IUIS-FAIS-IMMUNO-ETHIOPIA 2020

Neglected Tropical Diseases and Malaria Challenges in Sub-Saharan Africa

23rd February to 29th February 2020

Bahir Dar, Ethiopia

The IUIS-FAIS course on “Neglected tropical Diseases and Malaria Challenges in Subsaharan Africa” took place at the Lakemark Hotel in Bar Dar, Ethiopia. The course was very generously sponsored by the Volkswagen Foundation through a grant to support “Regional Immunology Schools in Sub-Saharan Africa”.

As with previous IUIS courses, applications were handled by the Immunopaedia platform (www.immunopaedia.org.za) which also provided a dedicated section on the website where specific teaching material was made availabe to all participants.

Among the unprecedented 307 applications, a selection committee consisting of 10 members of the IUIS Education Committee and additional scientists, 53 participants were selected, based on the material submitted with the application (short CV, letter of motivation, abstract, letter of support from supervisor), but also taking into consideration other parameters like country/region of origin and gender balance.

The selected participants were from Ethiopia (21), Nigeria (9), Ghana (4), Kenya (3) and the following additional countries: Benin, Burkina Faso, Burundi, Cameroon, Sierra Leone, Sudan, Tanzania, Tunisia. In addition, 5 participants were from Germany, to strengthen potential collaboration between institutions in Germany and Sub-Saharan Africa.

We were fortunate to have 20 experts, both from the local institutions as well as from abroad. Faculty members were from Canada, Czech Republic, Ethiopia, France, Germany, Ghana, South Africa, Switzerland, Tunisia, United Kindgom, and USA.

The first day of the course was devoted to give overview lectures on the basics of the immune system, covering the lymphoid system, innate immunity, B and T cell development, and unconventional T cells. Moreover, each morning started with a one hour session to review the relevant teaching material on the Immunopaedia web page.

Another asset of IUIS courses is to get the participants actively involved in the program. For the Immunopaedia review just mentioned, the students were in groups of 8 or so to answer a series of assigned questions and to report at the end of the session on a new aspect they had learned in the group session. Four interactive poster sessions were also conducted. In addition, a fellowship application exercise was initiated by Prof. Kropf and Prof. Letarte where the participants were assigned to a selected topic related to their work. Nine groups were formed and under the guidance of one or two faculty members, they worked on their application over the next few days. All projects were presented on the last day of the course, and assessed by a panel of 9 faculty members. All groups gave a 6 minute slide presentation that also included a CV and a letter of motivation. The best fellowship project was a cellular phone adapted immunoassay that could detect several infectious diseases at one time and be of great use in field work. All students stated that they greatly enjoyed the fellowship project and had learned a great deal in the process.

The program of the course is attached at the end of this report. The course included a session on fungal diseases as had been recommended by the Volkswagen Foundation grant appliation reviewers. The following pages contain summary reports on selected talks compiled by participants of the course who volunteered to act as “rapporteurs”.

We are very grateful to Markos Tadele, Rebecca Chukwuanukwu**,** Arthur D. Djibougou and Naffesa Al Sheik. Rebecca also conducted four interviews with faculty which are available on the Immunopaedia web site (https://www.immunopaedia.org.za/interviews/video-interviews/) and youtube (https://bit.ly/immunoethiopiainterviews). Jacqeline Hirscher, a professional photographer, took pictures of all lectures and additional events; a selection of her pictures is available here: https://sharegallery.strato.com/u/Lqg8CrlS/m-8VYrm8

A separate report by the German participants highlighting their experience will soon be available on the IUIS web page.

We thank all faculty members and participants for their excellent contributions, and once again the Volkswagen Foundation for the generous financial support which enabled free participation, travel and accomodation for all participants.

Last but not least, special thanks are due to Prof. Pascale Kropf and her team in Bahir Dar for all the local organization, and the Immunopaedia Team in Cape Town (Bon Holtak, Cheleka Mpande, Prof. Clive Gray) for making this platform available for the course! We are also grateful to Franziska Kabelitz for putting together the Program and Abstract booklet and for superb support with all travel arrangements.

Summary of selected talks

Malaria Immunology (*Markos Tadele and Rebecca Chukwuanukwu)*

Talk	Speaker
Malaria transmission (+ 2-4 hrs workshop on image analysis using an open source software (participants had to download the software on their laptops)	Friedrich Frischknecht
Basics of antimalarial immunity	Yaw Bediako
Studying immunity to malaria in African children – Systems immunology and human cohort studies (Can also cover topics related to naturally acquired immunity to malaria as well as the latest in vaccine induced protection.)	Yaw Bediako
Genomic insights into malaria population genetics	James Cotton
NET & Cerebral Malaria	Martin Herrmann

Fungul Immuniology *(Rebecca Chukwuanukwu and Arthur D Djibougou)*

Talk	Speaker
Epidemiology of Fungal Infections	Claire Hoving
Immunity of Fungal Infections	Claire Hoving
Genetics of the immune responses to fungal infections	Ridha Barbouche

Leishmania Immunology *(Naffesa Al Sheikh)*

Talk	Speaker
The role of sand flies in the transmission of Leishmania parasites	Iva Kolarova
Insights into the sand fly saliva: Blood-feeding and immune interactions between sand flies, hosts, and Leishmania	Iva Kolarova
Innate immune response to *Leishmania* parasites	Fabienne Tacchini-Cottier
Xenodiagnosis of leishmaniasis	David Sacks
Adaptive immune response to *Leishmania* parasites	David Sacks

The following summary articles have been published on the Immunopaedia Webpage

Immuno-Ethiopia: Malaria Highlight 1 (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-malaria-highlight-1/)

This year the IUIS-FAIS Immuno-Ethiopia course co-sponsored by the Volkswagen Foundation, IUIS and FAIS took place between 23rd-29th of February in Bahir Dar, Ethiopia. The theme of this course was “Neglected Tropical Diseases and Malaria challenges in Sub-Saharan Africa”. In the following, we highlight rapporteur reports of talks conducted at the course.

Our first Immuno-Ethiopia highlight is on talks by **Dr Yaw Bediako (PhD)**, WACCBIP, University of Ghana, about “**Immunity to malaria**’’ and “**Exploring naturally acquired immunity to malaria: Systems Immunology and Human Cohort Studies**”. He highlighted the global malaria burden emphasizing that Africa contributes to 75% of this burden.

Dr Bediako began his talk by discussing the life cycle of the parasite, host immune responses at different stages of infection. Adaptive immunity plays an important role in malaria infection; the role of antibodies in reducing motility, clearance of parasites and blocking transmission was briefly discussed. Further, he highlighted the importance of high circulating antibody titres to prevent and

control infection. To illustrate his point, Dr Bedakio explained that the RTSS vaccine elicits high antibody titres. These titres decrease rapidly and could be one of the reasons for low protection observed in clinical trials. Cellular immunity also plays an important role in anti-malarial immunity; in the liver, host immunity is (CD8+) T-cell mediated. However, this response is inadequate due to low levels of continuous stimulation of CD8+ T cells during the liver stage, which may be important for maximum protection. He also explained the role of schizonts in various clinical manifestations owing to inflammatory cytokines (IL-1β, IL-6, IL-8, IL-12 (p70), IFN-γ, and TNF) in the blood stage.

Dr Bediako briefly discussed the importance of natural immunity in protecting individuals from repeated Malaria episodes. Individual variation in susceptibility between exposed and non-exposed groups and across different age groups was noted. Further explanation was given on how continuous exposure to infection affects the expression of different cells (B-cells, T-cells, atypical MBCs and classical MBCs) and optimum immunoregulation. He described research that showed that continuous parasitic exposure increases the level of short-lived and long-lived plasma cells compared to unexposed individuals. He also described findings from the Systems Immunology for malaria susceptibility (SIMS) study that utilised samples from children living in endemic areas (Kenya). The study demonstrated that cohorts of children from coastal regions had a skewed increased malaria incidence, where some children experienced more episodes than would be expected. This suggests differences in host susceptibility and/or ability to acquire immunity (Ndungu et al, BMC Med 2015). He further discussed findings from a longitudinal cohort (weekly visits over approximately 8 years) in older children (~8 years old) who were malaria naïve, had low or high exposure. Results from the study show that hierarchical clustering distinguishes low and high exposure in the children (Bediako et al., BMC Med 2019). In a subsequent study (SIMS 2.0) from 2015-2018, they found that exposure to malaria significantly alters the 'steady-state' immune system in children. Whole-blood transcriptomic approaches were sufficiently robust to distinguish between healthy children with different levels of exposure.

In summary, talks conducted by Dr Bediako highlighted the complexities associated with malaria, specifically the different stages of infection and immune responses associated with them. He further described results obtained from studies on children, and the importance of studying natural immunity in groups majorly affected by the parasite.

Article by Markos Tadele and Rebecca Chukwuanukwu.

Immuno-Ethiopia: Malaria Highlight 2 (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-malaria-highlight-2/)

Our second highlight is on talks that focused on understanding malaria parasite transmission, motility and emergence of anti-malarial resistance, as well as the neutrophil activity in malaria friend or foe.

Prof. Freddy Frischknech (Ruprecht-Karis University, Heidelberg) gave a lecture on ''Transmission of malaria – from microscopy to experimental vaccine studies''. He opened his speech by sharing general information about malaria transmission, burden and mortality. He explained the transmission mechanism of the parasite, emphasizing the infective stage (Sporozoites), from how sporozoites are formed inside the insect vector, to their movements patterns *in vitro* and *in vivo*. His talk highlighted the importance of microscopy imaging in understanding sporozoite motility and the role it plays in infectivity. He showed images depicting the movement of sporozoites inside the salivary gland, upon a blood meal, their motility after inoculation, their entry into the blood vessels and migration to other sites. Prof. Frischknecht shared interesting findings on genetically manipulated sporozoites. Where inducing mutant sporozoites changes the shape, speed and motility patterns, resulting in reduced infectivity. Since the mutation also change sporozoite shape (compared to the wild type), researchers are developing mutants that affect infectivity but not shape. **Prof. Frischknecht** also illustrated different sporozoite motility patterns depending on microenvironment. However, the reason for these differences has not yet been identified. Finally, he concluded his talk by highlighting the importance of understanding sporozoite biology in developing drugs and attenuated vaccines which target motility of sporozoites. He also gave an insight into ongoing research activity on the function of CSP *in vivo*.

Dr James Cotton (Wellcome Sanger Institute, Cambridge), addressed the audience on the topic ''Genomic insight into malaria parasite population genetics''. 10-100 parasites (sporozoites) are transferred during a mosquito bite. This creates an "enormous bottleneck" in the genomic population responsible for malaria infection. Plasmodium genomes are 80% AT-rich, less complex with high intra-similarity. Once in the human host, the parasite undergoes rapid multiplication which results in high mutation rates. During his talk, Dr Cotton discussed how malaria parasites develop anti-malarial resistance relatively quickly, focusing on artemisinin-resistant populations. Artemisinin resistance was first reported in Western Cambodia in 2017 when treatment failure and requirement of a higher dose to clear the parasite was reported. Whole-genome sequencing of the resistant parasite identified artemisinin-resistant genes on locus 13.

Further GWAS of parasites isolated in South-East Asia identified 9 significant loci and 20 different changes in locus protein (Kelch 13 mutation, Miotto et al., 2015). Artemisinin resistance thus far has not been reported in Africa, South America nor South Asia and Oceania (Pearson et al., 2019). However, there is still a risk of ART-resistant parasite dissemination to other global regions, as seen with chloroquine and sulphadoxine resistance. He then highlighted how mutant k13-propeller polymorphism strongly correlates with parasite survival and clearance rate. Finally, he gave remarks on how the presence of these resistant genes can threaten the world's malaria control and elimination efforts.

In addition to talks by Dr Yaw Bediako, **Prof Martin Herrmann** also presented a talk on immune responses associated with malaria, focusing on neutrophil activity. Well known neutrophil immune strategies include phagocytosis, reactive oxygen species, degranulation of anti-microbial peptides and a lesser-known strategy, Neutrophil extracellular traps (NETs). NETs comprise extracellular DNA fibres that form web-like structures that immobilize pathogens, arresting their spread within tissues, and eventually facilitating their death.

Prof Herrmann explained that NETs have been associated with several pathologies and induce chronic inflammation (Boetz *et al.,* Front. Immunol 2017). Aggregated NETs (aggNETs) can initiate the resolution of inflammation, while bad aggNETs are involved in the obstruction of vessels and ducts. This appears to be the case in acute pancreatitis, cholestasis and rheumatoid arthritis. It has been described that NETs with trapped parasites circulate in children infected with *P. falciparum* (Baker et al., Malar J 2008). Prof Herrmann concluded his talk by discussing how aggNETs can cause more malaria pathology. Specifically, the parasites use hypoxanthine for metabolism and convert it into crystalline urate. The urate crystals are released during rupture of RBC and together with hemozoin induce aggNET formation. A clinical sign of cerebral malaria is the occlusion of the capillary bed (best seen in the eyes).

Article by Markos Tadele and Rebecca Chukwuanukwu

Fungal Immunity

Immuno-Ethiopia highlight: Fungal Epidemiology, Host Immunity and Pathogenesis (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-fungal-epidemiology-and-immunology/)

In this summary we shall focus on Fungal immunology talks presented by **Dr J. Claire Hoving (also (University of Cape Town).**

Dr Hoving's first talk focused on **"The Epidemiology of fungal infections".** She highlighted that although fungal infections cause more than 1.5 million deaths annually, the impact on human health is not widely recognized and deaths are often overlooked (Brown et al, Sci Trans Med, 2012). The enormous influence fungal pathogens have on plant and animal life is well recognised, especially for food security. However, fungal infections are often not perceived as life threatening to humans. This is not the case. Four major genera cause deaths: *Pneumocystis, Aspergillus, Cryptococcus* and *Candida species*. Public health agencies conduct little to no mycological surveillance, making epidemiological data for fungal infections notoriously poor. Roughly, 25% of the world's population are affected by superficial fungal infections, however these are generally not life threatening. In contrast, invasive fungal infections are associated with a high rate of mortality which often exceeds 50%. In Africa, second only to tuberculosis, fungal infections such as *Cryptococcal meningitis* and *Pneumocystis jirovecii* pneumonia are the leading cause of death of HIV-infected patients. In this resource limited setting, drug and diagnostic test availability is severely limiting the outcome for infected patients. Understanding how the host responds to infection is key to developing new diagnostic tests or drugs to clear infection.

Dr Hoving's second lecture titled "**Host Immunity and Fungal pathogenesis**", discussed aspects of fungal immunology including both innate and adaptive host responses. Dr. Hoving explained that fungal pathogens come in many shapes and sizes, and once entering the host, can alter their shape to avoid recognition. This impacts on how the host immune system responds to infection, for example a large fungal cell may stimulate an extracellular response while a smaller organism may be taken up by phagocytes. Innate immune receptors are important in shaping the adaptive immune response. C-type lectin receptors (CLR) are pathogen recognition receptors described for their role in fungal recognition. Synergistic signalling of Toll like receptors (TLR) and CLR has been shown in immune response to pathogens (Brown et al, Cell, 2010). The most prominent CLR in fungal recognition is Dectin-1, known to recognise B-glucan in the fungal cell wall (Brown et al, Nature Rev. 2018). These signalling CLRs trigger an intracellular signalling cascade which induces gene transcription and the production of various inflammatory mediators. This includes uptake and killing by phagocytes and subsequently the development of protective Th1 and Th17 responses. Fungi have developed mechanisms to evade the host immune response such as changing their shape, surface pathogen associated molecular patterns (PAMPS), releasing decoy components or they are able to survive harsh environment within a macrophage.

Compared to TB and HIV, fungal immunology is understudied. Talks by Dr Hoving, highlighted the importance of doing this research, that will lead to improved care for immunocompromised individuals who are at risk of acquiring "potentially" deadly fungal infection.

Article by *Rebecca Chukwuanukwu.*

Video interview available on youtube (https://www.youtube.com/watch?v=y1kZK1S56FQ)

Genetics of Fungal Immunology (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-highlight-genetics-of-fungal-immunology/)

Prof. Mohamed Ridha Barbouche from the Institut Pasteur de Tunis, Tunisia gave insights into **"**Genetics of the immune response to Fungal Infections". In his talk he highlighted the global fungal infection burden (over 14.9 million cases per year with over 1.7 million deaths worldwide). These fungal infections are polyclinical, with well-known forms including:

- **Invasive fungal infections** (Cryptococcal meningitis, Pneumocystis pneumonia, disseminated histoplasmosis, invasive aspergillosis, Candida bloodstream infection) which are often fatal
- **Skin, hair and nail infection** (ringworm, tinea capitis, athlete's foot, onychomycosis)
- **Mucosal infection** (oral and esophageal candidiasis, Candida vaginitis)
- **Allergic fungal disease** (allergic bronchopulmonary aspergillosis, severe asthma with fungal sensitization)
- **Chronic lung or deep tissue infection** (chronic pulmonary aspergillosis, endemic mycoses)

He explained that gene polymorphisms have been associated with fungal infections. These gene polymorphisms have been studied however, identifying the right population to study is critical for some fungal infection e.g. candida and aspergillosis because there is evidence of genetic susceptibilities to these fungal pathogens.

Specific genetic signatures (combination of variants) may determine the immune responses to those pathogens (Barbouche et al, 2017. Front.Immunol.). Genetic variants of for instance TLR1, TLR2, TLR3, TLR4, TLR5, TLR6, TLR9, CARD 9, MBL2, PLG, PTX3 are involved in the susceptibility to fungal infections like invasive pulmonary aspergillosis (IPA), recurrent vulvovaginal candidiasis (RVVC), chronical pulmonary aspergillosis (CPA) and allergic bronchopulmonary aspergillosis (ABPA) (Campos et al., 2018 Current Topics in Microbiology and Immunology). As lessons are being learnt, we understood that:

i. Identification of variants (polymorphisms) in pattern recognition receptors associated with susceptibility to fungi is helping decipher their contribution to disease
ii. Specific genetic signatures may determine the immune responses to these pathogens
iii. Understanding how these molecules are regulated at the genetic level may enable the possibility of targetted "therapy" that may restore defective pathways.

In addition to gene variants, inborn errors in immunological pathways also contribute to genetic susceptibility to fungal infections. Inborn errors of the phagocyte NADPH oxidase complex (chronic granulomatous disease), severe congenital neutropenia (SCN) and leukocyte adhesion deficiency confer a predisposition to invasive aspergillosis and candidiasis. In addition, inborn errors of IL-17 immunity have recently been shown to underlie chronic mucocutaneous candidiasis (CMC), while inborn errors of caspase recruitment domain-containing protein 9 (CARD9) immunity underlie deep dermatophytosis and invasive candidiasis (Li et al, 2017; Lanternier et al., 2013 Curr Opin Pediatr).

By Arthur D Djibougou

Leishmania Immunity (All summaries were written by *Naffesa Al Sheik)*

Role of sand flies in Leishmania transmission and immune interactions (https://www.immunopaedia.org.za/breaking-news/role-of-sand-flies-leishmaniasis/)

Dr Iva Kolarova (Charles University, Czech Republic) presented a lecture on ***"The role of sandflies in transmission of Leishmania parasites".*** She started her lecture by talking about leishmaniasis epidemiology, causative agents, distribution, prevalence and populations at risk (350 million people in 98 countries). She also mentioned that the risk factors of this disease include but are not limited to poverty, migration, climate changes and immunodeficiency. She also highlighted how the disease is transmitted, different species involved, clinical presentations and forms of leishmaniasis. Dr Kolarova talked about the biology of sandflies and how Leishmania sp. develop in the digestive tract of the sand fly. At the end of her interesting lecture, she raised a question whether sand flies are the only vectors for Leishmania parasites? She suggested that other routes of transmission of Leishmania sp. may also occur.

Dr Kolarova's other lecture focused on ***"Insights into the sand fly saliva: Blood feeding and immune interactions between sand flies, hosts, and Leishmania".*** Dr Kolarova explained that sand fly saliva is composed of a diverse group of molecules with pharmacological and immunomodulatory properties that contribute to sand fly hemostasis and blood feeding. Some of

these immunomodulatory properties include, anti-haemostasis, anti-vasodilation, anti-inflammation and induction of delayed type hypersentivity reaction. These properties have an impact of leishamniasis pathology, and can also be harnessed for vaccine development and disease monitoring. For example the development of anti-saliva immunity can be harnessed for transmission-blocking vaccines, or using anti-saliva antibodies as a marker of exposure to sand flies and determining the risk of *Leishmania* transmission.

Innate immune responses to Leishmania infection (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-anti-leishmania-immunity/)

Dr Fabienne Tacchini-Cottier (University of Lausanne, Switzerland) gave an interesting lecture on the innate immunity to *Leishmania* parasites. She explained how the body recognizes the parasite by the PRRs and talked about the role of selected innate cells in immunity against the parasite. She also showed how the parasite has developed sophisticated ways to bypass the first barrier of immunity, the skin, and subvert the innate immune response permitting infection in different ways. Some of these immune evasion mechanisms include the role of *Leishmania* GP63 protein in degrading extracellular matrix and facilitating parasites' movement in the dermis and inactivation of the complement system by *Leishmania* parasite. She also explained the role of the inflammasome in Leishmania infection, emphasising that distinct Leishmania species can dampen NLRP3 activation as an evasion strategy.

Dr Tacchini-Cottier also highlighted the role of Neutrophils in leishmaniasis, which include active engulfment of *Leishmania* promastigotes and production of an array of microbicidal factors against *Leishmania* such as nitric oxide, neutrophil elastase, platelet activating factor and neutrophil extracellular traps (NETs). In response to some of these mechanisms, some *Leishmania* species have developed various mechanisms to escape NET trapping and/or killing, as well as subvert macrophage killing and inhibit Denderitic cells function.

Video interview available on youtube (https://www.youtube.com/watch?v=CfgPk2IqjUA)

Xenodiagnosis of Leishmaniasis

Dr David Sacks (National Institutes of Health, USA) first lecture was on *"Xenodiagnosis to evaluate transmission dynamics of visceral leishmaniasis in Bihar, India"*. After talking about visceral leishmanias (VL) demographical distribution and the vectors involved, Dr Sacks focused on the Kala-azar elimination program in the South Asia Region and its goal to reduce incidence to <1 per 10,000

population at risk. He explained that this strategy to decrease transmission relies on early VL diagnosis and treatment, as well as vector control followed by post-elimination/maintenance phase. He higlighted that the strategy needs to shift from preventing disease to preventing infection and interrupting transmission which would require maintenance of effective surveillance through passive and active case detection. Dr Sacks also added *"if transmission is predominantly driven by asymptomatically infected hosts who are not eligible for treatment, only vector-related interventions have the potential to sustain the elimination effort''*. He suggested that the majority of infections with *L. Donovani* are asymptomatic and there is abundant evidence that asymptomatic individuals are infectious.

Dr Sacks mentioned that their objective is to *explore the relative ability of specific human-subject groups from across the infection spectrum to serve as reservoirs of Leishmania donovani infection* for sand flies in areas of anthroponotic transmission. They plan to achieve this using xenodiagnosis which is *the detection of a parasite by feeding supposedly infected material (e.g blood) to a suitable intermediate host and later examining the intermediate host responses for the parasite*. Using an established sand fly colony, they found out that sand fly infectivity correlates with severity of VL disease and that 9.0% of cured VL subjects transmitted infection to flies as revealed by qPCR. Post kala-azar dermal leishmaniansis (PKDL) patients were infectious to sandflies while none of the asymptomatic subjects were infectious to flies. Dr Sacks concluded that these findings inform the VL elimination strategy by suggesting that maintaining effective surveillance through passive and active case detection i.e.early treatment of VL and PKDL cases. Also via vector control by confining spraying to households/contiguous households of incident VL cases and to switch to a more precise, targeted methods of vector control or individual protection, e.g. insecticidal treated nets.

Adaptive Immune responses to leishmaniasis (https://www.immunopaedia.org.za/breaking-news/immuno-ethiopia-anti-leishmania-immunity/)

Dr Sacks' second lecture was on adaptive immunity against leishmaniasis, he explained that cutaneous Leishmaniasis infection of human hosts by *L. major* leads to the development of localized cutaneous lesions that eventually heal, and results in the generation of life-long immunity to re-infection. In the laboratory, most mouse genotypes control *L. major* infection, which is initiated typically by low dose needle inoculation of 100-1000 parasites into subcutaneous sites. This induces an IL-12-driven immunity which activates an IFN-γ-dominated Th1 response promoting healing and parasite clearance.

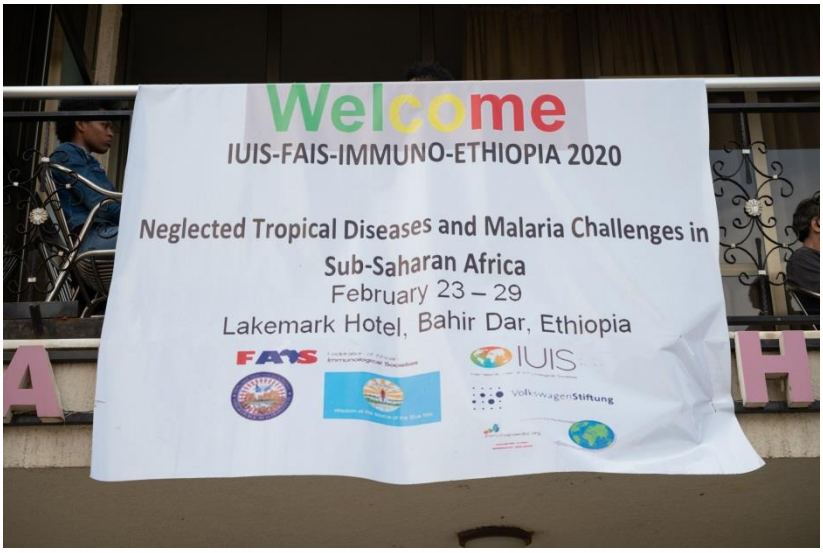
He has also explained the *"Infected Sand Fly Challenge Model"*, and how it has been used to determine the protective roles of memory CD4 T-cell subsets. Using this model, Dr Sacks suggests that only the effector CD4+ T cell subset and not central memory CD4 T cells confer protection against leishmaniasis infection.

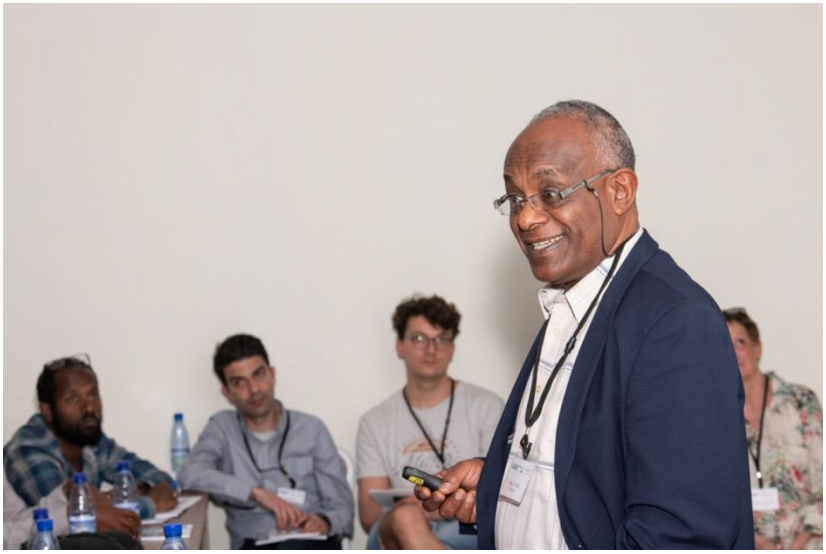
Current rationale for leishmaniasis vaccine strategies aim to mimic natural protective immune response kinetics, however he suggests that this protective immune responses can be simply defined by the existence of memory cells. He suggested that the failure of Leishmania vaccines against CL may be related to the fact that conventional vaccines cannot maintain a population of pre-existing, terminally differentiated effector cells. He suggested that vaccines may have to accommodate the requirement for infection and/or persisting antigen to establish and maintain the protective response.

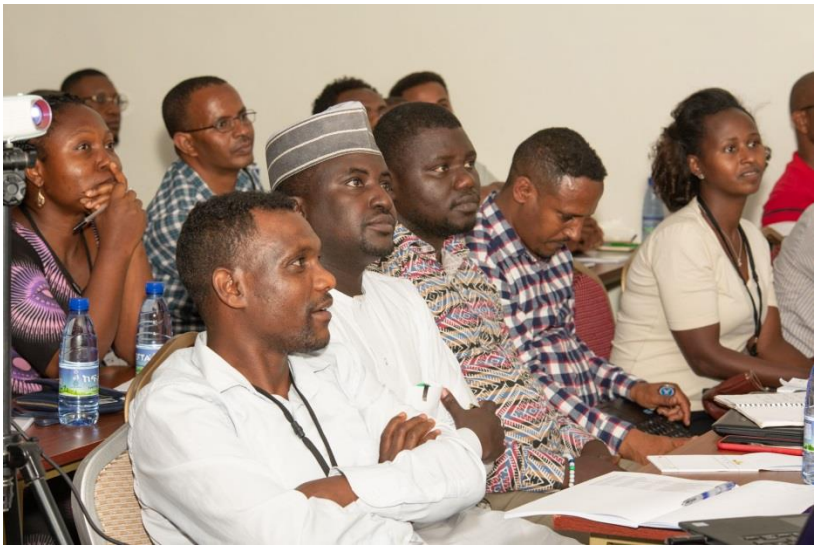
Video interview available on youtube (https://www.youtube.com/watch?v=xQca7dHsBNI)

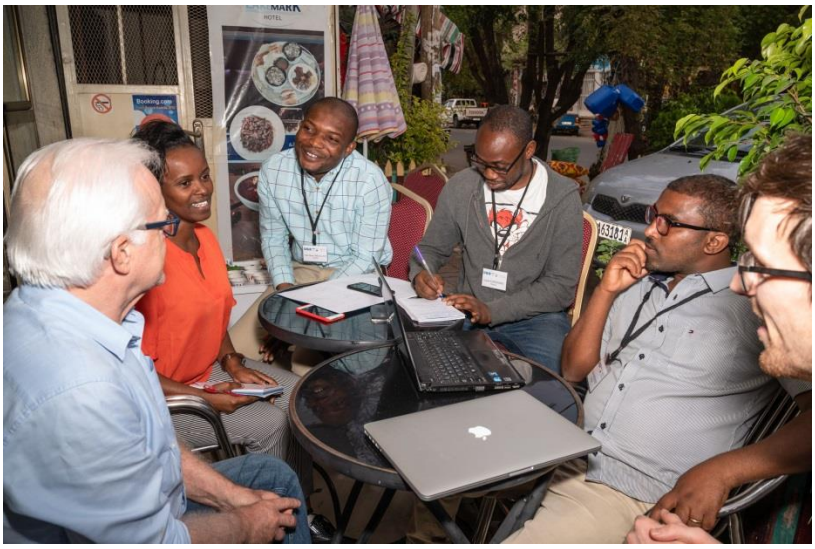
Rebecca Chukwuanukwu also conducted a video interview of Hans-Martin Jäck on his contribution to B cell immunology, this interview is available on youtube (https://www.youtube.com/watch?v=JYY5JF7p7YE).

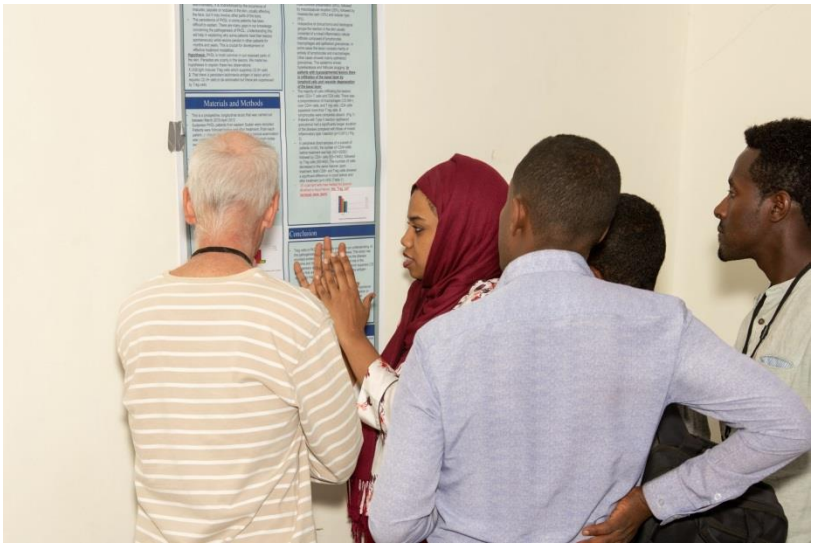
Impressions from the Immuno-Ethiopia course (All photography by Jacqueline Hirscher, DRFZ Berlin). More pictures are available at https://sharegallery.strato.com/u/Lqg8CrlS/m-8VYrm8

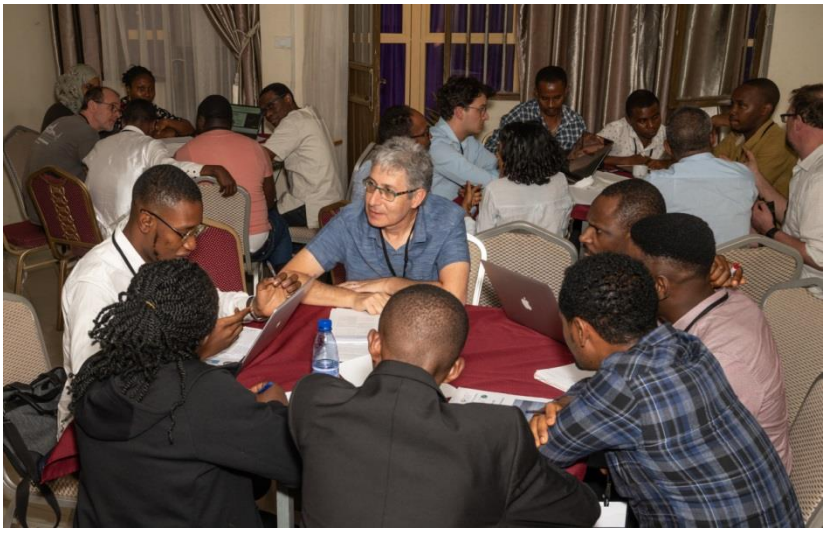


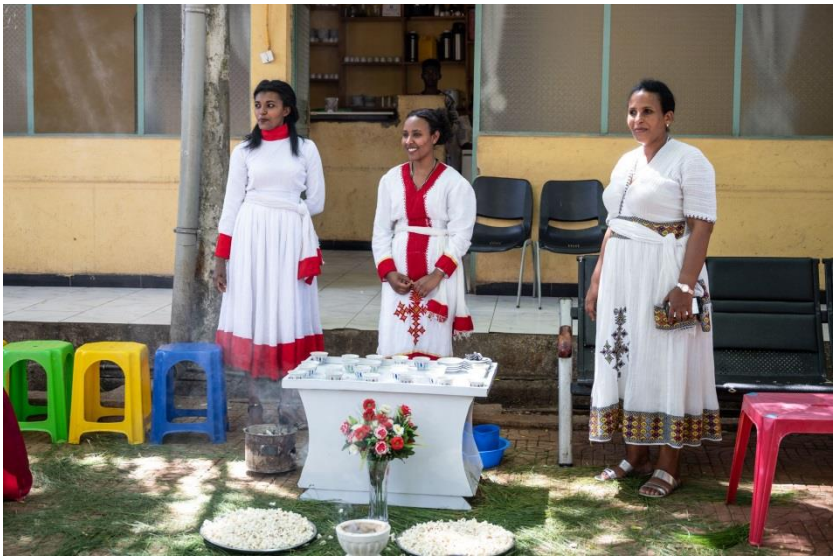


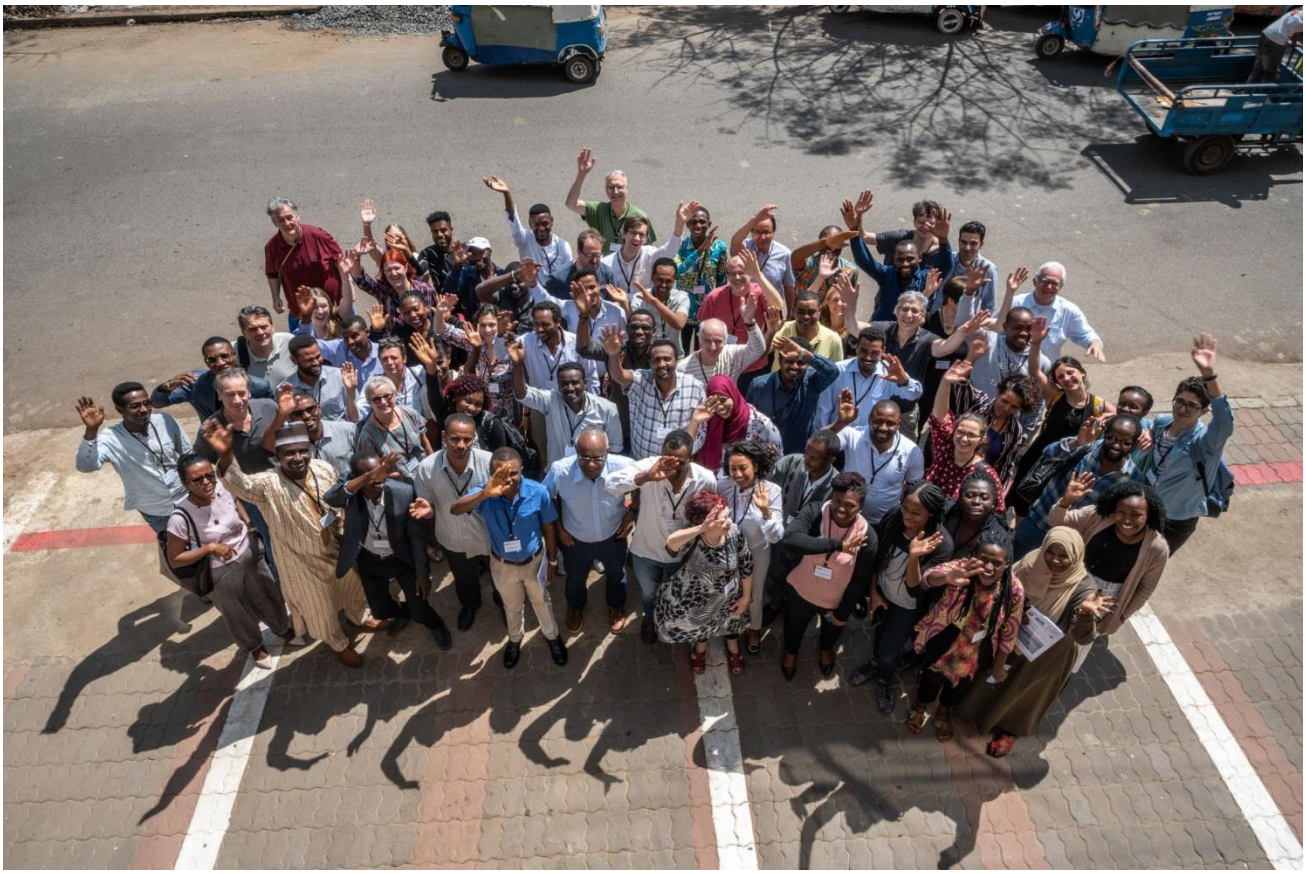





Materials and Methods







IMMUNO-ETHIOPIA 2020
Neglected Tropical Diseases and Malaria Challenges in Sub-Saharan Africa
February 23 – 29
Lakemark Hotel, Bahir Dar, Ethiopia

Local Organizers:

Pascale Kropf (APHI, Amhara Public Health Institute, Bahir Dar, Imperial College London)
Gizachew Yismaw (APHI, Bahir Dar)
Endakachew Nibret, (Bahir Dar University)
Ingrid Muller (APHI and Imperial College London)
Endalew Yizengaw (Bahir Dar University)
Mulat Yimer (Bahir Dar University)
Bizuayehu Gashaw (Bahir Dar University, Regional Health Bureau)

International organizers:

Dieter Kabelitz (University of Kiel, Germany, Chair of the IUIS-EDU Committee)
Michelle Letarte (University of Toronto, Canada, Past Chair of the IUIS-EDU Committee)
Fabienne Tacchini-Cottier (WHO Immunology Research and Training Centre, University of Lausanne, Switzerland)
Clive Gray (University of Cape Town, South Africa, Vice Chair of the IUIS-EDU Committee)

PROGRAM

SUNDAY 23 February **Arrival, Registration and Official Opening Session** ***Chairs:*** *Pascale Kropf and Gizachew Yismaw*		
14:00 – 16:00	*Registration*	
16:00 – 16:20	Official Opening from APHI and University of Bahir Dar	Gizachew Yismaw, Endakachew Nibret
16:20 – 16:40	Introduction to the Course / Immunopaedia	Dieter Kabelitz, Pascale Kropf, Michelle Letarte, Clive Gray
16:45 – 17:30	Opening lecture: Neglected tropical diseases in Sub-Saharan Africa	*to be determined*
17:30 – 18:15	Keynote lecture: Leishmaniasis in Sub-Saharan Africa	Asrat Hailu
19:00	*Reception and Dinner*	

MONDAY 24 February Review of Basic Immunology ***Chairs:*** *Michelle Letarte and David Sacks*		
08:30 – 09:30	Immunopaedia review for students	Bon Holtak/Clive Gray
09:30 – 10:15	Overview of the lymphoid system	Pascale Kropf
10:15 – 11:00	Early Innate immune responses to infection	Fabienne Tacchini-Cottier
11:00 – 11:30	*Coffee break*	
11:30 – 12:15	B cell development and function	Hans-Martin Jäck
12:15 – 13:00	T cell subsets and their function in the immune system	Clive Gray
13:00 –14:30	*Lunch / Meet the Experts*	
14:30 – 15:15	Unconventional T cells	Dieter Kabelitz
15:15 – 16:15	How to ask questions and generate a discussion	Clive Gray
16:15 – 16:45	*Coffee break*	
16:45 – 18:15	Introduction of the fellowship program writing; Presentations (5 min each) of potential projects by faculty Assignment of students to specific projects	Pascale Kropf L. Chapman, I. Kolářová, J. Cotton, C. Gray, F. Tacchini-Cottier, A. Dessein, F. Frischknecht, C. Hoving, M. Herrmann C. Gray
18:15 – 19:45	Poster Session 1 and Networking	*Moderators:* Dieter Kabelitz, Michelle Letarte
20:00	*Dinner*	

TUESDAY 25 February **Leishmaniasis 1** ***Chairs:*** *Alain Dessein and Ingrid Mueller*		
08:30 – 09:30	Immunopaedia review for students	Bon Holtak/Clive Gray
09:30 – 10:15	The role of sand flies in the transmission of *Leishmania* parasites	Iva Kolářová
10:15 – 11:00	Xenodiagnosis of Leishmaniasis	David Sacks
11:00 – 11:30	*Coffee break*	
11:30 – 12:15	Insights into the sand fly saliva: Blood-feeding and immune interactions between sand flies, hosts, and *Leishmania*	Iva Kolářová
12:15 – 13:00	Innate immune response to *Leishmania* parasites	Fabienne Tacchini-Cottier
13:00 –14:30	*Lunch / Meet the Experts*	
14:30 – 15:15	Adaptive immune response to *Leishmania* parasites	David Sacks
15:15 – 16:15	General Discussion with today's speakers	*Moderators:* Alain Dessein, Ingrid Muller
16:15 – 16:45	*Coffee break*	
16:45 – 18:15	Preparation of fellowship application	*All participants in groups with designated facilitators*
18:15 – 19:45	Poster Session 2 and Networking	*Moderators:* Dieter Kabelitz, Michelle Letarte
20:00	*Dinner*	

WEDNESDAY 26 February Leishmaniasis 2 ***Chairs:*** *Dieter Kabelitz and Iva Kolářová*		
08:30 – 09:30	Immunopaedia review for students	Bon Holtak/Clive Gray
09:30 – 10:15	Genetics of susceptibility and resistance to Leishmaniasis	Alain Dessein
10:15 – 11:00	Genomic insights into *Leishmania* population genetics	James Cotton
11:00 – 11:30	*Coffee break*	
11:30 – 12:15	Mathematical modelling of Leishmaniasis	Lloyd Chapman
12:15 – 13:00	Leishmaniasis treatments	Asrat Hailu
13:00 – 14:30	*Lunch / Meet the Experts*	
14:30 – 15:15	Anti-Leishmania vaccines	Toni Aebischer
15:15 – 16:15	General Discussion with today's speakers	*Moderators:* Dieter Kabelitz, Iva Kolářová
16:15 – 16:45	*Coffee break*	
16:45 – 18:15	Preparation of fellowship application	*All participants in groups with designated facilitators*
18:15 – 19:45	Poster Session 3 and Networking	*Moderators:* Michelle Letarte, Clive Gray
20:00	*Dinner and Cultural Evening*	

THURSDAY 27 February Schistosomiasis ***Chairs:*** *Pascale Kropf and Claire Hoving*		
08:30 – 09:30	Immunopaedia review for students	Bon Holtak/Clive Gray
09:30 – 10:15	Genomic insights into *Schistosomia* population genetics	James Cotton
10:15 – 11:00	Genetics of susceptibility and resistance to Schistosomiasis	Alain Dessein
11:00 – 11:30	*Coffee break*	
11:30 – 12:15	Pros and cons of Mass Drug Administration	Alain Dessein
12:15 – 13:15	General Discussion with today's speakers	*Moderators:* Pascale Kropf, Claire Hoving
13:15 – 14:45	*Lunch / Meet the Experts*	
14:45 – 15:30	How to be a successful scientist	Michelle Letarte
15:30 – 16:15	How to prepare a CV / motivation letter	Ingrid Muller
16:15 – 16:45	*Coffee break*	
16:45 – 18:15	Preparation of letter of motivation for fellowship application	*All participants in groups with designated facilitators*
18:15 – 19:45	Poster session 4 and Networking	*Moderators:* Michelle Letarte, Pascale Kropf
20:00	*Dinner*	

FRIDAY 28 February **Malaria** ***Chairs:*** *Hans-Martin Jäck and Asrat Hailu*		
08:30 – 09:30	Immunopaedia review for students	Bon Holtak/Clive Gray
09:30 – 10:15	Malaria transmission	Friedrich Frischknecht
10:15 – 11:00	Basics of antimalarial immunity	Yaw Bediako
11:00 – 11:30	*Coffee break*	
11:30 – 12:15	Genomic insights into malaria population genetics	James Cotton
12:15 – 13:00	Neutrophil extracellular traps (NETs) and cerebral malaria	Martin Herrmann
13:00 – 14:30	*Lunch / Meet the Experts*	
14:30 – 15:30	General Discussion with today's speakers	*Moderators:* Hans-Martin Jäck, Asrat Hailu
15:30 – 16:00	*Coffee break*	
16:15 – 19:45	Image Analysis Workshop	Friedrich Frischknecht
20:00	*Dinner*	

SATURDAY 29 February Malaria 2 and Fungal Infections, Project Presentations, Evaluation and Closing Remarks ***Chairs:*** *Fabienne Tacchini-Cottier and Clive Gray*		
08:30 – 09:15	Studying immunity to malaria in African children – Systems immunology and human cohort studies	Yaw Bediako
09:15 – 10:00	Epidemiology of Fungal Infections	Claire Hoving
10:00 – 10:30	*Coffee break*	
10:30 – 11:15	Genetics of the immune response to Fungal Infections	Ridha Barbouche
11:15 – 12:00	Immunity of Fungal Infections	Claire Hoving
12:00 – 12:30	General Discussion with today's speakers	Moderators: Fabienne Tacchini-Cottier Clive Gray
12:30 – 14:00	*Lunch/ Meet the Experts*	
14:00 – 16:00	Presentation of fellowship projects	A designated participant from each group
16:00 – 16:30	*Coffee break*	
16:30 – 18:00	Assessment of fellowship projects	Moderator: Michelle Letarte Panel: All facilitators present
18:00 – 19:30	Course evaluation and outcome, distribution of certificates and poster prizes, closing remarks	All participants and facilitators
20:00	*Farewell Dinner*	

SUNDAY March 1 Departure