BNITM 2021 / 2022:

"Characterization of the immunomodulatory and inflammatory effects of extracellular vesicles secreted by human brain endothelial cells during Plasmodium falciparum infection using next generation sequencing and CRISPR-Cas9 technologies".

PI: Dr. Nahla Metwally (BNITM) /

Prof. Holger Heine (FZB)

"PATHOgenesis in LUNGs upon Nipah virus infection (PATHOLUNG)"

PI: Dr. Beatriz Escudero Pérez (BNITM) /

Dr. Tobias Dallenga (FZB)

"Hormonal effects on Mycobacterium tuberculosis-infected human macrophages"

PI: Dr. Bianca Schneider (FZB) /

Dr. Julie Sellau (BNITM)

"Global profiling of susceptibility factors across flaviviruses in mosquitoes"

PI: Dr. Pietro Scaturro (LIV) /

Prof. Jonas Schmidt-Chanasit (BNITM)



University Medical Center Hamburg-Eppendorf

The close connection between the BNITM and the Medical Faculty of the University of Hamburg-Eppendorf, the UKE, has grown historically. A cooperation agreement between the UKE and the BNITM has existed since 1998. And since 1993, the number of tropical medicine chairs at the Faculty of Medicine has increased to two C4 professorships (parasitology and clinical research) and one W3 professorship for epidemiology of tropical diseases. In addition, two other BNITM staff members are associate professors and four staff members are private lecturers with teaching responsibilities at the Faculty of Medicine. In 2006, the UKE took over the clinical department of the BNITM and has since also operated the Bernhard Nocht Outpatient Clinic, which, however, is still located in the BNITM building. UKE and BNITM tropical medicine specialists offer competent travel advice and examinations for returning travelers.

The associated UKE department “Clinical Infection Immunology” at the BNITM headed by Prof. Marylyn Addo researches and develops vaccine strategies for infections with emerging and re-emerging viruses such as the Ebola virus, SARS-CoV-2 or the Middle

Eastern Respiratory Syndrome (MERS) coronavirus and other clinically relevant viruses, including the HIV and hepatitis B virus.

Since 2009, the BNITM has contributed two projects on liver involvement in malaria and amebiasis to the UKE Collaborative Research Center (SFB) 841 “Liver Inflammation-Infection, Immune Regulation and Consequences”. Since 2021, the UKE and BNITM have received DFG research funding worth €4.5 million to study “gender-specific differences in immune responses,” including in infectious diseases. In the future, it should be possible to consider individual gender-specific therapy for patients in advance.



Prof. Marylyn Addo, Director of the Institute for Infection Research and Vaccine Development at the UKE, in the BNITM research laboratory.



Tropical Medicine at the Bundeswehr Joint Medical Service

Although the last two years have been dominated by the corona pandemic, we have been able to achieve and maintain a great deal together. FbTropMed-Inf staff assisted in ensuring basic care for tropical returnees and travelers and in immunization campaigns. Despite Corona, the tropical dermatological consultation hours were still very popular. We also continued providing assistance in conducting BNITM virology studies, and speakers from FbTropMed and the Bundeswehr Hospital Hamburg were, as usual, involved in the "Diploma Course on Tropical Medicine" and the "Basic Travel Medicine Seminar". The "Barrier

Nursing" training course was further developed and a joint transfer exercise took place with the treatment center for high-risk infections at the UKE and the Hamburg Fire Department. We continued the joint methodological and epidemiological evaluations and further developments of tropical microbiological special diagnostics and entomology in close cooperation with researchers from the BNITM, which included entomological training in Gabon. The "Third Symposium on Tropical Medicine and Infectious Diseases in an International Military Context" in September 2022 took up this spirit of "Together and with each other" once again, offering a multinational platform for cooperative care and professional, collegial and academic exchange.



The clinical staff of the Department of Tropical Medicine/Infectious Diseases (from left to right: Petty Officer 2nd class Biemann, Master Sergeant Speer, Lt. Colonel (MC) Dr. Vanegas, Chief Petty Officer Lindenberg, Major (MC) Dr. Feischen, Lt. Colonel (MC) Halter and Lt. Colonel (MC) Dr. Wiemer)



INTERNATIONAL COLLABORATIONS



Drone view of the KCCR taken in 2022



The Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR)

was established in 1997 as a joint venture between the Ghanaian Ministry of Health (MoH), the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi,

Ghana, and the Bernhard Nocht Institute for Tropical Medicine in Hamburg, Germany. It serves as a location for research and training as well as for multidisciplinary collaboration with national and international partners. The KCCR is a research center associated with the *College of Health Sciences* and is located on the KNUST campus.

25th anniversary of KCCR

On 29 November 2022 the KCCR celebrated its 25th anniversary. The grand ceremony brought together personalities such as His Majesty Otumfuo Osei-Tutu II, King of the Ashanti and Vice Chancellor of KNUST, the German Ambassador to Ghana, His Excellency Daniel Krull, WHO Country Representative Dr. Francis Kasolo, the Dean of the UKE Prof. Blanche Schwappach-Pignataro, the Chair of the DZIF Prof. Dirk Busch, as well as Prof. Bernhard Fleischer, Prof. Rolf Horstmann, Prof. Egbert Tannich (all former heads of the BNITM) and Prof. Jürgen May (Chairman of the BNITM) and more than 60 dignitaries and collaborating scientists from Africa and Europe.



The 25th anniversary of the KCCR in Kumasi

Infrastructure

The KCCR has laboratories for molecular biology, immunology, parasitology and bacteriology. In order to be better prepared for future disease outbreaks, a new part of the building with biosafety level 2 and 3 laboratories was constructed in 2022, including rooms for sequencing and bioinformatics and a bacteriology laboratory. The efficient operation of the new BSL-3 laboratory is secured by a newly installed solar system.



Partner institutions

KCCR and its researchers collaborate with numerous institutions worldwide. Currently, there are collaborations with 116 organizations, 35 of which are in Ghana, 45 in the rest of Africa, and 36 in the global North (Europe, the United Kingdom, and the United States) and Asia.



New laboratory areas: BSL-3 laboratory and sequencing units



Visit by a German delegation to the KCCR

Visibility

Important figures have already paid a visit to the KCCR: the German Ambassador to Ghana, His Excellency Daniel Krull, the Deputy of Mission of the German Embassy in Ghana, Sivine Jansen, Irene Appiah, District Representative of the Free and Hanseatic City of Hamburg, and Armand Zorn, Member of the German parliament for Frankfurt.

Research

The KCCR's research work has made enormous progress in the reporting period.

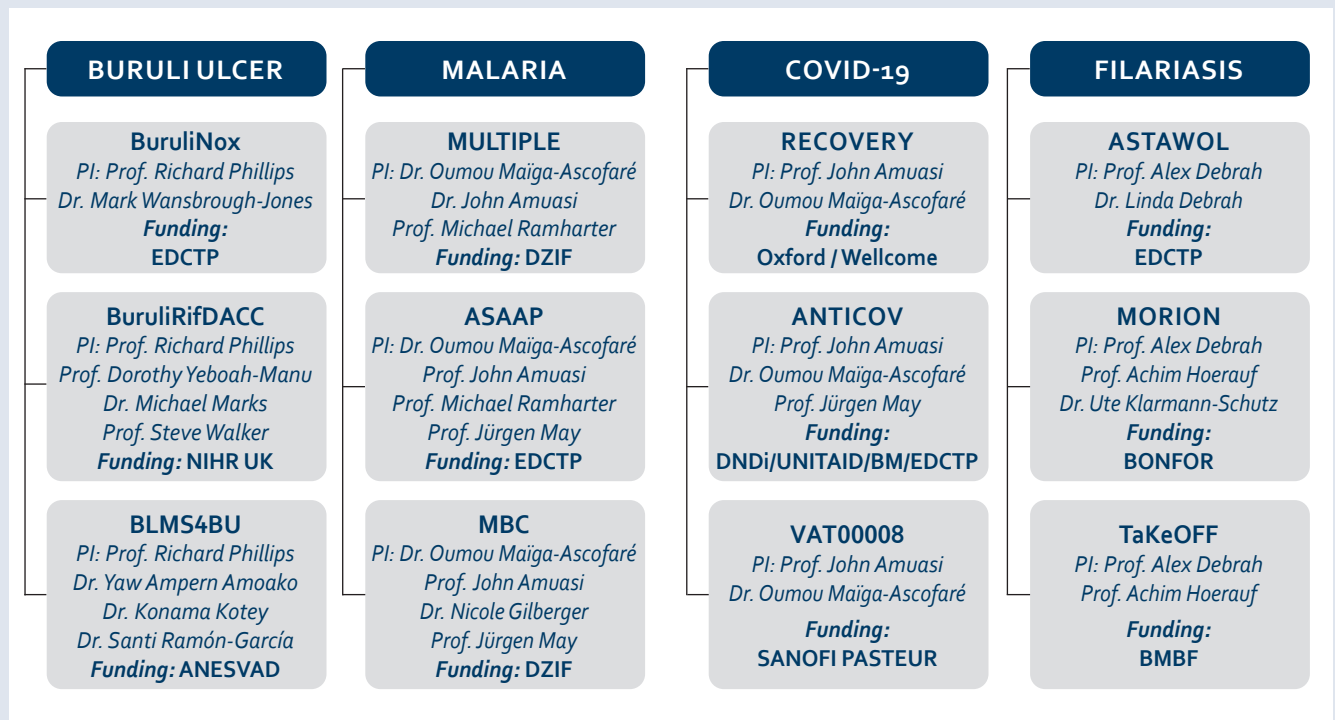
Current research groups are working on the following topics: One Health Topics, Molecular Diagnostics, Clinical Studies, Infectious Disease Epidemiology, Infectious Disease Immunology, Entomology and Vector Biology, Bioinformatics and *Computational Biology*. Diseases in focus include neglected and poverty-related infectious diseases such as malaria, bacterial infections, schistosomiasis, Buruli ulcer, filariasis, onchocerciasis and tropical skin diseases.

Education of postgraduates (PhD and MPhil/MSc)

Training and capacity building have now established themselves as significant elements of the KCCR. Of 28 PhDs at KCCR, four graduated in 2021-2022. An additional 40 PhDs are in continuing education. Twenty-eight of 74 master's students at the KCCR completed their studies in the period 2021-2022.

SEEG deployment

In September 2021, a team from the (German) "Epidemic Preparedness Team" (SEEG) traveled to KCCR to set up COVID-19 sequencing on site. With the help of the office of the the German Society for International Cooperation (GIZ), the Federal Ministry for Economic Cooperation and Development (BMZ) supported the procurement of equipment, while SEEG contributed to the establishment of training and logistics. The team consisted of members of the BNITM, the Friedrich Loeffler Institute (FLI) and Berlin's Charité hospital.





SEEG trainers in action

Laboratory diagnostics service

To manage public health, KCCR established a laboratory diagnostic service for COVID-19 during the reporting period, providing over 130,000 COVID-19 tests to 13 of 16 regions in Ghana (11.9 million people). The KCCR carried out COVID-19 tests both for soccer teams requiring a certificate to participate in sporting events and also for travelers. During a recent outbreak, opportunities to test for **monkeypox viruses**

were created and offered to many Ghanaian health-care facilities. In collaboration with the Ghanaian Health Service and the Directorate of Veterinary Services, **rabies** has also been diagnosed in encephalitis patients in the Ashanti region. **Tuberculosis** and **Buruli ulcer** continue to occur on a widespread basis. The KCCR is a member of the WHO Collaboration Network for the Diagnosis of *Buruli Ulcer*.

TO THE KCCR
WEBSITE





Centre de Recherches Médicales de Lambaréné, Gabon

From 2021 to 2022, there were also a large number of scientific cooperation projects between the BNITM and the *Centre de Recherches Médicales de Lambaréné* (CERMEL) in Gabon. One thematic focus was traditionally on malaria and filaria research, but also, due to the pandemic, on COVID-19 research.

Important joint projects that are ready for publication illustrate these thematic focuses: A multi-center study conducted in five African countries on over 7,000 malaria patients, showed that the malaria drug pyronaridine-artesunate was safe and well tolerated. Moreover, the study results showed that this drug also has good efficacy against *Plasmodium* species that are not so common. Two published projects

dealt with the optimization of filarial diagnostics, another with the symptomatology of the complex filarial disease Loiasis (*Loa loa* filariasis).

It should be emphasized that Prof. Ghyslain Mombombo-Ngoma has taken over the management of the "Drug Implementation Research Group" at BNITM. Previously, he had led the Department of "Clinical Operations" at CERMEL, a role he continues to hold. This institutional dual affiliation makes him an important partner for future research activities and strengthens both the area of implementation research at the BNITM and the connections between BNITM and CERMEL.





Irrua Specialist Teaching Hospital, Edo State, Nigeria



The *Irrua Specialist Teaching Hospital* (ISTH) was established in 1993 and serves as a central hospital for 19 local governmental areas with a population of several million. It is in a region where Lassa fever is highly endemic. In order to actively combat Lassa fever, the ISTH founded the “*Institute of Lassa Fever Research and Control*” in 2007 in close cooperation with the BNITM.

The BNITM Virology Department has been active in Nigeria since then and has set up a modern diagnostics infrastructure for Lassa fever, with which the specialized staff performs up to 4,000 tests annually. Furthermore, a new isolation ward for the treatment of Lassa fever patients was opened in 2010. Since 2018, the ISTH and the BNITM Clinical Research Department have been building capacities for conducting clinical studies in accordance with Good Clinical Practice (GCP) on site. This lays an important foundation for conducting interventional clinical trials on viral hemorrhagic fevers in Nigeria.

The research results of the first pharmacokinetic study on the currently recommended Lassa fever therapy show that the drug, which has been used for decades, does not have a sufficient antiviral effect on the Lassa virus and does not represent an adequate antiviral therapy in this form.



Ukraine: Scientific cooperation in the context of biosafety competence

Our work continues unflinchingly, despite absurd disinformation campaigns: the BNITM has been cooperating with Ukraine since 2016, funded by the German Foreign Office. In August 2022, the team led by Dr. Petra Emmerich trained scientific colleagues from the Public Health Center of Ukraine (PHCU) in Kiev in issues of biosafety and biosecurity as well as in the molecular genetic and serological detection of highly pathogenic BSL-3 and BSL-4 viruses. The delegation attended the German Foreign Office's "Open Day" in Berlin and the "Symposium on Tropical Medicine and Infectious Diseases in an international Military Context" in Hamburg. In addition, it accepted an invitation from the Ukrainian Consul General, Dr. Iryna Tybinka, to visit the Ukrainian independence Day celebrations in the Church of St. Michaelis.

"For a long time it was not clear whether the director of the institute and the head of virology would be able to come despite the acts of war," Dr. Emmerich said. "We will continue to support our Ukrainian colleagues in maintaining the surveillance of infectious diseases during this difficult wartime."



Ukrainian Independence Day celebrations at the St. Michael's Church in Hamburg.

In December, further workshops were held at the BNITM with participants from the Lviv regional laboratory.

The cooperation project "Sustainable strengthening of biosafety skills in dealing with proliferation-critical pathogens in Ukraine" has been so far extended through the end of 2023.

GLOBAL COLLABORATIONS

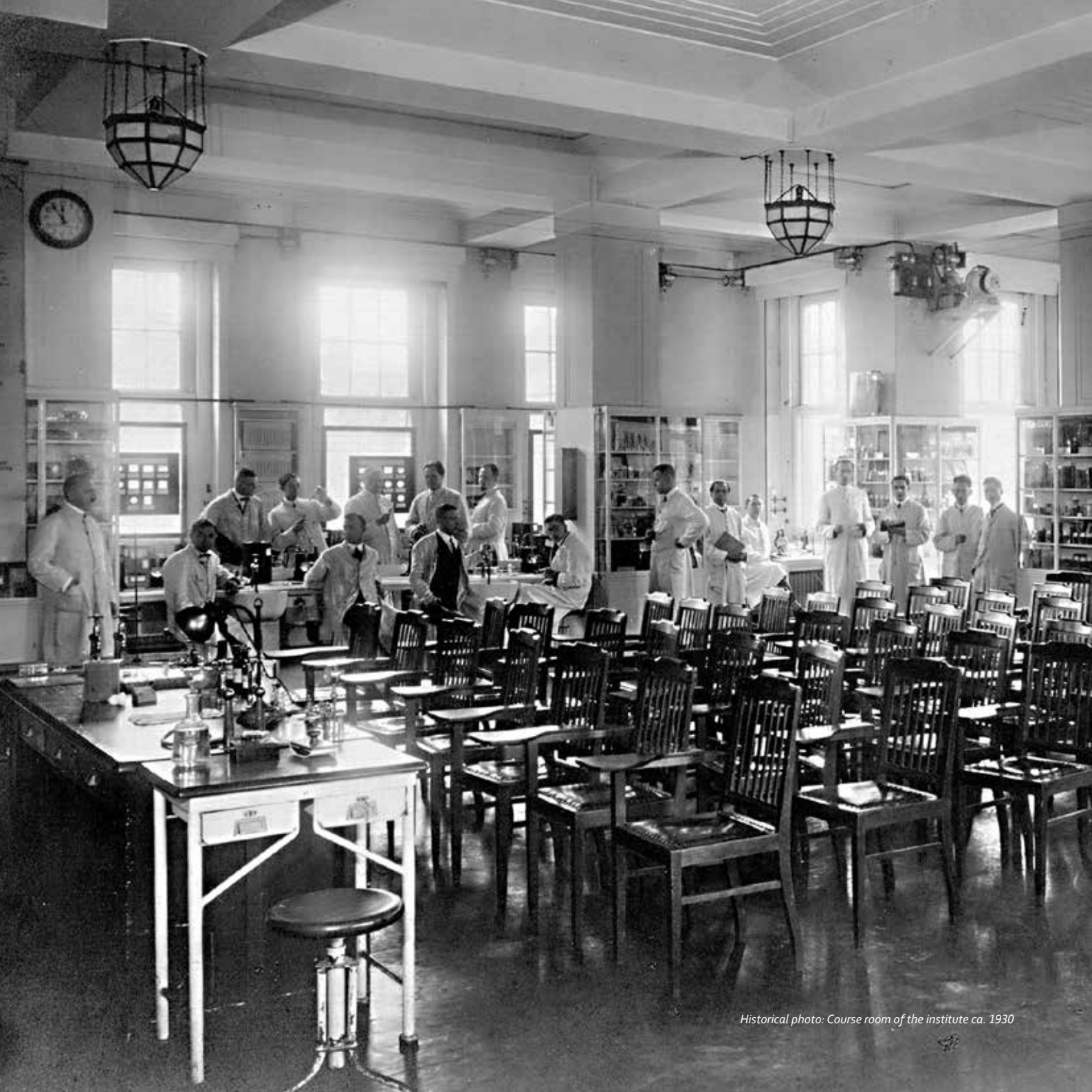


TO THE WEBSITE
OF COOPERATIONS





EDUCATION AND CAPACITY REINFORCEMENT



Historical photo: Course room of the institute ca. 1930

MEDICAL TRAINING AND FURTHER EDUCATION

On 1 October 1900, the Institute for Tropical Medicine was founded under the direction of Bernhard Nocht. The Institute's task was to treat tropical medicine patients, research the diseases involved and provide further education and training for medical professionals. The central component of the training was the diploma course in tropical medicine, which has been held annually since

1905 and has only had to be canceled five times due to wars or pandemics. In the last 16 years alone, around 700 people have received a diploma in tropical medicine. Training continues to be an important endeavor at the institute, and the course offering has grown steadily.

DIPLOMA COURSE IN TROPICAL MEDICINE

The aim of the diploma course is to prepare doctors for work in the tropics and subtropics in accordance with the continuing education regulations of the German medical associations. They need to be able to recognize and treat diseases imported from these regions in travelers and migrants and provide preventive medical advice.

The **central theme** of the course is to present human diseases that are typical of the tropics. Teaching focuses on the pathogenesis, diagnosis, clinic, treatment, epidemiology and prophylaxis of parasitic, bacterial, viral and also non-communicable tropical and travel-related diseases. At the same time, the biology, epidemiology and control of the pathogens are taken into account, as are vector animals and animal reservoirs. 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. Topics of migrant and refugee medicine are also addressed and the basics of occupational medicine in the tropics are taught.

The curriculum is divided into twelve thematic sections. The classification principle follows the taxonomy of the pathogens and is supplemented by insights into the fields of travel, migrant and occupational medicine as well as topics from the *public health* sector. The curriculum consists of approximately 360 hours of lectures plus 60 hours of case discussions, workshops, small group classes and practical exercises that are primarily microscopic-based. During the course, the German reference library for tropical medicine literature at the BNITM is available for self-study. The Diploma Course on Tropical Medicine is recognized by the German Medical Association as part of the continuing education for the additional title of "Tropical Medicine" and by the *American Society of Tropical Medicine and Hygiene* (ASTMH) and was accredited by the Hamburg Medical Association with 512 further training points (2021/2022).

Scientific Lead:

Dr. Benno Kreuels

OTHER COURSES OFFERED

- Basic seminar in travel medicine
- Refresher course on current tropical medicine
- Travel Health Day



Course room of the Institute today



INTERNATIONAL EDUCATION AND TRAINING

Public health threats call for global and international preparedness and effective responses. The BNITM contributes to this through training and capacity-strengthening initiatives, primarily in cooperation with countries of the Global South. These international training courses are primarily developed and organized by the *International Teaching & Capacity Unit* (iTCB, Dept. Infection Epidemiology). The course coordinators use digital, virtual, and face-to-face teaching

and learning methods to teach, for example, Global Health, One Health, epidemiology and infectious disease control, strengthen laboratory and diagnostic capacities, promote international scientific exchange and inform public health policy. Over the last five years, more than 1,500 participants from more than 70 countries have been reached by the international education and capacity-strengthening initiatives of the BNITM's iTCB Unit to strengthen capacities.

tropEd NETWORK FOR EDUCATION IN INTERNATIONAL HEALTH

The BNITM is a member of tropEd, an international higher education network in the field of international and global health, which offers a collaborative master's program. TropEd has established standardized course accreditation and quality assurance procedures. The BNITM was accredited as a tropEd member institute in 2019; the intensive courses EPICID and Lab-SPHERE (see below) were accredited in 2020.

In 2022 BNITM employee Dr. Dewi Ismajani Puradiredja was elected tropEd President by the Network; the tropEd General Assembly in September 2022 was hosted at BNITM.

Scientific Lead:

Dr. Dewi Ismajani Puradiredja

EPIDEMIOLOGY & CONTROL OF INFECTIOUS DISEASES IN OUTBREAK SETTINGS (EPICID)

EPICID is a three-week, internationally advertised intensive course on infectious disease epidemiology with a special focus on outbreak investigations. The course, which has been held annually since 2018, is accredited by the tropEd *Network for Education in International Health*, certified by the Medical Association, and integrated into the UKE PhD program.

Target groups:

The course is aimed at health professionals and experts, as well as PhD and MSc students.

Scientific Lead:

Dr. Dewi Ismajani Puradiredja

GLOBAL PARTNERSHIP INITIATED BIOSECURITY ACADEMIA FOR CONTROLLING HEALTH THREATS (GIBACHT)

GIBACHT is an initiative of the BNITM within the framework of the German Biosecurity Program. In collaboration with the Robert Koch Institute (RKI), the Swiss Tropical and Public Health Institute (Swiss TPH) and the *African Field Epidemiology Network* (AFENET), BNITM has been implementing this supra-regional fellowship program since 2013. Over the last ten years, the GIBACHT program has trained more than 100 participants from over 25 countries as multipliers in the field of biosecurity.

Target groups:

The course is aimed at postgraduate experts in public health from the target regions of Africa, the Middle East, southern and central Asia, as well as eastern Europe.

Scientific Lead:

Dr. Eva Mertens

DIGITAL LEARNING PLATFORM: GERMAN ONLINE PLATFORM FOR BIOSECURITY AND BIOSAFETY (GO4BSB)

GO4BSB is an initiative of the BNITM, in collaboration with the Robert Koch Institute (RKI), the Friedrich-Loeffler-Institut, the Federal Research Institute for Animal Health (FLI), the Bundeswehr Institute for Microbiology (IMB), and the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), within the framework of the German Biosecurity Program. Since 2017, the platform has promoted responsible action and scientific discourse in the life

sciences. More than 950 international users from over 50 countries are currently registered on the platform.

Scientific Lead:

Dr. Dewi Ismajani Puradiredja

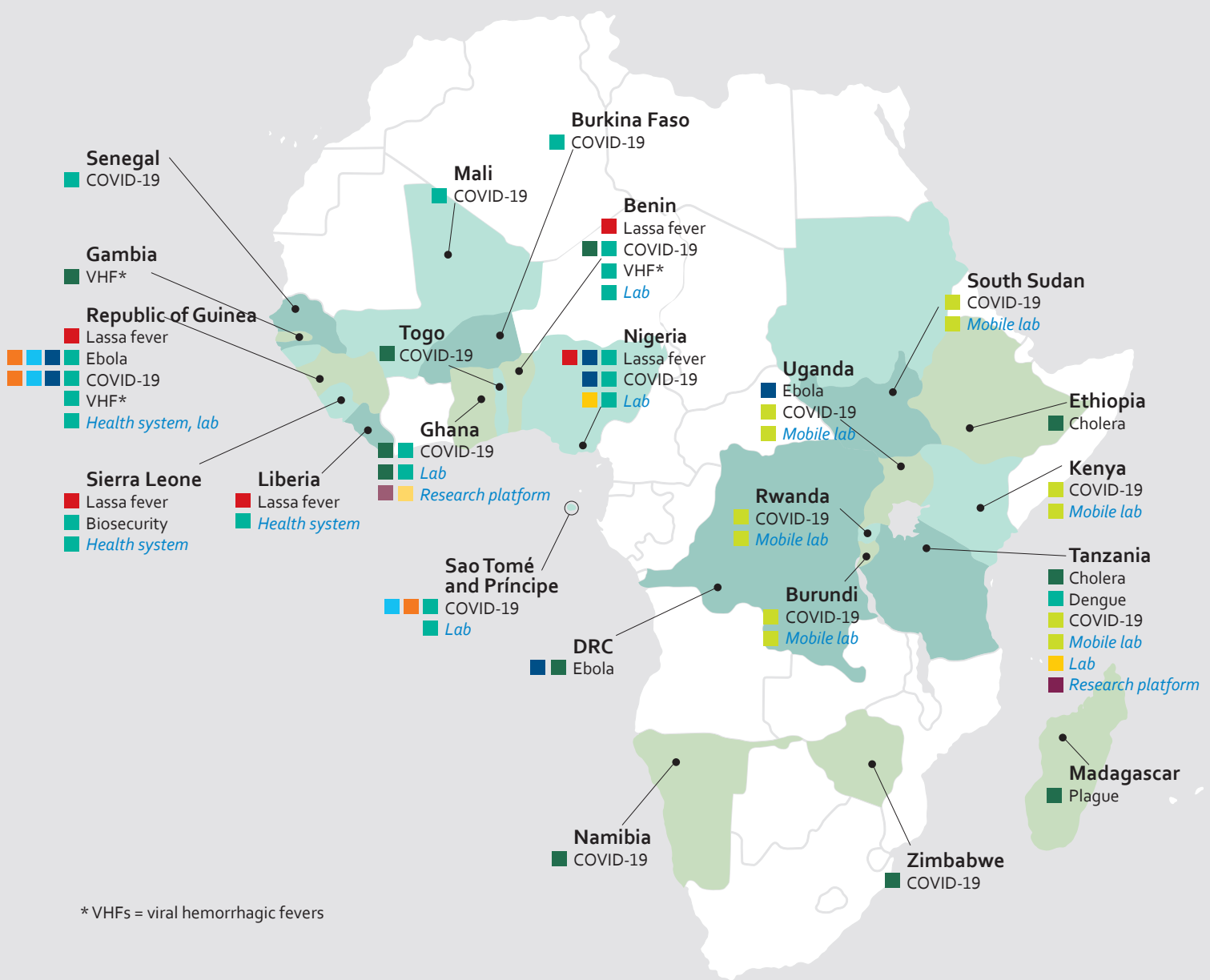
Further information and courses such as *“Laboratory Systems and Public Health in Resource-Limited Settings (Lab-SPHERE)”* can be found here: <https://www.bnitm.de/en/training/courses/international-courses>



OUTBREAK PREPAREDNESS AND RESPONSE

BNITM employees actively participate in outbreak investigations, thus strengthening initiatives to contain infectious disease outbreaks globally: They support on-site research and laboratory diagnostics, and help to monitor and control pathogens with epidemic or pandemic potential, such as SARS-CoV-2. The BNITM initiatives include projects of the *Global Health Protection Program (GHPP)*: ACHES, AfroLabNet, Lassa- Nigeria, ORDER-HC and STp-CoV as well as collaborations

with the *Coalition for Epidemic Preparedness Innovations (CEPI)* and the *African Coalition for Epidemic Research, Response and Training (ALERRT)*. Partner countries are supported through participation in the Global Outbreak Alert and Response Network (WHO GOARN) or the German Epidemic Preparedness run by GIZ (SEEG). Partner countries and institutes in the Global South receive additional support through training and further education in the field of *outbreak preparedness*.



* VHF = viral hemorrhagic fevers





MOBILE LABORATORIES

The aim of the “Mobile Labs” team at BNITM is to strengthen the laboratory capacities of the requesting countries so that they are prepared and able to respond in time to outbreaks of infectious diseases caused by viral pathogens up to risk group 4, such as the Ebola virus. At the same time, the BNITM has one of the world's largest civilian networks for mobile laboratories. To this end a coordination unit has been established at the BNITM.

The Institute has gained more than ten years of experience with field operations in emergency situations by participating in the EMLab (European Mobile Laboratories) network. Over the past two years, nine mobile laboratories have been set up and specialists trained in the six countries of the East African Community (EAC). New laboratories for One Health and antimicrobial resistance are being established.

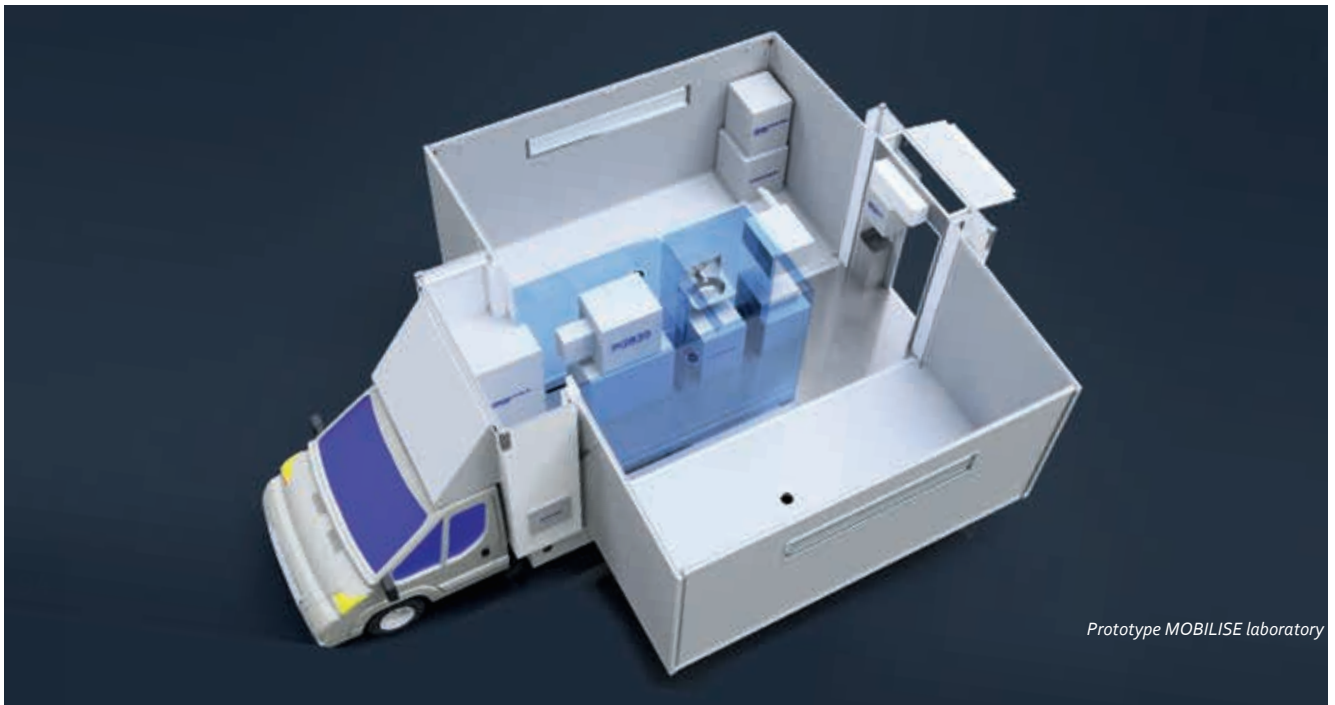
EUROPEAN MOBILE LABORATORIES

The European Mobile Laboratory (EMLab) team responds to disease outbreaks worldwide by using state-of-the-art field laboratories to detect pathogens up to risk group 4, such as the Ebola virus. It provides molecular-based diagnostics, primary clinical care, and viral genomic sequencing capacities. An EMLab is located at the BNITM. It is coordinated by the Department of Virology and managed by the Institute's *Mobile Laboratory Service Unit*. Since its initial deployment in 2014, the EMLab has played an important part in responding to numerous outbreaks, including Ebola, yellow fever, Marburg virus, Lassa fever, and COVID-19. The EMLab has been used in public health emergencies in multiple African

and European countries, including the Republic of Guinea, Liberia, Sierra Leone, Nigeria, Uganda, the Democratic Republic of Congo, Germany, and Greece. EMLab is a partner of the WHO *Global Outbreak Alert and Response Network (GOARN)*, including the *GOARN Rapid Response Mobile Laboratory initiative (RRML)* and is part of the European Civil Protection Pool (ECPP) in Germany. The EMLab network consists of numerous partner institutions and experts from all over the world.

Scientific Lead:

Dr. Sophie Duraffour and Dr. Emily Nelson



Prototype MOBILISE laboratory

EAST AFRICAN COMMUNITY (EAC) MOBILE LABS

The *East African Community*, in collaboration with BNITM, trained 12 “trainers of trainers” and more than 100 laboratory experts in the partner states’ National Public Health Laboratories (NPHLs) of the partner states during the initial phase (2017-2021), and has acquired and handed over nine mobile modular BSL-3/4 laboratories. Now, in the second phase (2021-2024), the existing network is to be supplemented by six truck-mounted BSL-3 container-based labs. These enable on-site bacterial cultures and next-generation sequencing for the effective moni-

toring of drug resistance. In addition, EAC Mobile Lab teams conducted COVID-19 testing at national borders, and coordinated and organized diagnostics during the outbreak of Ebola in Uganda and of Marburg in Tanzania.

Scientific Lead:

Dr. Muna Affara and Dr. Florian Gehre

MOBILISE LABORATORIES

At the end of 2022, the EU’s “MOBILISE” project, funded with €4 million, was launched. The aim of the project is to establish *A novel and green mobile One Health laboratory for (re-)emerging infectious disease outbreaks*, that is able to prepare and analyze samples from humans, as well as from animals and the environment, for molecular diagnostics, serology, and microbiology. Additionally, this prototype mobile lab will be the first to include a novel, next-generation sequencing platform: It should be possible to detect any DNA or RNA virus right at the source before it spreads to humans or animals.

To this end, BNITM is developing a novel, quality-assured, green and mobile *One Health* laboratory solu-

tion together with the Friedrich-Loeffler-Institut (FLI) and other partners from four European countries (MDSC Systems OÜ in Estonia, the Austrian Agency for Health and Food Safety (AGES) and the Austrian Institute of Technology (AIT) in Austria, Red Cross Bucharest and BEIA Consulting in Romania, and the National Public Health Organization and EXUS in Greece). It is green because the MOBILISE laboratories will be powered by solar and wind energy.

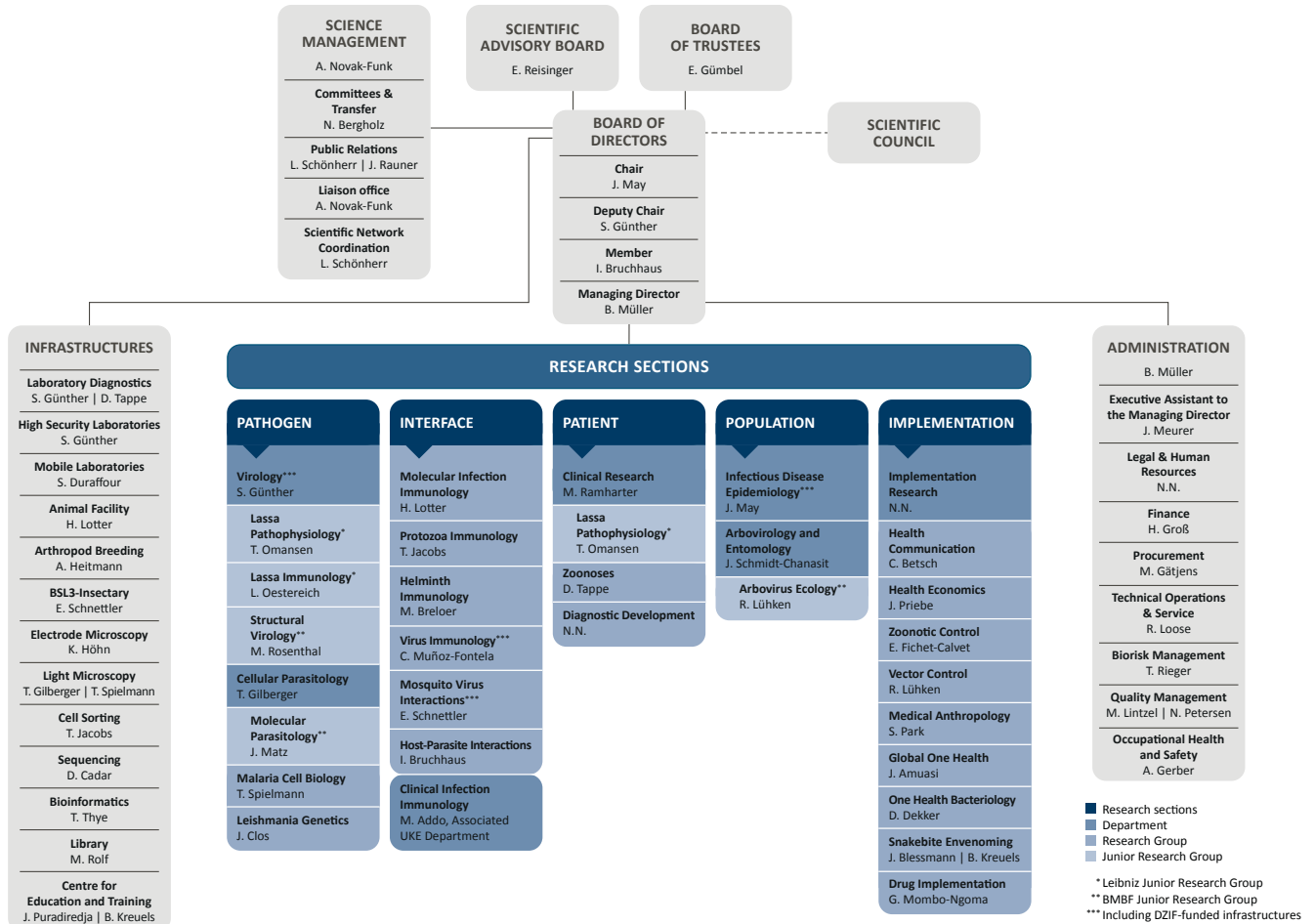
Scientific Lead:

Dr. Florian Gehre and Dr. Muna Affara



FACTS AND FIGURES

ORGANIZATIONAL CHART



Date July 2023



EMPLOYEES

387 employees, including 190 scientists, including doctoral candidates (as of 31 December 2022)

BUDGETARY RESOURCES

	2021	2022
	Million Euro	Million Euro
Institutional Funding	19.0	21.2
Third-party funding	14.5	17.2
Amount passed through to collaborating partners	0.9	3.1
Amount retained at BNITM	13.6	14.0
Additional in-house resources	2.3	2.2
Total funding	35.9	41.1

The institute received third-party funding from the following organizations:

Federal German Foreign Office, Science, Research, Equality and Districts Authority (BWFGB), Bio-X-Change, Blackwell Science, Federal Office for Agriculture and Food (BLE), Federal Ministry of Education and Research (BMBF), Federal Ministry of Food and Agriculture (BMEL), Federal Ministry of Health (BMG), German Federal Institute for Risk Assessment (BfR), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (UBA), Federal Office of Administration (BVA), Charité - Universitätsmedizin Berlin, Center for Structural Systems Biology (CSSB), Claussen-Simon-Stiftung, Coalition for Emergency Preparedness Innovations (CEPI), Coalition for Operational Research on NTDs (COR-NTD), German Academic Exchange Service (DAAD), German Aerospace Center (DLR), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, DAHW - Deutsche Lepra- und Tuberkulosehilfe e.V., Deutsches Elektronen-Synchrotron (DESY), German Research Foundation (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 (FHH), Free and Hanseatic City of Hamburg, FUJIFILM Toyama Chemical Co., Ltd., GeoSentinel Network, German Scholars Organization e. V., Klaus Tschira Boost Funds, Gilead Sciences GmbH, Helmholtz Centre for Infection Research GmbH, Hermes Arzneimittel GmbH, Leibniz Institute for Virology (LIV), FHH, Instand e.V., Institute of Tropical Medicine Antwerp ITM, International Society of Travel Medicine, ISGlobal - Barcelona Institute for Global Health, Joachim Herz Foundation, Jürgen Manchot Foundation, Kirmser Foundation, Klaus Tschira Stiftung gGmbH, "la Caixa" Foundation, Leibniz Association, Borstel Research Center (FZB), London School of Hygiene & Tropical Medicine (LSHTM), National Agency Education for Europe at the German Federal Institute for Vocational Education and Training, Project Management Jülich / Federal Ministry for Economic Affairs and Energy, PT-VDI/VDE/BMBF, Robert Koch Institute (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, University Hospital Hamburg-Eppendorf (UKE), German Environment Agency (UBA), University of Hamburg (UHH), University of Oxford, University Hospital Tübingen (UKT), VW Foundation, WERNER OTTO Foundation, World Health Organization (WHO).

PERFORMANCE INDICATORS

	2021	2022
Publications	255	237
Peer-reviewed journals	246	228
<i>Average impact factor</i>	8.2	12.5
<i>Median impact factor</i>	4.4	5.8
Other journals	9	9
Scientific qualifications		
Bachelor / Master thesis	21	21
Dissertations	14	9
Teaching, training and further education		
University teaching (teaching hours)	636	967
Training and further education events (teaching days)	68	68
Technology transfer (ongoing)		
Patents and licenses	23	29
Invention disclosures	2	1
Laboratory diagnostics (MVZ)¹		
Number of cases	33,834	29,572
Number of tests	62,696	69,404
International cooperations		
Jointly financed third-party funded projects	59	81
KCCR²		
Total projects at KCCR	60	46
Of which external projects	43	33

1 Laboratory diagnostics of the “Medical Care Centre of the Bernhard Nocht Institute for Tropical Medicine GmbH” (MVZ-BNITM GmbH)

2 KCCR
Kumasi Centre for Collaborative Research in Tropical Medicine: Number of projects supervised / number of external projects carried out without BNITM participation.



EU PROJECTS (ONGOING)

Project abbreviation	Funding program	Project goal	Start	Funding volume
EYWA e shape	Horizon 2020	(EIC Horizon Prize for 'Early Warning for Epidemics'.) The project aims to set up and promote a sustainable organization dedicated to users' uptake of European EO [Environmental Observations] resources, building on Copernicus and GEOSS through the development of co-design pilots (i.e., application-oriented products, services or solutions) built on a user-centric approach and delivering economic, social and policy value to European citizens.	1 May 2019	€ 15,772,895.84
ISIDORe	HORIZON-IN-FRA-2021-EMERGENCY-02	Integrated Services for Infectious Disease Outbreak Research	1 January 2022	€ 20,991,756 €
ALEERT	Second European and Developing Countries: Clinical Trials Partnership Programme (EDCTP ₂)	African coalition for Epidemic Research, Response and Training - ALERRT	1 December 2017	€ 9,999,394
PANDORA-ID-NET	Second European and Developing Countries: Clinical Trials Partnership Programme (EDCTP ₂)	Pan-African Network for Rapid Research, Response, Relief and Preparedness for Infectious Diseases Epidemics - PANDORA-ID-NET	1 March 2018	€ 9,997,501
SHARP JA	CHAFEA MGA	Strengthened International Health Regulations and Preparedness in the EU - Joint Action - SHARP JA	1 April 2019	€ 9,875,000
EPIC-CROWN-2	HORIZON-HLTH-2021-CORONA-01	Equine Polyclonal antibodies Immunotherapy against COVID-19/SARS-CoV2-VOC	1 June 2021	€ 9,195,135
ASAAP	EDCTP ₂ Call for Proposals - Mobilisation of research funds in case of Public Health Emergencies - RIA ₂₀₁₈ Emergency Funding Mechanism - Research and Innovation Action	ASAAP Clinical evaluation of artesunate + amodiaquine + atovaquone – proguanil tri-therapy for malaria treatment in African children	1 March 2019	€ 7,642,364

Project abbreviation	Funding program	Project goal	Start	Funding volume
ISOLDA	RIA - Research and Innovation Action	Improved Vaccination Strategies for Older Adults	1 January 2020	€ 6,087,315
PEDVAC-iNTS	RIA - Research and Innovation Action	Pediatric Phase 1/11 age de-escalation dose finding study of a vaccine against invasive non-typhoidal salmonellosis in sub-Saharan Africa - PEDVAC-iNTS	1 March 2021	€ 5,698,964
MOBILISE	Horizon Europe	MOBILISE: A novel and green mobile One Health laboratory for (re-)emerging infectious disease outbreaks	1 October 2022	€ 3,999,892
ERINHA-Advance	RIA - Research and Innovation Action	Advancing European Research Infrastructure on Highly Pathogenic Agents - ERINHA-Advance	1 January 2019	€ 3,246,805
freeBILy	Second European and Developing Countries: Clinical Trials Partnership Programme (EDCTP ₂)	FREEBILY - Fast and reliable easy-to-use diagnostics for eliminating Bilharzia in young children and mothers	1 February 2018	€ 2,999,409
MAMAH	Second European and Developing Countries: Clinical Trials Partnership Programme (EDCTP ₂)	Improving maternal and infant health by reducing malaria risks in African women: evaluation of the safety and efficacy of dihydroartemisinin/piperazine for intermittent preventive treatment of malaria in HIV-infected pregnant women - MAMAH	1 March 2018	€ 2,985,000
MALART	ERC-2020-ADG	Cellular basis of Artemisinin resistance in malaria parasites	1 December 2021	€ 2,388,243
ITAIL-COVID-19	Mobilisation of funding for COVID-19 research in sub-Saharan Africa – 2020	Integrated testing approaches and intensive laboratory training as strategy against SARS-CoV-2 spread in Brazzaville - ITAIL-COVID-19	1 May 2020	€ 500,000
MA-CoV	European and Developing Countries Clinical Trials Partnership Association implementing EDCTP ₂	Prevalence and impact of SARS-CoV-2 infection on maternal and infant health in African populations - MA-CoV	1 July 2021	€ 499,999



Appendix

INSTITUTE SEMINARS

28 September 2021

Dr. Julia Port

Mediation of SARS-CoV-2-associated immune responses and pathogenesis by transmission route – the Syrian hamster model of aerosol and fomite transmission

Laboratory of Virology, Division of Intramural Research, National Institute of Allergy and Infectious Diseases, National Institute of Health, Hamilton, MT, USA

7 October 2021

Andre Siqueira, MD, MSc. PhD

Therapeutic challenges of vivax malaria and chikungunya in Brazil: how can we do better?
Clinical Research Scientist, National Institute of Infectious Diseases, Fundação Oswaldo Cruz, Rio de Janeiro, Brazil

12 April 2022

Mathias Iken

Corona in the media
Hamburger Abendblatt newspaper, Hamburg, Germany

5 May 2022

Dr. Richárd Bártfai

Epigenetic plasticity of malaria parasites
Department of Molecular Biology, Radboud University, Nijmegen, The Netherlands

13 May 2022

Dr. Ulrike Fillinger

Environmental management for the control of parasitic infectious diseases
International Center of Insect Physiology and Ecology (ICIPE), Kenya

14 June 2022

Dr. Anne Hoppe

Implementation Science - A Global Health Perspective
FIND, Geneva, Switzerland

28 June 2022

Dr. Michael F. Duffy

Bromodomain proteins in *Plasmodium falciparum* chromatin are essential regulators of gene expression in multiple parasite lifecycle stages
University of Melbourne, Peter Doherty Institute, Bio21 Institute, Melbourne, Australia

12 July 2022

Prof. Katharina Kranzer

The Health Research Unit Zimbabwe - implementation research and capacity building
Clinical Research Department, London School of Hygiene and Tropical Medicine, UK & The Health Research Unit Zimbabwe

18 August 2022

Prof. Thomas D Otto

Bioinformatics & Evolution in Malaria
Bioinformatics, Institute for Infection, Immunity and Inflammation, University of Glasgow, UK

23 August 2022

Prof. George T Albert

How hearing in mosquitoes works and how we might use it to control their populations

*Ear Institute,
University College London,
UK*

8 September 2022

Dr. Dennis Bente

The role of ticks in the transmission and pathogenesis of Crimean-Congo hemorrhagic fever virus

*University of Texas Medical Branch
& Galveston National Laboratory,
Galveston,
USA*

27 September 2022

Dr. Raquel González

Control of Malaria in Pregnancy: from clinical trials to implementation science

*ISGlobal, Barcelona,
Spain*

11 October 2022

Dr. Pietro Scaturro

Flaviviruses: orthogonal proteomics to untangle the host-infected landscape

*Systems Arbovirology,
Leibniz Institute of Virology (LIV),
Hamburg,
Germany*

18 October 2022

Dr. Tom Beneke

Introducing the CRISPR Cytosine Base Editor toolbox LeishBASE - High throughput gene editing in Leishmania without DNA double strand breaks and donor DNA

*Chair of Cell and Developmental Biology,
Biocenter of the Julius-
Maximilians-Universität of
Würzburg,
Germany*

10 November 2022

Dr. Moritz Krämer

Digital and molecular epidemiology of emerging infectious diseases

*Pandemic Sciences Institute and
Department of Biology,
University of Oxford,
UK*

15 November 2022

Dr. Aurélia Souares

Implementation research for prevention and disease control: examples of 3 research projects at different stages of implementation

*Heidelberg Institute of Global Health – HIGH, Heidelberg
University Hospital,
Germany*

22 November 2022

Dr. Henry McSorley

The role and control of IL-33 responses in helminth infection

*Division of Cell Signaling and Immunology School of Life Sciences, University of Dundee, Scotland,
UK*

6 December 2022

Dr. Salome Dürr

Basic and applied One Health Research – what has a bigger impact?

*Veterinary Public Health Institute,
Vetsuisse Faculty
University of Bern,
Switzerland*



Toni Rieger and the high-security laboratory in the Süddeutsche Zeitung, 8 April 2022



Malaria - new hope through a vaccine
Thomas Jacobs, as an expert in immunology in the 'Tagesspiegel' newspaper, 28 April 2021



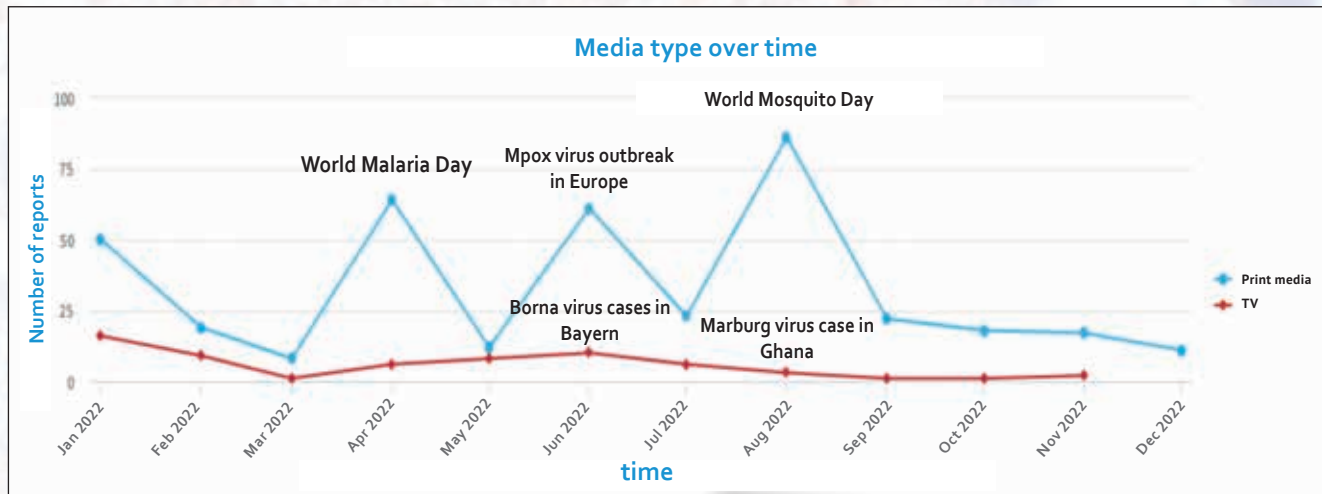
Dennis Tappe in the Bavarian regional press on the Borna virus, 12 August 2022



Anna Heitmann in the NTV documentary "Der Corona-Code" ("The Corona Code") about her work in the BSL-3 Insectarium, filmed on 4 October 2022

MEDIA RESONANCE 2022

Total: 5,416 reports from print, radio, and TV
2,508 online reports



Jonas Schmidt-Chanasi in DAS! (NDR TV), 26 August 2022



The new chairman of the Board of Directors Jürgen May in the Hamburger Abendblatt, 4 October 2022

CHRONICLE

2021

12 January 2021

Young scientists at the Bernhard Nocht Institute for Tropical Medicine (BNITM): Dr. Till Omansen from the Clinical Research department received funds from the Leibniz funding program to set up an independent junior research group. The aim is to research the pathophysiology of Lassa fever. The new translational group is based in both the Clinical Research and Virology departments of the BNITM.



Till Omansen, Head of the Lassa pathophysiology group

30 January 2021

Second World NTD Day: As one of more than 350 partner institutions worldwide, the BNITM also called for people not to lose sight of neglected tropical diseases (NTDs) at the time of the coronavirus pandemic. The well-known North German moderator Yared Dibaba, who has Ethiopian roots, supported the BNITM campaign as a prominent ambassador. Daniela Fusco, Ph.D., organized a digital round table attended by more than 100 guests.



© Oliver Reetz

Presenter Yared Dibaba

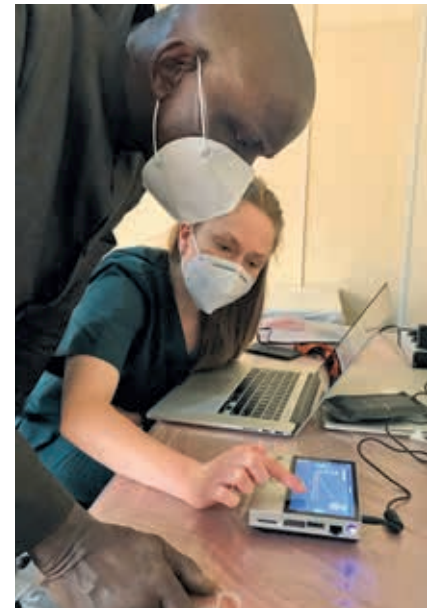
5 February 2021

Men get sick differently – an so do women. What are the immunological reasons for this? This is what the cross-institutional research group “Sex Differences in Immune Responses” has been researching, funded by the Deutsche Forschungsgemeinschaft (DFG) with €4.5 million. Researchers from the BNITM, the University Medical Center Hamburg-Eppendorf (UKE) and the Leibniz Institute for Virology (LIV) were involved.



March 2021

The BNITM has been helping to contain the Ebola outbreak in the Republic of Guinea. At the request of Guinea’s Health Ministry, the institute sent teams to help increase diagnostic and sequencing capacities. The mission took place within the framework of the WHO network “Global outbreak alert and response network” (GOARN) and the “Global Health Protection Program” (GHPP) of Germany’s Federal Ministry of Health. The result: The outbreak could apparently be traced back to the epidemic of 2014-2016; survivors had been carrying the virus longer than expected. A corresponding publication appeared in *Nature*. Several authors were members of the Department of Virology at BNITM.



Mission possible despite COVID19: The BNITM has been helping to contain the Ebola outbreak in the Republic of Guinea.

22 April 2021

Due to the pandemic, the 14th Girls' and Boys' Day was held for the first time in digital form. One-hundred and eleven girls and boys took part in a zoom conference, with a virtual tour, thematic breakout rooms and a final input on non-science careers at the institute. "Today, I was lucky enough to experience how a child who was otherwise worn out by video conferences came out of his room totally happy after a few hours of a virtual visit to the Bernhard Nocht Institute for Tropical Medicine" wrote Arne's mother.

22 April 2021

Dr. Tobias Spielmann received an "ERC Advanced Grant" from the European Research Council (ERC), endowed with almost 2.4 million euros. Dr. Spielmann's Malaria Cell Biology research group in the BNITM Pathogen Section will be studying specific forms of antibiotic resistance in malaria parasites over the next five years.



Tobias Spielmann, Head of the Malaria Cell Biology Research Group

21 May 2021

Dr. Sophie Duraffour from the Department of Virology was honored with the GlaxoSmith-Kline Foundation's "Clinical Research" Prize. It is awarded in recognition of outstanding scientific work: Dr. Duraffour and collaborating partners were able to use metagenomic sequencing technology to gain important insights into the successful control of the Lassa fever outbreak in Nigeria. The prize money amounted to €10,000.



Sophie Duraffour, Head of the Outbreak Preparedness and Response Research Group

31 May 2021

At the age of 84, longtime BNITM employee Dr. Klara Tenner-Racz passed away. Together with her husband Prof. Paul Racz, she achieved groundbreaking research results on pathology and virus replication in HIV infections and received numerous awards for this, including the Federal Cross of Merit, the Körber Prize and the Medal for Art and Culture of the City of Hamburg. Ms. Tenner-Racz continued her research in the Körber laboratory long after she had retired.

April - June 2021

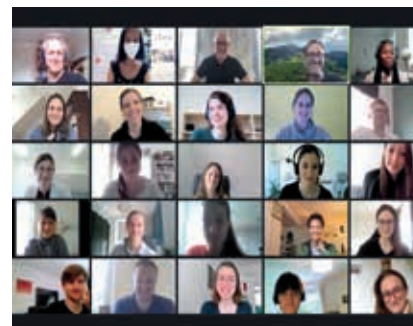
Following a pandemic-related interruption in 2020, the three-month diploma course in tropical medicine took place again, in part virtually and partly on site. All 45 participants passed the exam and received their diploma.



First hybrid diploma course in tropical medicine

3 - 4 June 2021

In order to do justice to the curriculum despite the corona pandemic, the BNITM organized the first digital LCI Summer School on the topic of the "Molecular biology of pathogens" with virtual workshops, keynote lectures and other scientific presentations. There was also a "Speed Talk" series with 22 lively, well-prepared short presentations about their own doctoral theses. The three best speed talks were awarded at the end of the event; Cari Lehmann from the BNITM received third prize.



First LCI Digital Summer School

17 June 2021

Dr. Benno Kreuels received the "Award for Tropical Medicine" from the German Society for Tropical Medicine, Travel Medicine and Global Health e. V. (DTG). It was endowed with €5,000 and was funded by the Else Kröner-Fresenius Foundation. The prize promotes young scientists and is awarded for special achievements in the fields of tropical medicine or international health sciences.



Prize for Benno Kreuels

23 June 2021

First joint appointment by BNITM and UKE with a partner institution in Africa: Dr. Ghyslain Mombo-Ngoma took up the professorship for "Clinical development and implementation of drugs for poverty related infectious diseases". He and his research group will enrich the Implementation section. Dr. Mombo-Ngoma is heading the Clinical Research department at CERMEL (Lambaréné, Gabon) and will be conducting research for CERMEL and the BNITM / UKE from there.



Michael Ramharter and Ghyslain Mombo-Ngoma after signing the contract

17 September 2021

With a scientific symposium, the BNITM said goodbye to its chairman and long-standing department head Prof. Egbert Tannich, including numerous welcoming speeches in the historic lecture hall and digitally connected scientists from all over the world.



The new and previous Chair of the Board of Directors, Jürgen May and Egbert Tannich

1 October 2021

The new Chairman, Prof. Jürgen May, took up office. The regional media presented the Institute's new director. May will also continue to lead the Department Infectious Disease Epidemiology.



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The change of management in the media

1 October 2021

Growth in implementation research: Communication researcher Prof. Cornelia Betsch from the University of Erfurt and the social anthropologist Dr. Sung Joon Park from the University of Halle took up their work as research group leaders. Furthermore, the One Health Bacteriology Research Group began under the leadership of Dr. Denise Dekker.



© Marco Bargreve



Cornelia Betsch, Head of the Health Communication Research Group, Sung-Joon Park, Head of the Medical Anthropology Research Group, and Denise Dekker, Head of the One Health Bacteriology Research Group

12 October 2021

Prof. Rolf Garms passed away at the age of 89. He had worked at the BNITM for over 60 years and left a special mark on the institute through his tropical medical entomological research. His focus was research on blackflies as transmitters of river blindness (onchocerciasis), in particular their ecological characterization and analysis of transmission conditions.



The focus had always been on using the findings to combat the disease.

Rolf Garms

27 October 2021

"Thank you for your commitment!" The Hamburg Citizens' Associations awarded Prof. Marylyn Addo the Hamburg Citizens' Prize for 2020/2021. She had made a significant contribution to the cohesion in the city with her commitment during the corona pandemic.



Marylyn Addo at City Hall

3 - 4 November 2021

The Scientific Advisory Board audited the two departments of Infectious Disease Epidemiology and Clinical Research as well as the two research groups on Zoonoses (AG Tappe) and Infectious Diseases and Global Health (AG Amuasi).

14 December 2021

Dr. Julie Sellau received the Werner Otto Prize endowed with a sum of €8,000 for her outstanding knowledge of gender-specific immunology. The scientist from Prof. Hanna Lotter's Molecular Infection Immunology group published the award-winning work in the renowned journal *Nature Communications*.

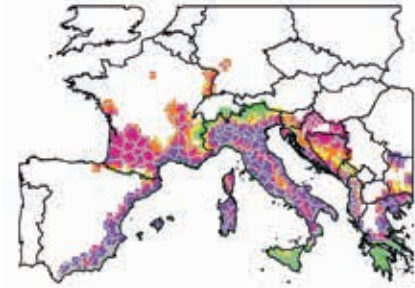


Julie Sellau and Werner Otto at the award ceremony

2022

17 January 2022

The European Commission honored the epidemic early warning system "EYWA" and with it the Department of Arbovirology and Entomology of the BNITM under the direction of Prof. Jonas Schmidt-Chanasit. He was a partner in the 15-member consortium. The prize was endowed with €5 m. The international research group then used the prize money to expand its established early warning system in Europe and in the countries of the Global South.



Chikungunya virus risk map for Europe

27 - 28 January 2022

The international symposium of the Leibniz Center Infection (LCI) with around 200 participants was held digitally. They discussed the influence of epigenetics on infections and the immune system.

17 February 2022

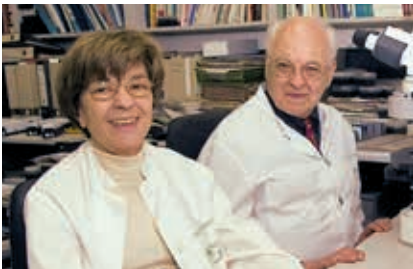
Dr. Jani Puradiredja, leader of the iTCB teams, became the new President of the tropEd Network for Education in International Health. Her focus is on international teaching and capacity building. In September, the BNITM will host the general assembly of the tropEd network for the first time.



First general meeting of the TROPED network in Hamburg

13 March 2022

Former departmental head Prof. Paul Racz died at the age of 97. Together with his wife, Dr. Klara Tenner-Racz, he achieved groundbreaking research results on the pathology and virus replication in HIV infections. He also received numerous awards, such as the German Federal Cross of Merit, the Körber Prize and the Medal for Art and Culture of the City of Hamburg. Long after retiring, Paul Racz enthusiastically continued his research in the Körber laboratory.



Klara Tenner-Racz and Paul Racz

28 April 2022

Guests again at last! More than 30 children and young people participated in BNITM's Boys' Day. The participants were between ten and 14 years old and came from Hamburg and the surrounding area. At the end there was a lot of praise: "It was so cool and confirmed my plan to work in medical research."

April - June 2022

The tropical medicine diploma course took place again entirely on site.



Participants on the diploma course in tropical medicine

31 May 2022

The BNITM gained another BMBF Junior Research Group: Dr. Joachim Michael Matz raised over €2m for research into the cell biology of the malaria parasite *Plasmodium falciparum*.



Joachim Michael Matz,
Head of the Molecular Parasitology Research Group

18 June 2022

At tropical temperatures and what feels like 100 percent atmospheric humidity, 25 active, former and possible future BNITM members took place on the 20th HafenCity ("harbor city") run: The route covered four kilometers across the latest Grasbroed construction section, in part over freshly excavated sand. Not the best conditions for the youngest!



A sweaty task, even without running:
HafenCity ("harbor city") Run 2022

1 July 2022

The Vereinigung der Freunde des Tropeninstituts (Association of Friends and Supporters of the Institute for Tropical Medicine) awarded its doctoral prizes to Dr. Luzia Veletzky (Dept. of Clinical Research) for her work on the burden of disease in infections with the Loa loa nematode, and to Dr. Marie Groneberg (AG Molecular Infection Immunology) for her work on gender-specific differences in the immune reaction in amoebic liver abscesses. Afterwards, the institute's friends and supporters celebrated the 100th anniversary at the traditional summer party in the Institute's garden.



Luzia Veletzky and Marie Groneberg

29 July 2022

Representatives of the Executive Board, the Equal Opportunities Team and Staff Council once again hoisted the rainbow flag at Hamburg's Pride Week, to the applause of around 25 BNITM members. Afterwards there were drinks in the garden.



The rainbow flag represents acceptance of gender and sexual diversity.

15 - 28 August 2022

Visit from the Public Health Center of Ukraine (PHCU) in Kyiv, as part of the BNITM project "Sustainable strengthening of biosecurity competencies in the management of proliferation-critical human pathogens in Ukraine": The aim of the trip was to provide training for the Ukrainian delegation, as well as the open day at the Federal Foreign Office in Berlin, and the planning and further design of the project activities in the coming program phase.



Delegation at the open day at the German Foreign Office

31 August 2022

For the first time since the pandemic began in early 2020, an information event was held for the general public: A high school senior class listened intently to Dr. Denise Dekker's presentation on "One-Health Bacteriology in the Tropics". In December, the number of guests again reached pre-pandemic heights: Seventy-five interested people engaged in lively discussions with doctoral students Lina Widderspik, Saskia Johanns and Barbara Honecker. They had previously provided a vivid insight into their research into Ebola, Lassa and amebiasis with a series of "Speed Talks".

1 September 2022

The Parliamentary State Secretary at the Federal Ministry for Economic Cooperation and Development (BMZ), Niels Annen, visited the BNITM. He was particularly interested in neglected tropical diseases (NTDs) and arbovirology.



Niels Annen (BMZ) visited the BNITM

2 September 2022

A delegation from the Federal Ministry of Health (BMG) visited the BNITM.

1 October 2022

Dr. Renke Lühken took over the leadership of the BMBF Junior Research Group "Arbovirus Ecology" in the Implementation Section. In addition to his work in the BMBF junior research group, he'll be conducting research on vector control, primarily in Africa.

21 October 2022

First conference on schistosomiasis in Madagascar: Together with partners, the laboratory group of Daniela Fusco, Ph.D., organized the "Conférence sur les Stratégies de contrôle de la Schistosomiase à Madagascar" (CCSM). Guests of honor were the Madagascan health minister, the German ambassador and the WHO representative of the NTD program.



First schistosomiasis conference in Madagascar

21 October 2022

Representatives of the Nigeria Centre for Disease Control (NCDC) visited the institute and discussed future cooperation strategies with the board.

27 October 2022

At the BNITM, a group of DAAD alumni from Paris learned about the institute and its work. Following an introduction by Dr. Leni Schönherr, Scientific Officer, Dr. Saskia Davi from Dr. Johannes Mischlinger's laboratory group provided an insight into clinical trials on HIV and malaria in Gabon.

1 November 2022

Second joint appointment of BNITM and UKE with a partner institute in Africa: Prof. John Amuasi took up the professorship for *Global One Health*. He had already headed the eponymous research group at the BNITM within the Implementation Section and the "Global Health & Infectious Diseases" research group at the KKCR in Kumasi, Ghana.



© Vera Obeng

John Amuasi, Head of the Global One Health research group

7 - 8 November 2022

In an institute-wide audit, the Scientific Advisory Board certified that the BNITM had achieved excellent development and specifically highlighted the performance of the newly founded Implementation Section.

11 November 2022

In Tallin, Estonia, the international, cross-institutional EU „MOBILISE: research project got under way: *A novel and green mobile One Health laboratory for (re-)emerging infectious disease outbreaks*". In the coming years, BNITM will develop a new quality-assured mobile one-health laboratory solution together with the FLI, the Federal Research Institute for Animal Health, and other partners from four European countries. MOBILISE received €4 million from the "Horizon Europe" EU framework program for research and innovation for this.



© MOBILISE

Visualization of a truck prototype

17 November 2022

The new Snakebite Envenoming Research Group led by Dr. Jörg Blessmann and Dr. Benno Kreuels hosted the first "Meeting on Snakebite Envenoming" at BNITM and brings together various European and African players.

21 November 2022

A delegation of German Social Democrat members of the Subcommittee on Global Health in the Bundestag (German Parliament) visited the BNITM to learn more about the institute's strategy on the topic of "Global Health/One Health Research in Africa". Members discussed with the Board how policies could better support this approach.

29 - 30 November 2022

The Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) in Ghana celebrated its 25th anniversary with a ceremony and a scientific symposium. The research facility has been run jointly by Kwame Nkrumah University of Science and Technology (KNUST), the Ghanaian Ministry of Health and the BNITM. The cornerstone of the *joint venture* is a treaty between the Republic of Ghana and the Free and Hanseatic City of Hamburg.



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The coronavirus pandemic has shown us that pathogens do not stop at borders. The BNITM has always conducted research for global health. It is Germany's largest research facility for tropical and emerging infectious diseases. After more than 120 years of researching and fighting tropical diseases, BNITM's work is more important than ever. You can help us do this: Donate to our foundation account. Your financial support fully benefits the work of the Institute. You decide where we use your donation, for example on general teaching and research or in a specific area!

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To our donation page:



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THANKS!

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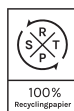
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