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GHTM | ACTIVITY PLAN 2021 MONITORING



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1 Introduction and executive summary:

The year 2021 was, for GHTM, another year of struggle against the adversities and constraints posed by the SARS-CoV-2/COVID-19 pandemic. Reinforcing our commitment to the mission of producing knowledge on global health and tropical medicine, developing tools and strengthening health systems through excellence in research, training and cooperation for development, GHTM researchers were at the forefront of science and evidence-based knowledge production, that has greatly contributed to the fight against this pandemic, both nationally and internationally.

GHTM researchers were able to maintain the excellent scientific research that characterizes GHTM, using mechanisms of working at distance and maintaining social distance, as well as reinforcing our international cooperation that allowed us to keep projects in progress, maintain scientific productivity and even see new projects approved for funding, projects for the coming years, which we hope post-pandemic. The contributions to the assessment of the impacts of the pandemic on health systems and on the health of populations, in particular vulnerable populations, both in Portugal and in the CPLP space, were deeply monitored and studied in close association with the assessment and study of the adverse consequences for the control of infectious endemic diseases that are one of the main focuses of our work – tuberculosis, HIV, malaria and other opportunistic infections. We also reinforced our role in research in vector-borne diseases and in the health of migrants and travelers, by strengthening GHTM laboratory infrastructure with a new ACL/BCL-3 Security Insectary and by maintaining applied research on the control of these diseases and on health care delivery. It is also worth noting the permanent presence in the media, internet and social networks of our researchers, producing and sharing credible information and enlightening populations about all the science on which the global fight against COVID-19 was based and on which global health is based today. A reflection of the success of all this work are the various merit and excellence awards given to our researchers and their projects, in 20/21.



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Our scientific council (GHTM CC) and organizational framework (Figure 1) maintained its structure and aims with two changes. Two researchers left the Center and their coordination responsibilities at GHTM CC being replaced by new members that were invited by the GHTM Scientific Coordinator, with the approval of the GHTM CC and GHTM Director, to take over these coordination responsibilities – Reynaldo Dietz ended his contract with IHMT NOVA at the end of 2021 and was replaced at the coordination of the Individual Health Care Research Group by Marcelo Urbano Ferreira (<https://ghmt.ihmt.unl.pt/profiles/marcelo-urbano-ferreira/>) and Luis Lapão resigned his affiliation with the GHTM Research Center and was replaced at the coordination of Public Health Information Cross Cutting Issue by Inês Fronteira (<https://ghmt.ihmt.unl.pt/profiles/ines-fronteira-2/>).

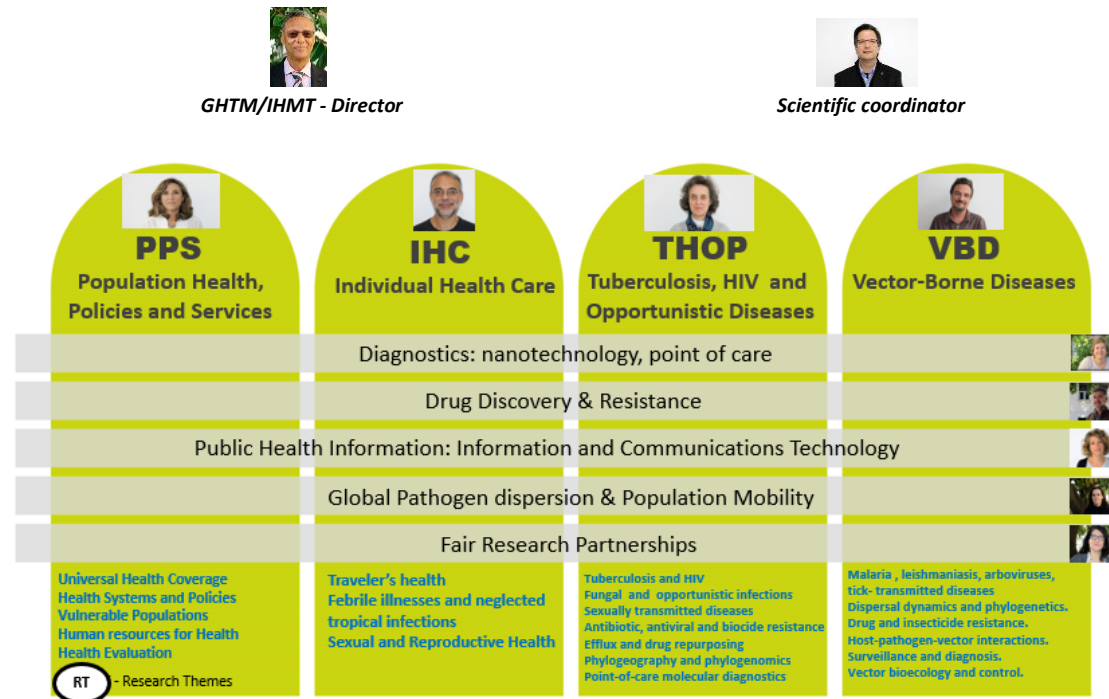


Figure 1 - GHTM / IHMT / NOVA scientific council and organizational framework



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In continuation of previous years and despite the limitations, 2021 was a successful year in scientific production and approved projects, with **56** projects in progress and **10** new projects approved. Our **65** researchers (59,70 ETIs) have published **192** international referenced articles, with a weighted citation impact for the scientific area of 22% above the world average. Part of this research was based on the reinforcement of postgraduate training with **11** new doctors in 2021, contributing to the strengthening of our global network of teaching and research in global health and tropical medicine.

2 General strategic objectives and 2021/2022 scientific council and organizational framework:

- **Promote and develop RESEARCH** in the areas of excellence at the center, in the context of the objectives of the research groups (Research Groups -RG) and the priority research lines (Cross-cutting Issues - CCI) of the GHTM / IHMT / NOVA (Figure 1), in line with NOVA's global scientific strategy (emphasizing NOVA Health platform) and IHMT/NOVA;
- **Implement in 2021 the strategy** defined and approved for the GHTM / IHMT / NOVA for 2019-2023 incorporating the improvement proposals of the FCT Evaluation Panel (2019) and the GHTM Scientific Advisory Board recommendations, ensuring the success of the execution and financing plan approved by FCT for 2019-2023, and implementing specifically the activities and plans approved and compiled at GHTM - ACTIVITY PLAN 2021_03_02_FINAL (in attachment to the documentation);
- Promote the **Open Science policy** at GHTM / IHMT / NOVA through the maintenance and constant updating of its activities in the bibliometric repository PURE-NOVA [<https://novaresearch.unl.pt/en/organisations/global-health-and-tropical-medicine-ghmt>], support for attracting new projects and managing ongoing projects;
- Implement the **integrated management GHTM / IHMT / NOVA** with the new strategic infrastructures - **security insectary ACL-3 VIASEF** - and the **Biological Resources Center / biobank - Biotropical Resources (BIOTROP)** [<https://www.ihmt.unl.pt/investigacao/biobanco/>];
- Complete the implementation of the general sample management regulation and standard procedures to regulate the data management of the research carried out at IHMT / NOVA;



- Promote the implementation of a **new Associated Laboratory of the Science and Technology Foundation [Associated Laboratory in Translation and Innovation Global Health Towards]**, in consortium with NOVA Medical School's Comprehensive Health Research Center (CHRC) [http://www.nms.unl.pt/main/index.php?option=com_content&view=article&id=2376:comprehensive-health-research-centre-chrc&catid=2:uncategorised&Itemid=500&lang=pt], the National School of Public Health [<https://www.ensp.unl.pt/>], FCT / NOVA's LIBPhys [<https://www.libphys.fct.unl.pt/>] and the University of Évora [<https://www.uevora.pt/>];
- Framing the research actions of the GHTM / IHMT / NOVA in the Sustainable Development Goals (SDGs) and in the guidelines of the GHTM / IHMT / NOVA;
- Direct and adapt the Central Research Themes of the GHTM / IHMT / NOVA (Figure 1) to the objectives and actions of the European Union and National Horizon Europe Strategies [https://ec.europa.eu/info/horizon-europe_en] and Portugal 2030 [<https://www.portugal.gov.pt/pt/gc21/governo/programa/portugal-2030.aspx>] framework and align these themes with the priorities of the Portugal 2030 Strategy and the University NOVA, promoting the sharing of NOVA Saúde initiatives at IHMT / NOVA;
- Align the objectives for Research at the GHTM / IHMT / NOVA with the objectives for the teaching and training of post-graduate human resources at IHMT / NOVA, reinforcing the inclusion and participation of doctoral students (3rd Cycle) of IHMT / NOVA in GHTM / IHMT / NOVA.

In continuation of previous years and despite limitations, 2021 was a successful year in scientific production and approved projects - **56 ongoing projects and 10 new projects approved (3 approved from UE – HORIZON EUROPE - 1 as Coordinator)**. Our **65 IHMT researchers (59.70 FTEs) (94 GHTM researchers)** published **192 international referenced articles**, with a weighted citation impact for the scientific area of **1.22%** above the world average in 2021 (data consolidation ongoing).

Global output	2018	2019	2020	2021	Evolution
<i>Total of publications</i>	Nº	Nº	Nº	Nº	Variation (2018 – 2021)
IHMT	182	175	179	192	↗

UO	2016	2017	2018	2019	2020	2021	Variation (2018 – 2021)
	FWCI	FWCI	FWCI	FWCI	FWCI	FWCI	
IHMT	1,33	1,52	1,36	1,11	1,31	1,22 ¹	↗

¹ data collection for 2021 not consolidated

Figure 2 : Percentile 75 distribution of overall publications in the consolidated period (2017-2021)

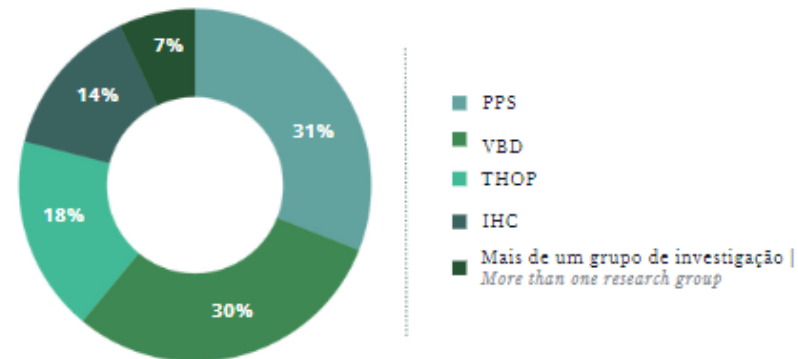


Percentage of publications with international collaboration (2017/2021) **76%**

GHTM 2021 publications in SCOPUS TOP 10% **14%**

Part of this research was based on the reinforcement of postgraduate training with **11 new doctors in 2021 (9 in 2020)**, contributing to the strengthening of our global network of teaching and research in global health and tropical medicine.

Figure 3 : Publications distribution by GHTM Research Group in 2021





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MONITORING OF RESEARCH GROUPS ACTIVITIES IN 2021

- - Not done/ Canceled/ No Outcome
- - Done/ Concluded/ Outcome
- - Delayed/ Postponed/ Delayed Outcome



RG – IHC

main lines of action of the IHC group are related to the transversal areas of the GHTM, Global Pathogen Dispersion and Population Mobility, Drug Discovery & Resistance and Diagnostics and Clinical Trials. The activities planned for 2021 fall within the transversal themes described above:

IHC activities were aligned with Sustainable Development Goals (SDGs) especially #1 – No poverty; #3- Good Health and Well-being, #4-Quality Education and #10 - Reduce inequality within and among countries

ACTIVITIES	PROPOSED/REACHED OUTCOMES FOR 2021	EVIDENCE
<p>Ongoing activities 2020/2021 with CCIs: CCIs - Drug Discovery and Resistance (DDR) and Diagnostics (DG) (Including Clinical Trials)</p> <ul style="list-style-type: none"> ● Therapeutic trials for the treatment of African Human Trypanosomiasis (THA) coordinated by DNDi and EDCTP funded. The 1st is an ongoing Clinical Trial on the "Efficacy of Fexinidazole in the treatment of patients with infection caused by <i>T. brucei rhodesiense</i> in Malawi. The activation of an additional site in Uganda is expected to happen in 2021, which will increase patient enrollment. ● A second clinical trial with the new oral drug (Acoziborole), in a single dose, for the treatment of THA caused by <i>T. b. gambiense</i> in children and adults (≥15 years), coordinated by DNDi, was recently approved by the EDCTP for funding. This study is expected to start enrolling patients from The Democratic Republic of Congo and Guiné in 2021. ● Observational cross-sectional study on visceral leishmaniasis (VL), caused by <i>L. infantum</i>. This corresponds to the Doctoral Thesis of a student in Tropical Medicine, will determine the prevalence of asymptomatic human VL in Portugal. ● Surveillance of antimalarial drug response in imported malaria cases in Portugal. 	<p>(Ongoing) Patient enrollment was completed in October 2021. Last patient-last follow up visit should be completed in October 2022.</p> <p>(Ongoing). Due to unexpected difficulties in the development of the pediatric formulation, the clinical trial could only be started in January 2022 in the DRC.</p> <p>Thesis topic of a PhD student in Tropical Medicine, scheduled to start in mid-2021</p> <p>(Ongoing)</p>	<ul style="list-style-type: none"> ● Lutje, V, ...Seixas J. et al. (2021). Chemotherapy for second-stage human African trypanosomiasis: drugs in use. The Cochrane database of systematic reviews, 12(12), CD015374. https://doi.org/10.1002/14651858.CD015374 ● One PhD grant : Rafael Amorim Rocha Supervisors: Carla Maia, Cláudia Conceição, and Luzia Gonçalves. Title: Prevalence of asymptomatic leishmaniasis in Portugal. (SFRH/BD/GHTM/DTM2020) ● Silva-Pinto, A., et al. (2021). Artemether-lumefantrine treatment failure of uncomplicated Plasmodium falciparum malaria in travelers coming from Angola and Mozambique. International Journal of Infectious Diseases, 110, 151-154. https://doi.org/10.1016/j.ijid.2021.07.008



<p>New research Projects:</p> <p>CCI - Public Health Information (PHI) - ● COVID-19 vaccination in migrants from Lisbon area: protocol will be developed with the objective of evaluating the knowledge, attitudes, practices and health literacy of migrants with regard to safety, efficacy and confidence in vaccination against COVID 19, which should take place in 2021. The target population will include a sample of migrants from CPLP countries, mainly from the PALOP countries and Brazil, from the Greater Lisbon area. –</p> <p>CCI – Diagnostics (DG) – ● A cross-sectional study, to be developed at the Hospital de Lubango, Angola, is scheduled for 2021. The objective will be to evaluate the performance of clinical and laboratory diagnostic techniques in the differential diagnosis of SARS CoV-2 infection in an endemic area of malaria, DENV, CHIKV, Salmonella and Leptospirosis and with seasonal incidence of viral and bacterial respiratory infections in winter. It is also intended to develop an optimized diagnostic algorithm, based on the results of the discriminating power of the clinical case definition parameters and the diagnostic tests used.</p>		<p>● Submitted and approved for funding in 2021 and should start in March 2022. Funding: Centro Padre Álvares Correia, Lisboa.</p> <p>● Study start was postponed mainly due to the low incidence of SARS-CoV-2 in the proposed study site. The study is under revision in order to possibly drop the SARS-CoV-2 component. Inclusion of a second study site in Luanda is under evaluation</p>
<p>Congresses//Events:</p> <p>● 8th International Conference on <i>Plasmodium vivax</i> Research. Global virtual event. (https://www.vivax2022.org/). IHC members involved.</p> <p>● XVII Reunião Nacional de Pesquisa em Malária. Local in-person event, Rio de Janeiro, Brazil, 24-28 April, 2022 (https://www.malaria2020.com.br/). IHC members involved:</p> <p>● Symposium on Antimalarial Drug Development and Molecular Mechanisms of Resistance. In-person/virtual event jointly organized by IHMT and ICB-USP in São Paulo, Brazil. Organizers: IHC members</p>	<p>Event held in 5-8 April, 2022.</p> <p>Event to be held in 24-28 April, 2022.</p> <p>Event to be held in August, 2022.</p>	
<p>Publications/Training:</p>	<p>At least 5 papers in international journals related with the results and outcomes of the ongoing clinical trials and projects indexed in Scopus.</p> <p>At least one new doctoral student enrolled in GHTM-IHC group</p>	<p>● At least 21 publications in journals indexed in Scopus.</p> <p>● Rafael Rocha, MD, PhD candidate in the Tropical Medicine program. Ongoing.</p>



<p>Capacity building:</p> <ul style="list-style-type: none"> ● Zoom meetings for training local PIs in Lubango, Angola ● Keep updated the PURE-NOVA profiles of IHC members. ● Meeting on human African trypanosomiasis elimination ● Participation in open science initiatives ● Knowledge dissemination initiatives on the ongoing pandemics supporting efforts from the public health authorities, including seminars and interviews for the media. 	<p>Participation of several IHC members as scientific/technical reviewers of the digital platform on vaccines and immunization IMUNE.PT, awarded with two prizes of communication/scientific dissemination.</p> <p>Participation of IHC members in initiatives raising general public comprehension on COVID.</p>	<ul style="list-style-type: none"> ● A one-day Workshop-Webinar on ‘the sociocultural dimensions and community perspectives on HAT Elimination’ was organised by the Institute of Hygiene and Tropical Medicine in Lisbon (Portugal) in collaboration the WHO HAT Elimination Network on 19 July 2021. Coordination: Philip J. Havik (IHMT); Jorge Seixas (IHMT); Jorge Atouguia (IHMT); José Ramón Franco (WHO); Gerardo Priotto (WHO); Augustin Kadima Ebeja (WHO) ● https://www.imune.pt/ JNina and CConceição, among others: Regular presence in the Media – TSF radio, SIC, RTP and TVI Networks, Newspapers and magazines (see 2021 IHMT Report for further details)
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RG – PPS

The main research topics of the PPS group are: Health Policy and Planning; Human Resources for Health; Health determinants of vulnerable populations. The activities planned for 2021 fall into the various cross-cutting areas described above:

PPS activities were aligned with Sustainable Development Goals (SDGs) especially #1 – No poverty; #3- Good Health and Well-being; #4-Quality Education and #10 - Reduce inequality within and among countries.

ACTIVITIES	PROPOSED/REACHED OUTCOMES FOR 2021	EVIDENCES
<p>Ongoing activities 2020/2021 with CCIs:</p> <p>CCI - Global Pathogen dispersion and Population Mobility (GPPM) 3 studies related to the adult and child immigrant population:</p> <ul style="list-style-type: none"> ● at the adult level, a work on acculturation, lifestyles and health of CPLP immigrants in two Iberian contexts; ● in terms of child health, the cohort study in the Amadora region will be continued through a second survey of data ● the elaboration of the Protocol for a cohort study of children in Cape Verde and / ● or S. Tomé and Prince. ● Project on the impact of the pandemic on health inequalities (FCT funding) <p>CCI - Public Health Information (PHI) 2 projects funded by European Funds:</p> <ul style="list-style-type: none"> ● VAX-TRUST - Addressing vaccine hesitancy in Europe – Financing UE -Horizonte 2020. ● BCG vaccine to reduce unplanned absenteeism due to illness of health care workers during the COVID-19 pandemic. A multi-center randomized controlled trial. Financing EU /ECDTP. ● Knowledge dissemination initiatives on the ongoing pandemics supporting efforts from the public health authorities, including seminars and interviews for the media. 	<p>No information</p> <p>Data on the second wave of data were collected through phone and face to face interviews and administrative data</p> <p>Cape-Verde: Protocol for the first data collection already approved by Cape-Verde NEC; questionnaires already in redcap; (S. Tomé: not implemented).</p> <p>Determinants and health needs of migrant children in a pandemic context: a longitudinal study for the Region of Lisbon and the Tagus Valley.</p> <p>Data for some countries already collected.</p> <p>Participation of PPS members in initiatives raising general public comprehension on COVID.</p>	<p>No information</p> <ul style="list-style-type: none"> ● Data set completed ● Protocol approval ● Signed and started 2021 2 Researcher Fellowships ● Signed and started - 1 Fellowship: Ongoing. Edital already completed. - 1 Grant Holders /Fellowship. ● Signed and started.. Fellowship1 Grant Holders /Fellowship posdoc ● Tiago Correia among others: Regular presence in the Media – TSF radio, SIC, RTP and TVI Networks, Newspapers and magazines (see 2021 IHMT Report for details)



<p>CCI – Fair Research Partnerships (FRP)</p> <ul style="list-style-type: none"> ● 2 important partnerships: one between the United Kingdom, Portugal and Mozambique as part of an investigation into patterns of health literacy and demand for men's health care in Mozambique and another between Portugal, Mozambique, Cape Verde and Angola on strengthening the capacity of bioethics committees. ● IANDA GUINÉ SAÚDE - Guinea-Bissau Health Reinforcement (Inst Camões, FCG) 	<p>Ongoing</p>	<p>1 postdoc fellowship for 6 months in bioethics</p>
<p>New research Projects:</p> <ul style="list-style-type: none"> ● 6 projects (as PI) and 1 approval were submitted to FCT's last call. ● VAX-TRUST - Addressing vaccine hesitancy in Europe- H2020 ● BCG vaccine to reduce unplanned absenteeism due to illness of health care workers during the COVID-19 pandemic. A multi-center randomized controlled trial - UE/EDCTP ● Non-specific effects of BCG in under-five children"- FCT, EXPL/SAU-EPI/0067/2021 ● Health literacy in times of coronavirus and COVID-19: the COVID-HL school survey. ● Determinants and health needs of migrant children in a pandemic context: a longitudinal study for the Region of Lisbon and the Tagus Valley. PTDC/SAU-SER/4664/2020 ● Impact of COVID-19 on non-EU migrant's health: knowing more for a better intervention- PT/2021/FAMI/699 ● Impact of deforestation for the emergence of new emergent infectious diseases- Marie Curry- H2020 ● A cohort study of HBV-infected pregnant women in Lubango, Angola: vertical transmission and relationship with maternal, obstetric and newborn complications 	<p>Signed in February 2021 and already started</p> <p>Signed and already started. Most of data already collected</p> <p>Signed and started</p> <p>Started and already ended</p> <p>Signed in February 2021 and already started</p> <p>Signed in October 2021 and already started</p> <p>Marie Currie Grant; signed and started in January 2022</p> <p>Not funded</p>	



<p>Conferences/events: Organization of 5 National and international seminars / conferences</p> <ul style="list-style-type: none"> ● Organization of a European Conference (EUPHA Health Workforce Research Group 2nd midterm conference 'Health workforce development: disruption, innovation and resilience beyond the COVID-19 crisis'), ● Luso-Brazilian Meeting (in Health Assessment and Knowledge Management) ● 3 seminars on: Health Human Resources, Knowledge Management and Communication Strategies. 	<p>Held in June 2021</p> <p>Postponed to 2022</p> <p>No information</p>	<p>Link WEB:</p>
<p>Publications/Training:</p> <ul style="list-style-type: none"> ● PPS group members, including students, will participate, with presentation of communication, in at least 7 Congresses and Conferences: ● Publications in journals indexed in Scopus 	<p>3rd World Congress on Maternal Fetal and Neonatal Medicine - MARCH 25-27, 2021 - Venice, Italy;</p> <p>International HBV Meeting - September 14-17, 2021 - Toronto, Canada;</p> <p>Tenth EDCTP Forum, 17-21 de Outubro 2021.</p> <p>XXXIX Reunión Anual de la Sociedad Española de Epidemiología y XVI Congresso da Associação Portuguesa de Epidemiologia, 7 a 10 de setembro, 2021</p>	<ul style="list-style-type: none"> ● Posters: Cá, E., Nielsen, S., Fronteira, I., Benn, C.S., Schaltz-Buchholzer, F. High prevalence of SARS-CoV-2 antibody among health care workers in Guinea-Bissau. Tenth EDCTP Forum, 17-21 de Outubro 2021. Fronteira, I., Schaltz-Buchholzer, F., Nielsen, S., Araújo, I., Aide, P., Ferrinho, P., Bem, C. Prevalence of observed BCG scar in health care workers from the BCG-COVID-RCT trial. Tenth EDCTP Forum, 17-21 de Outubro 2021. Amaral, P., Fronteira, I. Profile of traditional chinese medicine users according to ICD-11. XXXIX Reunión Anual de la Sociedad Española de Epidemiología y XVI Congresso da Associação Portuguesa de Epidemiologia, 7 a 10 de setembro, 2021 Amaral, P., Fronteira, I. Profile of traditional chinese medicine users according to differential diagnosis of traditional medicine. XXXIX Reunión



	<p>Congress on Tropical Medicine and International Health: Global challenges in health, migration and equity. Sep 27 - Oct 1, 2021 online, Bergen, Norway</p> <p>Profissões da Saúde. NOVA Saúde Health Systems and Policies, 12 Nov 2021. Instituto de Higiene e Medicina Tropical da Universidade NOVA de Lisboa</p> <p>XXXIX Reunión Anual de la Sociedad Española de Epidemiología y XVI Congreso da Associação Portuguesa de Epidemiología, 7 a 10 de setembro, 2021</p> <p>I Encontro da Liga de Tuberculose da Escola de Enfermagem de Ribeirão Preto (online), March 2021</p>	<p>Anual de la Sociedad Española de Epidemiología y XVI Congreso da Associação Portuguesa de Epidemiología, 7 a 10 de setembro, 2021</p> <p>● <u>Oral communications:</u> Socioeconomic impact of COVID-19 among immigrants in Lisbon Region, 12th European Congress on Tropical Medicine and International Health: Global challenges in health, migration and equity. Sep 27 - Oct 1, 2021 online, Bergen, Norway</p> <p>Professions in Health. NOVA Saúde Health Systems and Policies, Instituto de Higiene e Medicina Tropical da Universidade NOVA de Lisboa. 12 Nov 2021</p> <p>How the syndemic perspective can change the way we understand the SARS-CoV-2 pandemic. Roundtable: Syndemics: the logic of multiple causes. XXXIX Annual Meeting of the Sociedad Española de Epidemiología and XVI Congress of the Portuguese Association of Epidemiology, September 2021</p> <p>Tuberculosis in the global context: challenges for Portugal in "Tuberculosis in the global context: challenges for Brazil, Portugal,</p>
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	<p>AORTIC Cancer in Africa Conference, November 2021</p> <p>publications in journals indexed in scopus</p> <p>At least two new doctoral students enrolled in PPS-IHC group</p>	<p>Nigeria, Mozambique and Guinea-Bissau" at the 1st Meeting of the Tuberculosis League of the School of Nursing of Ribeirão Preto (online) , March 2021</p> <p>Epidemiological profile of esophageal cancer in patients followed at Dr. Baptista de Sousa hospital in S. Vicente island, Cape-Verde, between 2010 and 2015. AORTIC Cancer in Africa Conference, November 2021</p> <p>● 65 publications (see 2021 GHTM Research Report report)</p> <p>● 3 PhD grants signed <i>Regina Amado; Reka Cane; Iolanda Alves</i></p>
<p>Capacity building: ●/● organization of an advanced Statistics course for INS-MISAU, Mozambique; ethics course in health research in e-learning for CPLP</p>	<p>3 advanced courses</p> <p>1 in person</p> <p>2 e-learning</p>	<p>● Advanced Course on Health Statistics (May 2022, INS-MISAU)</p> <p>● Training course for field agents within the ECTP-project</p> <p>● e-learning Course on Ethics for Health Research (14-18 March 2022) 368 candidates 50 selected participants from Angola, Cape-Verde, Guine-Bissau, Mozambique and S. Tomé e Príncipe</p>



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<p>● Participation in open science initiatives</p>	<p>Participation of several PPS members as scientific/technical reviewers of the digital platform on vaccines and immunization IMUNE.PT, awarded with two prizes of communication/scientific dissemination.</p>	<p>https://www.imune.pt/</p>
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RG – THOP

The overarching aim of the THOP Group is the molecular epidemiology, diagnosis, study of drug-resistance mechanisms, drug discovery and control of tuberculosis (TB), HIV and opportunistic diseases on a Global Health perspective in an era of antimicrobial resistance, chronic immunosuppressive diseases and now the COVID pandemic. Despite the many challenges and uncertainty brought by the ongoing pandemic, THOP members achieved and in some cases, even exceeded, most of the goals established for 2021 and initiated new areas of research. Most of the planned activities not accomplished, mainly due to the pandemic restraints, were rescheduled for 2022-2023.

THOP activities were aligned with Sustainable Development Goals (SDGs) especially #1 – No poverty, #3- Good Health and Well-being, #4-Quality Education, #6-Clean Water and Sanitation, #10 - Reduce inequality within and among countries and #15 - Life on Land.

ACTIVITIES	PROPOSED/REACHED OUTCOMES FOR 2021	EVIDENCES
CCI - DRUG DISCOVERY & RESISTANCE (DDR)		
● Drug design and development against mycobacterial drug resistant infections (FCT, EUCAST and EU-MepAnti Marie Skłodowska-Curie action)	<ul style="list-style-type: none"> - Establishment of the genetic diversity of candidate loci linked to <i>Mycobacterium tuberculosis</i> resistance to bedaquiline, delamanid and pretomanid. - Multicentre testing of the EUCAST broth microdilution reference method for MIC determination on <i>Mycobacterium tuberculosis</i>. - Design of new antitubercular isoniazid derivatives with improved reactivity and membrane trafficking abilities. 	<ul style="list-style-type: none"> ● Gómez-González et al. (2021). Scientific reports, 11(1), 19431. https://doi.org/10.1038/s41598-021-98862-4 ● Schön et al. (2021). Clinical microbiology and infection 27(2), 288.e1–288.e4. https://doi.org/10.1016/j.cmi.2020.10.019 ● de Faria, et al. (2021). Biomedicine & pharmacotherapy 144, 112362. https://doi.org/10.1016/j.biopha.2021.112362
● Computational drug discovery and drug repurposing for <i>M. tuberculosis</i> and <i>Neisseria</i> (EU-Marie Curie Action)	<ul style="list-style-type: none"> - Identification of 57 approved drugs with predicitive activity against <i>Neisseria gonorrhoeae</i> 	<ul style="list-style-type: none"> ● 1 poster ECCMID2021; 1 poster Microbiotec21.
● Antibiotic and biocide resistance profiling in major human and veterinary staphylococcal pathogens (FEDER/FCT)	<ul style="list-style-type: none"> - Antibiotic and biocide profiling for >400 staphylococci. - Proposal of 2 new ECOFFs for identification of antibiotic resistant staphylococcal populations (FEDER/FCT, in collaboration with the COST Action ENOVAT). 	<ul style="list-style-type: none"> ● 2 posters in ECCMID2021 and 4 posters in MicroBiotec21, 1 Msc thesis ● Costa et al. Microb Drug Resist. 2021 27:1555-59, https://doi.org/0.1089/mdr.2020.0402
● Evaluation of efflux-mediated resistance in the major veterinary pathogen <i>S. pseudintermedius</i> .	<ul style="list-style-type: none"> - Characterization of efflux activity for 155 <i>S. pseudintermedius</i>; - COwt values for EtBr and TPP; contribution of efflux for FQ MICs 	<ul style="list-style-type: none"> ● Msc Thesis, Ramos B, Msc Biomedical Sciences Dec 2021; ● Leal M, Msc Biomedical Sciences (to be defended March 2022). ● 2 posters MicroBiotec2021
● Phylogenomics of multidrug efflux pumps in staphylococci	<ul style="list-style-type: none"> - Workplan delayed due to the pandemics. Expected to be completed by mid-2023 	



● Antimicrobial resistance in <i>S. aureus</i> causing bloodstream infections in children in Mozambique	- Workplan delayed due to the pandemics. Expected to be completed by mid-2022.	● 1 poster MicroBiotec2021
● Resistance to antiretrovirals	- European multi-cohort study data on effectiveness of integrase strand transfer inhibitor-based regimens in HIV-infected treatment-naive individuals.	● Rossetti et al.; EuResist Network, INTEGRATE study group. J Antimicrob Chemother. 2021;76(9):2394-2399. https://doi.org/10.1093/jac/dkab200
● Drug repurposing for inhibition of SARS-Cov-2 replication (FCT).	- Project concluded, report submitted to FCT	● 1 poster MicroBiotec2021 ● One manuscript submitted to "Molecules".
CCI - DIAGNOSTICS (DG)		
● SARS-CoV-2 serological survey analysis.	- Data on genome-wide diversity of Zika virus - New nomenclature proposal	● Seabra et al. Manuscript accepted at Virus Evolution 2022 3 ongoing MSc Thesis
● Development of point-of-care tools for SARS-Cov-2 diagnosis (FCT)	No information	
● Development of point-of-care tools for drug resistance detection on <i>M. tuberculosis</i>	Proposal of Electrochemical Detection of Single-Nucleotide Polymorphism Associated with Rifampicin Resistance in <i>Mycobacterium tuberculosis</i> Using Solid-Phase Primer Elongation with Ferrocene-Linked Redox-Labeled Nucleotides.	Ortiz, M et al. (2021). ACS sensors, 6(12), 4398–4407. https://doi.org/10.1021/acssensors.1c01710
● Microbicidal activity of macrophages exposed to pathogenic spirochetes <i>Borrelia garinii</i> and <i>B. lusitanae</i>	(Ongoing)	- 1 poster MicroBiotec2021
● Optimization and application of an indirect immunofluorescence test as an alternative to the microscopic agglutination test (reference test) for the diagnosis of leptospirosis (with VBD)	(Ongoing)	-
● Purification and characterization of exosomes in Portuguese patients chronically infected with HDV	Project concluded, manuscript in preparation.	
● Determination of the transcriptomic alterations in HDV-induced hepatocellular carcinoma (FCT)	(Ongoing)	-
● Development of point-of-care tools for immunonodiagnosis of <i>Pneumocystis pneumonia</i> .		- 4 papers/book chapter – to confirm - 4 conference/scientific meeting communications
● Identification and characterization of intestinal parasitic infections in Mozambique.	Data on occurrence of intestinal parasites in fresh horticultural products sold in maputo markets and supermarkets, Mozambique	- Salamandane et al. (2021). Microorganisms, 9(9), [1806]. https://doi.org/10.3390/microorganisms9091806 - 4 conference/scientific meeting communications
● Study of the gut mycobiome using nanopore sequencing approaches	No information	-
CCI - GLOBAL PATHOGEN DISPERSION AND POPULATION MOBILITY (GPPM)		
● Phylogeography, dispersion of MDR/TB in Brazil	Genomic-based surveillance reveals high ongoing transmission of multi-drug-resistant <i>Mycobacterium tuberculosis</i> in Southern Brazil.	Salvato et al. (2021). International journal of antimicrobial agents, 58(4), 106401. https://doi.org/10.1016/j.ijantimicag.2021.106401



<p>● Identification of prevalent clonal lineages of staphylococcal pathogens - associations with multidrug resistance, biofilm formation and virulence potential (FEDER/FCT).</p>	<p>- Establishment of the main clonal lineages causing SSTIs in humans and companion animals for 3 staphylococcal species - Evaluation of biofilm production and virulence potential on representative strains of these main clonal lineages</p>	<p>Ferreira et al. <i>Antibiotics</i> 2021, 10(5), 518. doi.org/10.3390/antibiotics10050518 Costa et al. <i>Antibiotics</i> 2021, 10(4), 345. doi.org/10.3390/antibiotics10040345 2 posters in ECCMID2021, 3 posters in MicroBiotec21, 2 Msc thesis</p>
<p>● Transmission dynamics of HIV-1 in Europe and in migrant populations</p>	<p>- Sociodemographic, Clinical, and Genomic Characteristics of HIV and Tuberculosis Co-Infection Among Migrants in Portugal - Patterns of post-migration HIV-1 infection acquisition among Portuguese immigrants of different geographical origin - Determinants of HIV-1 Late Presentation in Patients Followed in Europe. - Determinants of HIV-1 Late Presentation in a Cohort of Portuguese HIV-1 Patients</p>	<p>● Tavares et al. <i>AIDS Res Hum Retroviruses</i>. 2021 Jan;37(1):34-37. doi: 10.1089/AID.2020.0119. ● Pimentel et al. <i>AIDS</i>. 2022 Feb 25. doi: 10.1097/QAD.0000000000003203 ● Miranda MNS et al. <i>Pathogens</i>. 2021 Jul 2;10(7):835. doi: 10.3390/pathogens10070835. ● Miranda AC et al. <i>AIDS Res Hum Retroviruses</i>. 2021 Nov;37(11):846-851. doi: 10.1089/AID.2020.0175. Epub 2021 Feb 16 ● Two oral presentations and one poster in European HIV and Hepatitis Meeting 2021 ● One abstract selected for oral presentation in ECCMID2022.. ● One PhD thesis being finalized.</p>
<p>● Evolutionary history and drug resistance patterns of HIV-1 in Cabo Verde</p>	<p>(Ongoing)</p>	<p>One abstract submitted to international conferences; one manuscript in preparation</p>
<p>● Epidemic history of HBV and HCV in Portugal</p>	<p>(Ongoing)</p>	<p>One PhD completed. One manuscript submitted.</p>
<p>● Phylogeography, dispersion of HIV and resistance to antiretrovirals in Portugal, with a special focus on vulnerable populations (migrants and PALOPs).</p>	<p>(Ongoing)</p>	
<p>● Genome-wide diversity of Zika virus: exploring spatio-temporal dynamics to guide a new nomenclature proposal</p>		<p>Horizon 2020, FCT; manuscript submitted</p>
<p>● Participation in project DogIPM-Immune precision medicine as a new opportunity to control canine trypanosomatid diseases</p>	<p>(Ongoing)</p>	
<p>CCI - PUBLIC HEALTH INFORMATION (PHI)</p>		
<p>● Knowledge dissemination initiatives on the ongoing pandemics supporting efforts from the public health authorities, including seminars and interviews for the media.</p>	<p>Participation of THOP members in >3 initiatives raising general public comprehension on COVID.</p>	<p>● J Piedade: Oral communication “Vacinas contra a COVID-19”, webinar “VACINAS COVID 19: VERDADES E MITOS”, in the scope of project “IANDA Guiné Saúde” (Feb 2021).</p>



		<ul style="list-style-type: none"> ● CCunha among others: Regular presence in the Media – TSF radio, SIC, RTP and TVI Networks, Newspapers and magazines (see 2021 IHMT Report for further details)
CCI - FAIR RESEARCH PARTNERSHIPS (FRP)		
<ul style="list-style-type: none"> ● Capacity building initiatives on Covid-19 diagnosis and awareness in Angola and other CPLP countries. 	Participation in project IANDA Guiné Saúde	<ul style="list-style-type: none"> ● J Piedade: Oral communication “Vacinas contra a COVID-19”, webinar “VACINAS COVID 19: VERDADES E MITOS”, in the scope of project “IANDA Guiné Saúde” (Feb 2021). ● CCunha. webinars for Benguela and another for Luanda Military Hospital
<ul style="list-style-type: none"> ● HIV vertical transmission in Angola (w/ HIC and PPS members) 	Evaluation on vertical transmission of sexually transmitted infections to newborns.	<ul style="list-style-type: none"> ● Oliveira et al. (2021). J. Infect. Dev. Ctries., 15(10):1547-1550. doi:10.3855/jidc.12731.
TRANSVERSAL:	One strategic infrastructure of GHTM IHMT is coordinated by members of the THOP group – the Bioinformatics HUB Two additional GHTM transversal facilities coordinated by THOP members are the MinION and the Flow Cytometer	
<ul style="list-style-type: none"> ● Definition of GHTM’s Bioinformatics HUB’s general SOPs for data storage and management. 	GHTM’s Bioinformatics HUB’s general SOPs for data storage and management prepared (awaiting for final GHTM’s CC approval) General SOPs for MinION usage defined	<ul style="list-style-type: none"> ● GHTM’s Bioinformatics HUB’s general SOPs for data storage and management (2021 version) ● General SOPs for MinION use (2021 version)
<ul style="list-style-type: none"> ● Training of GHTM members on MinION and Flow Cytometer 	Formation provided by THOP members (responsible for GHTM’s Bioinformatics Hub) to students and technicians on good practices for MinION usage Training provided by THOP members on GHTM’s Flow Cytometer to PhD and MSc students.	<ul style="list-style-type: none"> ● Training on MinION provided for 13 GHTM members ● Training provided to several PhD and MSc students (individual practice training)
<ul style="list-style-type: none"> ● Collaborate/contribute to GHTM’s Bioinformatics HUB’s and to GHTM’s BRC/Biobank 		<ul style="list-style-type: none"> ● Integration of IHMT’s mycobacteria collections at GHTM’s BRC/Biobank (delayed)
NEW RESEARCH PROJECTS APPROVED / STARTED 2021	THOP implemented 1 new research project (as initially anticipated)	
11 submitted projects (6 more than initially anticipated)	Signed in 2021 and already started	



<ul style="list-style-type: none"> ● EuCARE - European Cohorts of Patients and Schools to Advance Response to Epidemics (UE HEurope), 2021-2026 ● New strategies for drug design and development against mycobacterial drug resistant infections; Multicenter validation of EUCAST broth microdilution reference method for MIC determination on Mycobacterium tuberculosis for Pretomanid (TB Alliance), Delamanid (Otsuka) and Bedaquiline (Jenssen) – AMST-ESCMID-EUCAST ● MARVEL - Minimizing the emergence and dissemination of HIV-1 drug resistance in PALOPs through an evidence-based portable high-throughput sequencing and computational approach. ● Next-generation sequencing to understand the HIV-1 transmission patterns in Angola (ENVOLVE Ciência PALOP Fundação Gulbenkian Ciência) ● “TRAINEXTB” - Targeting Mycobacterial Energy Metabolism to Train the Next Generation of Drug Discovery Researchers MARIE SKŁODOWSKA-CURIE ACTIONS. Doctoral Networks (DN) - Call: HORIZON-MSCA-DN-2021 ● New tools for point of care diagnosis of MDRTB, Malaria and HIV –Rapid, cost-effective detection of infectious disease and antibiotic resistance -RIDAR (Call LaCaixa 2021). ● In silico discovery and biological validation of new drugs against Neisseria gonorrhoeae (CEEI, FCT). ● Computational drug discovery and drug repurposing for Neisseria gonorrhoeae (FCT/LaCaixa). ● Target.BIOFILM - Drug repurposing to counteract biofilm and antimicrobial resistance in staphylococci.. ● Genome-wide diversity of Zika virus: exploring spatio-temporal dynamics to guide a new nomenclature proposal (Horizon 2020, FCT) ● Impact of environmental determinants on respiratory microbiome. 	<p>Signed and already started. Most of data already collected</p> <p>Signed in 2021 and already started</p> <p>Signed in 2021 and already started</p> <p>Submitted. Under evaluation by EU HORIZON</p> <p>Submitted. Under evaluation by LA CAIXA</p> <p><i>Submitted, not awarded</i></p> <p><i>Submitted, not awarded</i></p> <p><i>Submitted, not awarded</i></p> <p>Submitted. Under evaluation by EU HORIZON</p> <p><i>Submitted, not awarded</i></p>	
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<ul style="list-style-type: none"> ● Searching for immune signature and miRNAs biomarkers to advance Lyme borreliosis blood based differential diagnosis (with VBD as PI and NOVA Medical School,). ● Development of a microRNA/target signature of Cancer Drug Resistance from NOVA Medical School (THOP member as PI in IHMT) 	<p><i>Submitted, not awarded</i></p> <p><i>Submitted, not awarded.</i></p>	
PARTICIPATION IN CONFERENCES	Participation of THOP members in national/international scientific meetings with presentation of project results	
<ul style="list-style-type: none"> ● 31st European Congress of Clinical Microbiology & Infectious Diseases 2021 ● Tuberculosis 2021 ● European Meeting in HIV & Hepatitis 2021 ● MicroBiotec 2021 ● 15th International Workshop on Opportunistic Protists (IWOP-2021), Czech Republic ● European AIDS Conference 2021 - EACS 2021 		<ul style="list-style-type: none"> ● Participation of 6 THOP members at ECCMID2021 (3 posters) and MicroBiotec21 (9 posters) . ● Participation of 3 THOP members on European Meeting in HIV & Hepatitis 2021, 2 oral presentations and 1 poster ● 1 poster in European AIDS Conference 2021 - EACS 2021 (best poster award)
ORGANIZATION OF SCIENTIFIC EVENTS		
<ul style="list-style-type: none"> ● Organization of the National Congress of Microbiology and Biotechnology (MicroBiotec21): several THOP members ● GHTM sessions/seminar on: <ul style="list-style-type: none"> - TB and HIV (nano)diagnosis - Determination of the microbicidal activity of macrophages infected with spirochetes of the <i>Borrelia burgdorferi</i> (s.l.) 		
<ul style="list-style-type: none"> ● 5th GHTM Antimicrobial Resistance Awareness Day (Nov 2021) ● Summer School/Course on antibiotic and biocide resistance in bacteria and OneHealth 	<ul style="list-style-type: none"> - Postponed for 2022 due to overlap w/ MicroBiotec21 - Postponed for 2022 due to pandemic constraints 	
PUBLICATIONS/TRAINING		
<ul style="list-style-type: none"> ● Increase the number of doctoral students enrolled in GHTM-THOP group 	<p>At least 3 new PhD students enrolled in GHTM-THOP group by the end of 2021 (2 supported by GHTM/FCT PhD grants).</p>	<ul style="list-style-type: none"> ● Catarina Morais (GHTM/FCT PhD Grant) ● Jéssica Antunes (GHTM/FCT PhD Grant) ● M^a Carolina Ferreira (FCT PhD Grant)
<ul style="list-style-type: none"> ● Keep the publication track record 	<p>At least 12 research papers and one book chapter published during 2021</p>	<ul style="list-style-type: none"> ● > 12 research papers in 2021 ● 1 e-book (Matos & Chiao, ed) ● 2 book chapters (Matos O; Rodrigues L, et al. Methods Mol Biol. 2021;2314:231-245)



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● Increase internationalization of GHTM-THOP publications	Increase the number of publications with international partners by 10%, all in open access	
● Increase the participation of students in GHTM-THOP publications	At least 7 articles published with PhD/MSc students as co-authors	● Partially achieved (<7).
CAPACITY BUILDING		
● Participation in open science initiatives	Participation of several THOP members as scientific/technical reviewers of the digital platform on vaccines and immunization IMUNE.PT, awarded with two prizes of communication/scientific dissemination.	https://www.imune.pt/
● Initiatives on capacity building activities, using online/other platforms involving MSc or PhDs students, technicians, other	● Partially achieved.	



RG – VBD

The Strategic objective of VBD is the reinforcement of local and global capacity to control vector-borne diseases. Major research competences include molecular, genetic, and eco-epidemiological studies, mechanisms of drug and insecticide resistance, transmission and vector/host-pathogen interactions, host-pathogen microbiome, vector bioecology and control, and development of diagnostic and surveillance/control innovative methods. Although research activities have been hindered by the COVID-19 pandemic and the year 2021 mostly dedicated to recover from delays in work plans, the productivity of the VBD group exceeded the expectations in almost all expected indicators.

VBD activities were aligned with Sustainable Development Goals (SDGs) especially #1 – No poverty, #2 – Zero Hunger, #3- Good Health and Well-being, #4-Quality Education, #6-Clean Water and Sanitation, #10 - Reduce inequality within and among countries and #15 - Life on Land

ACTIVITIES	PROPOSED/REACHED OUTCOMES FOR 2021	EVIDENCE
ONGOING RESEARCH ACTIVITIES IN 2021 WITHIN CCIs:	Development of research activities in the framework of ● 27 financed projects (10 as proponent institution/investigator).	
CCI - Diagnostics (DG)		
● Xenodiagnosis in domestic cats (<i>Felis catus</i>) naturally infected by <i>Leishmania infantum</i> (FAPESP)	ongoing	● Vioti et al. doi: 10.1111/tbed.14216
● Optimization of an infection protocol by <i>Borrelia burgdorferi</i> s.l. and human macrophages + study on <i>Leptospira</i> spp – (WITH THOP)	delayed	● MSc thesis (Feb2022)
● SUBFAM protocol: Submicroscopic <i>Plasmodium falciparum</i> infections in Guinea-Bissau: a barrier to eliminate malaria? (with Bandim Health Project, Guinea-Bissau) – (ALSO WITHIN CCI FRP)	ongoing PhD thesis of a local student	
External collaborations beyond vector-borne diseases		
● Virologic screening of fish specimens captured along the Portuguese coast using a tetraplex qPCR to detect and quantify NoV GI, NoV GII and HAV genomes, and the detection of NoV genomic RNA in a pool of seabass brains (with iBET)	Assessment of the circulation enteric viruses in seawater or fish contamination	● PhD thesis (non-IHMT) ● Filipa-Silva et al doi: 10.3390/microorganisms9061149
CCI – Drug Discovery & Resistance (DDR)		
Drug discovery & resistance		
● A multitarget strategy to hit all stages of the Plasmodium life-cycle (FCT)	Delayed Manuscript in prep (da Silva et al <i>Synthesis of antimalarial indoles via one-pot A³ coupling and domino cyclization.</i>)	● Milheiro et al doi: 10.1021/acs.inorgchem.0c01795
● AMAZING - AMAZonian snake toxins: CreatING value from bioresources (CIRCNA)	Delayed Manuscript in prep	
● A small couple against the big three (FCT)	Surface-active ionic liquids (SAIL) obtained by acid-base combination of primaquine with natural fatty acids are disclosed both as antimalarial drugs and drug delivery systems	● Silva et al. doi: 10.3390/ijms21155334 ● MSc thesis, (March 2022)



<ul style="list-style-type: none"> ● Pyrazino (1,2b) quinazoline-3,6-diones derivatives, their production and uses thereof (Patent P2020, SAICT) 		<ul style="list-style-type: none"> ● Long et al. doi: 10.1021/acsmchemlett.1c00589
<ul style="list-style-type: none"> ● Development of nanovectors for the targeted delivery in <i>Anopheles</i> mosquitoes of agents blocking transmission of <i>Plasmodium</i> parasites (UE / Euronanomed III) 		<ul style="list-style-type: none"> ● Lantero et al. doi: 10.3390/biom10081136
<ul style="list-style-type: none"> ● Identification of new antimalarial treatments through a target-centred "drug repositioning" approach (FCT) 		<ul style="list-style-type: none"> ● Cassiano et al Book chapter Tavella et al. doi: 10.1021/acsinfectdis.0c00454 ● Lima et al doi: 10.1002/cmdc.202000685
<ul style="list-style-type: none"> ● Synthetic peroxides as new potential anti-Leishmania Chemotypes (FCT) 	<p>1,2,4-trioxolane and 1,2,4,5-tetraoxane endoperoxides against Old-World Leishmania parasites: in vitro activity and mode of action. Synthesis, structure and antileishmanial evaluation of endoperoxide-pyrazole hybrids.</p>	<ul style="list-style-type: none"> ● Two manuscripts 2022 (Pharmaceuticals / Molecules (under review))
<p>Insecticide discovery & resistance</p> <ul style="list-style-type: none"> ● Evaluation of the effectiveness of the environmental repellent 3-(N-Acetyl-N-Butyl) Aminopropionic Acid Ethyl Ester (IR3535®), as a tool for malaria control (FBA) – (WITH PPS) 	<p>In 2022 Participatory mapping of mosquito breeding sites (May 2022) CAP (June 2022) 1st year trial report (nov 2022)</p>	
<p>Host/Vector – Pathogen interactions and Microbiome</p> <ul style="list-style-type: none"> ● Exploring the tick-host interactome: on the path to vaccine development (FCT) 		<ul style="list-style-type: none"> ● Pacheco et al. doi: 10.1016/j.heliyon.2021.e06721 ● Couto et al doi: 10.3390/biomedicines9040363 ● Paulino et al. doi: 10.3390/pathogens10020167 ● Sanches et al. doi: 10.3389/fcimb.2020.611113
<ul style="list-style-type: none"> ● Immunogens compatible with integrated management strategies in tick control (CYTED) 	On going	
<ul style="list-style-type: none"> ● The Ixodes ricinus group of ticks in the western Mediterranean region and north Africa: new insights into their population genetics and microbiome fauna (FCT) 	On going	
<ul style="list-style-type: none"> ● Vaccine for Prevention and Treatment of <i>Trypanosoma cruzi</i> Infection (H2020) 	Experimental immunization of dog model (prophylactic setting) and humoral and cellular immune evaluation completed.	
<ul style="list-style-type: none"> ● Achieving new frontiers through trypanosomatid exosomes (TE_x) (FCT) 	On going	
<ul style="list-style-type: none"> ● When the host cell is not so cosy anymore? A drop off in energy or an increase in toxicity? (FCT) 	Host glycolytic metabolite 2,3-DPG impairs <i>P. falciparum</i> intraerythrocytic developmental cycle in in vitro cultures (inhibition of parasite growth, significantly lower progeny)	<ul style="list-style-type: none"> ● Morais et al. doi: 10.3389/fcimb.2022.840968 ● MSc thesis



		<ul style="list-style-type: none"> ● Manuscript in prep (Carvalho et al 2,3-DPG and the protective effect of pyruvate kinase deficiency against malaria infection – exploring the role of the red blood cell membrane.)
<ul style="list-style-type: none"> ● Identification of genetic modifiers in children with Sickle Cell Anaemia in an endemic area of Malaria, Angola 		<ul style="list-style-type: none"> ● Santos et al doi: 10.1007/s11033-020-05628-8
<ul style="list-style-type: none"> ● Effect of Oral Polio Vaccine on gut and upper respiratory microbiomes of infants – 	Ongoing financed by GHM (UID/Multi/04413/2013, FCT, Portugal).	<ul style="list-style-type: none"> ● Oral polio revaccination is associated with changes in gut and upper respiratory microbiomes of infants (npj Biofilms and Microbiomes, under review) ● Presentations at scientific meetings (IV International Conference NOVAhealth Chronic Disease and Infection “Microbiota and Health” and Microbiotec – Webconference)
CCI - Fair Research Partnerships (FRP)		
<ul style="list-style-type: none"> ● Learning to Investigate by Field Experiment for Southeast Asia Emerging Diseases (Erasmus+) 	ended 2021	
<ul style="list-style-type: none"> ● UMAP (University of Maryland-Angola-Portugal) Malaria working group development (Presidents’ Global Impact Fund) (with INIS Angola, University of Maryland, USA) 	ongoing PhD thesis of a local student - Study of <i>P. falciparum</i> demography in southwestern Africa, with a focus in Angola. manuscript in prep (Malaria in Angola, in 2021: recent progress, challenges and future opportunities)	<ul style="list-style-type: none"> ● poster presentation at 2021 Annual Meeting of ASTMH (<i>Plasmodium falciparum</i> population structure in southwestern Africa: Initial genome wide sequence data from Angola)
<ul style="list-style-type: none"> ● IANDA GUINÉ SAÚDE - Guinea-Bissau Health Reinforcement (Inst Camões, FCG) 	Ongoing	
CCI - Global Pathogen dispersion and Population Mobility (GPPM)		
<ul style="list-style-type: none"> ● A global alliance for Zika virus control and prevention (H2020) 	ended 2021	
<ul style="list-style-type: none"> ● Review on leishmaniasis in the European Union, the Enlargement countries and the European Neighborhood Policy countries (ECDC) 	ended 2021 A questionnaire survey of animal and human health authorities in Europe revealed that: i) leishmaniases are considered emergent diseases in most countries and not notifiable in all	<ul style="list-style-type: none"> ● Berriatua et al. doi:10.3201/eid2706.210239



	with autochthonous cases; ii) few countries implement surveillance and control targeting both animal and human infections.	
<p>An operational early WARning system for DENGue and other arboviral diseases in Madeira Island</p> <ul style="list-style-type: none"> ● ARBOMONITOR: Dengue, Chikungunya and Zika vector in Europe: cost effective optimization of surveillance and control (FCT) ● Aedes invasive Mosquitoes (EU / COST) ● A study on the distribution of the kdr mutations V1016G and F1534C, associated with resistance to pyrethroid insecticides, in European populations of <i>Aedes albopictus</i>. 	<p>High dispersal of these mutations in the European continent, which raises alerts about the need to improve monitoring of insecticide resistance in Europe.</p> <p>Molecular detection assays revealed widespread superinfection of <i>Aedes albopictus</i> with the endosymbiont <i>Wolbachia</i></p>	
<ul style="list-style-type: none"> ● Molecular characterization of Afrotropical mosquitoes, potential arbovirus vectors using multiple genetic markers and a combination of sequence analysis techniques 	<p>Use of molecular data as analysis of male/female mosquito genitalia for comparative classification of mosquito vectors of multiple arboviruses</p> <p>Manuscript in prep</p>	<ul style="list-style-type: none"> ● MSc thesis ● 247 CoxI sequences submitted to GenBank / mounted genitalia deposited in the Insect collection of IHMT
<ul style="list-style-type: none"> ● Utilization of multiple genetic approaches based for the analysis of nucleotide and protein sequences of classical insect-specific flaviviruses (cISF): characterization of multiple genetic lineages 	<p>1st reconstruction of cISF evolutionary history and spatiotemporal dispersal - dynamic and dependent on human activities.</p>	<p>PhD thesis</p>
<ul style="list-style-type: none"> ● Assessment of the role of domestic cats as potential reservoirs of zoonotic leishmaniosis 	<p>Evaluation of the role of cats as reservoirs for <i>Leishmania</i>:</p>	<p>PhD thesis</p> <ul style="list-style-type: none"> ● Pereira et al doi: 10.1016/j.vetpar.2021.109531
<ul style="list-style-type: none"> ● Evaluated the utility of mitochondrial cytochrome oxidase subunit I (COX1) and 16S ribosomal DNA (16S-rDNA) sequence analyses as a complementary/alternative tool to classical taxonomy of hard tick species from Portugal 	<p>Assessment of the performance of different genetic markers for molecular classification of ticks</p>	<ul style="list-style-type: none"> ● Filipe et al https://doi.org/10.1016/j.vprsr.2021.100551
<ul style="list-style-type: none"> ● Screening of potential zoonotic pathogens in mosquitoes and other arthropods Portugal (with /FacMedVet, Univ Estremadura, Spain) 	<p>Detection of three <i>Gongylonema</i> sp. larvae in two specimens of the dung beetle <i>Geotrupes mutator</i> (Marsham, 1802) from western Spain.</p>	<ul style="list-style-type: none"> ● Bravo-Barriga et al. doi: 10.21307/jofnem-2021-050
<p>External collaborations beyond vector-borne diseases</p> <ul style="list-style-type: none"> ● Screening and genetic analysis of Human polyomaviruses (HPyVs) in water samples (waste+environmental) the Lisbon Metropolitan area (with iBET) 	<p>Developing a two touch-down PCR multiplex protocol for the characterization of HPyVs in the Lisbon Metropolitan area + completion of a MSc Dissertation with a publication (see below).</p>	<p>MSc thesis</p> <ul style="list-style-type: none"> ● Condez et al. doi: 10.3390/pathogens10101309.



CCI - Public Health Information (PHI)		
<ul style="list-style-type: none"> ● MosquitoWeb (NOVA Health): European Citizen Science project involved in the NEWSERA network (newsera2020.eu) 	Report of the presence of mosquitoes in Mainland Portugal / Characterization of dispersion, activity of both invasive and native species.	https://newsera2020.eu/labs/citizen-and-society-at-large/
<ul style="list-style-type: none"> ● healTh Risk and social vulnerability to Arboviral Diseases in mainland Portugal (FCT) 	Started in 2021	
TRANSVERSAL:	Two strategic infrastructures of GHTM IHMT are coordinated by members of the VBD group – the biobank (BIOTROP) and the high security insectary (VIASEF)	
Biotropical resources – BIOTROP (Biobank / Biological Resources Center)		
<ul style="list-style-type: none"> ● Activity of 2021 is detailed in the <u>annual report</u> available for consultation at the GHTM IHMT site ● A <u>catalog</u> has been created for internal and external consultation of biological collections ● Elaboration and implementation of <u>strategic plan for 2021-2023</u> ● Collaboration with the Travel Consultation and Central Laboratory of IHMT – Prospective collections [storage of an aliquot of positive samples for any infectious agent, collected during the diagnostics routine, and donated after informed and voluntary consent of patients in post-travel consultation] 	<p>Higher visibility and accessibility of biological collections both to internal and external users. Establishment of a clearly defined workflow for deposition/requisition of samples Establishment of SOPs, Forms, Agreements, and Informed Consent Submission and approval by the Ethical Committee of IHMT (CEIHMT) Project, workflow, SOPs, posters, and flyers for consciousness of users of the ADMT/Traveler's Consultation etc, approved by CEIHMT</p> <p>NOT IMPLEMENTED</p>	<ul style="list-style-type: none"> ● http://ihmtweb.ihmt.unl.pt/download/comunicacao/BIOTROP_Annual_Report_2021_v21-12-2021.pdf ● https://www.ihmt.unl.pt/investigacao/biobanco/ ● http://biotropical.ihmt.unl.pt# ● http://ihmtweb.ihmt.unl.pt/Download/BIOTROP/BIOTROP_2021-2023_STRATEGIC_PLAN_vsf.pdf ● https://www.ihmt.unl.pt/investigacao/biobanco/ <p>(Annex II of Strategic Plan)</p>



<p>Visibility and Participation in Conferences</p> <ul style="list-style-type: none"> ● Improvement of BIOTROP section at the IHMT website ● For information in English to better reach international researchers, the site of NOVA university is being used ● Implementation of a communication plan and presence on the social networks <ul style="list-style-type: none"> ● Biobanking African Pediatric Upper Respiratory and Gut Microbiomes. Poster presentation at Microbiotec'21 Congress, Lisbon, Portugal. ● Biotropical Resources – GHTM/IHMT-NOVA Biobank: Biobanking African Pediatric Upper Respiratory and Gut Microbiomes”. IV International Conference NOVAhealth Chronic Disease and Infection “Microbiota and Health”, Lisbon. Portugal. <p>Outreach activities CIÊNCIA VIVA21 Training Secondary School Students. 19-23 July 2021</p>		<p>https://www.ihmt.unl.pt/investigacao/biobanco/</p> <p>https://impact.webview.pt/2021/03/05/biotrop-biotropical-resources-biobank/ https://www.facebook.com/biotropicalresources/</p> <p>https://www.instagram.com/biotropbiobank/</p> <p>https://www.ihmt.unl.pt/doencas-tropicais/videos/</p> <p>https://microbiotec21.organideia.pt/abstract-book/</p> <p>https://ghm.ihmt.unl.pt/ghm-for-teens-biobanks-discover-their-importance-in-scientific-research/</p>
<p>● INFRASTRUCTURE - VIASEF - In vivo Arthropod Security Facility (FCT)</p> <p>The priority was given to the establishment of SOPs and implementation of promotion and dissemination activities, with the objective of attracting funding and research projects as well as to the</p> <p>Establishment of protocols/SOPs</p> <ul style="list-style-type: none"> ● Development of protocols for <i>Plasmodium falciparum</i> gametocyte production ● Other SOPs delayed ● Business plan delayed 	<p>● Conclusion in 2021</p> <p>Construction and implementation concluded in 2021 Operational implementation delayed Business plan and operational management delayed</p>	<p>Building/Facilities concluded https://www.ihmt.unl.pt/viasef-in-vivo-arthropod-security-facility-infraestrutura-de-alta-seguranca/ Inauguration – June 2021 https://www.ihmt.unl.pt/ihmt-nova-infraestrutura-de-alta-seguranca-viasef-in-vivo-arthropod-security-facility-inaugurada-a-21-de-junho-14h30/</p>



<ul style="list-style-type: none"> ● Implementation of a malaria genetic and genomic surveillance pipeline for Angola that leverages COVID19-associated infrastructure development (Bill & Melinda Gates foundation, GCE) ● Genomic epidemiology of silent malaria in Guinea-Bissau (La Caixa) ● INOVEC- A research and InNOvation Partnership for enhancing the surveillance and control of mosquito VECtors of emerging arboviruses (HORIZON-MSCA-2021-SE-01-01; Proposal number: 101086257) ● Artificial intelligence approaches to accelerate antimalarial drug discovery (FCT) ● Estratégias em quimiogenômica computacional e biologia sintética para identificação de novos compostos contra Plasmodium vivax (FAPESP) ● Identification of the mechanisms of resistance to primaquine and tafenoquine in malaria parasites through experimental evolution, genomics and transgenesis (FCT) ● Purydrazides, a novel class of antimalarial drugs (FCT) ● Diagnostics of Low-density malaria infections: a threat to malaria elimination efforts? (FCT) ● Innovative devices for clean and sustainable mosquito control (FCT) ● Portuguese scientific biological collections of interest for health sciences (FCT) ● Point-of-care diagnostic tests for aquaculture-fish pathogens: contribution of in-silico tools for the characterization of microbial surface proteins (PTDC/ASP-PES/0894/2021). ● Microbiome of Phlebotomus perniciosus, the main vector of leishmaniasis in the western Mediterranean and the effect of its microbiota on transmitted human and animal pathogens (PTDC/SAU-PAR/3191/2021). ● Mosquitoes Virome: Metagenomic approach to assess the abundance and diversity of virus in mosquitoes isolated from Portugal continental (PTDC/BIA-VIR/0358/2021). 		
<p>PARTICIPATION IN CONFERENCES</p>	<p>● Participation in at least 10 national/international scientific meetings with presentation of project results</p>	
<ul style="list-style-type: none"> ● IV International Conference NOVAhealth Chronic Disease and Infection “Microbiota and Health”, Lisbon ● Congress of Microbiology and Biotechnology “Microbiotec – Webconference”, Lisbon ● 14th International Symposium on Ticks and Tick-borne Diseases, Freie Universität Berlin ● 31st European Congress of Clinical Microbiology & Infectious Diseases ● XXXIIIrd EAVA Congress, Belgium ● II Conferência científica sobre a COVID-19 (webinar) ● 2021 CVBD@ WORLD FORUM TOUCHPOINT. online ● 28th International Conference of the World Association for the Advancement of Veterinary Parasitology 		



<ul style="list-style-type: none"> ● Annual Meeting of American Society of Tropical Medicine and Hygiene. online ● Reunião Anual Sociedade Portuguesa de Genética Humana. online 		
<p>ORGANIZATION OF SCIENTIFIC EVENTS</p>	<ul style="list-style-type: none"> ● Organization of at least 3 meeting events. 	
<ul style="list-style-type: none"> ● Portuguese microBiological Resource Center Network meeting, 7th May 2021 (within Pt-mBRCN) ● Internal scientific sessions – GHTM sessions (Investing in diagnostics towards better health) ● GHTM Spirochetes meeting - participation in GHTM Session "Determination of the microbicidal activity of macrophages infected with spirochetes of the <i>Borrelia burgdorferi</i> sensu lato complex (s.l.) – with THOP) 	<p>Season 1 (17 March – 22 September; 11 sessions; all RGs)</p>	
<ul style="list-style-type: none"> ● 5th GHTM Antimicrobial Resistance Awareness Day ● Webinar on Diagnosis of neglected tropical diseases: differential diagnosis of febrile syndromes. ● Webinar on trypanosomatid exosomes 		
<p>PUBLICATIONS</p>	<ul style="list-style-type: none"> ● 50 research papers, 1 book and 8 book chapters were published during 2021 <p>Full list is available at 2021 GHTM RESEARCH REPORT</p>	
<p>TRAINING</p> <p>PhD students Concluded - 3 Ongoing - 3</p> <p>MSc students Concluded - 3 Ongoing - 2</p> <p>BSc students Concluded - 1 Ongoing -</p> <p>External collaborations beyond vector-borne diseases 1 MSc concluded (with iBET)</p>	<ul style="list-style-type: none"> ● VBD group have students of different levels (BSc, MSc, and PhD) developing their thesis plans in the framework of ongoing research activities and projects. <p>At least</p>	



CAPACITY BUILDING		
<p>Organization of workshops/courses</p> <ul style="list-style-type: none"> ● Hands-on Workshop on “Gene editing in Trypanosomatids: Modern approaches for identification of novel drug targets”. ● Hosting of an Erasmus+ training student from Spain on Leishmaniasis. ● Hosting of one Short Term Scientific Mission in the framework of the AIM-COST action on “Pyriproxyfen for <i>Aedes albopictus</i> control” ● Hosting of Two Short Term Scientific Missions in the framework of the AIM-COST action on “Population genetics of <i>Aedes albopictus</i> in Romania and Czech Republic” ● UCIMI/IHMT course on insecticide resistance surveillance for malaria vectors in São Tomé and Príncipe. ● Workshop on flow cytometry ● Effective Communication Skills – 2nd Ed. (NOVA Doctoral School). 	Cancelled due COVID restrictions on travel/stay	
<p>Participation in training actions</p> <ul style="list-style-type: none"> ● Monoclonal Antibodies Unit (30 h), Master in Biotechnology, University Eduardo Mondlane, Maputo, Mozambique ● Three workshops of the European Consortium NEWSERA with the citizen science initiative MosquitoWeb. ● Erasmus+ training on gene editing in Leishmania, Wellcome Centre for Integrative Parasitology, University of Glasgow, UK, Sept-Oct-2021 ● System Biology approach towards the characterization of tick–parasite interactions. Conferência/aula integrada no Mestrado em Microbiologia, Universidade de Aveiro. 9th June, 2021 ● BioSocial Talks, Research Centre for Anthropology and Health (CIAS), Coimbra University ● 7th National Conference on Health and Technology, Luanda, Angola 		
<p>Hosting of national/international trainees</p> <ul style="list-style-type: none"> ● 1 Short-Term Scientific Mission Grant, Morphological and phylogenetic study of other species of <i>Aedes</i> genus that are detected during the surveillance of <i>Aedes albopictus</i>. Current status in Europe, September 2021) ● 1 Erasmus + Mobility Agreement Staff Mobility for Training, from Poland, 3 months, Tick and parasite epidemiology ● 1 Erasmus + Mobility Agreement Staff Mobility for Training, Poland, 2 weeks, qPCR detection of tick parasites ● 1 Erasmus + Programme (PhD student), Poland, 1 month, Tick and parasite epidemiology ● Highschool “Ciência Viva” short trainings 		



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GHTM | ACTIVITY PLAN 2021

MONITORING OF CROSS CUTTING ISSUES ACTIVITIES IN 2021

- - Not done/ Canceled/ No Outcome
- - Done/ Concluded/ Outcome
- - Delayed/ Postponed/ Delayed Outcome



CCI – DIAGNOSTICS (DG)

Objective: to develop novel diagnostic tools for epidemiological assessment and surveillance, to improve precision treatment and to provide affordable, rapid and sensitive diagnosis to field settings and/or travel medicine. This is achieved by research activity on molecular diagnostics, biomarkers, point-of-care testing and devices, lab-on-a-chip technologies addressed to infectious diseases and carried out by all Research Groups. 2021 was especially dedicated to promoting the interaction between RGs and the CCI, and transfer of knowledge and technology between GHTM researchers.

Key subjects: Develop and implement novel tools; Molecular diagnostics; Biomarkers; Point-of-care testing and devices; Lab-on-a-chip technologies; Infectious Diseases

ONGOING ACTIVITIES 2020/2021 WITH RGs:	OUTCOMES	EVIDENCES
In collaboration with the <u>IHC group</u>		
<ul style="list-style-type: none"> ● Differential diagnosis of SARS CoV-2 infection in an endemic area of malaria, DENV, CHIKV, Salmonella and Leptospirosis and with seasonal incidence of viral and bacterial respiratory infections in winter 	<p>To evaluate the performance of clinical and laboratory diagnostic techniques in the differential diagnosis of SARS CoV-2 infection in an endemic area of malaria, DENV, CHIKV, Salmonella and Leptospirosis and with seasonal incidence of viral and bacterial respiratory infections in winter at the Hospital de Lubango, Angola.</p> <p>To develop an optimized diagnostic algorithm, based on the results of the discriminating power of the clinical case definition parameters and the diagnostic tests used.</p>	<ul style="list-style-type: none"> ● Study start was postponed mainly due to the low incidence of SARS CoV 2 in the proposed study site. The study is under revision in order to possibly drop the SARS Cov 2 component. Inclusion of a second study site in Luanda is under evaluation GHTM session on the 17th of March 2021
<ul style="list-style-type: none"> ● Diagnosis of malaria parasites (Central Laboratory) 		<ul style="list-style-type: none"> ● Santos-Reis & Nina doi: 10.20344/AMP.15814
In collaboration with the <u>PPS group</u>		
<ul style="list-style-type: none"> ● Network COST- HARMONY-Novels tools for test evaluation and disease prevalence estimation. 	<p>Implementation of Bayesian Latent Class Models (BLCMs) to both the identification and control of pathogens in humans and animals</p> <p>Until October 2023</p>	<ul style="list-style-type: none"> ● Oliveira et al doi: org/10.3390/math8081258 Paper in prep w/ Carla Maia (VBD)
In collaboration with the <u>THOP group</u>		
<ul style="list-style-type: none"> ● <i>Pneumocystis</i> diagnosis 		<ul style="list-style-type: none"> ● Matos & Xiao. doi: 10.3389/fmicb.2021.701879 ● Matos & Xiao doi: 10.3389/978-2-88971-156-7 ● Szydlowicz & Matos doi: 10.1016/j.pt.2021.07.010 ● Szydlowicz et al. https://doi: 10.1093/infdis/jiab209



<p>● Diagnosis of infections by spirochetes (THOP / VBD) (Project PTDC/SAU-INF/3114/2021 not funded; submitted again 2022)</p>	<p>Microbicidal activity of macrophages exposed to pathogenic spirochetes <i>Borrelia garinii</i> and <i>B. lusitaniae</i></p>	<p>● GHM session on the 22nd of September 2021</p>
<p>● Development of point-of-care tools for drug resistance detection on <i>M. tuberculosis</i></p>	<p>Optimization and application of an indirect immunofluorescence test as an alternative to the microscopic agglutination test (reference test) for the diagnosis of leptospirosis (with VBD)</p>	<p>● Ortiz et al. doi: 10.1021/acssensors.1c01710 ● Opota et al. doi: 10.3389/fpubh.2021.666187 ● Schön et al. doi: 10.1016/j.cmi.2020.10.019</p>
<p>● Diagnosis of fungal infections</p>	<p>Not implemented</p>	
<p>● Serological survey of SARS Cov2 in Cascais, Portugal</p>	<p>ongoing; 1st phase concluded in September 2021</p>	<p>● https://ghm.ihmt.unl.pt/cascais-municipality-sars-cov-2-sero-epidemiological-survey/ GHM session on the 6th of April 2022</p>
<p>● Identification and characterization of intestinal parasitic infections in Mozambique.</p>	<p>Data on occurrence of intestinal parasites in fresh horticultural products sold in maputo markets and supermarkets, Mozambique</p>	<p>● Salamandane et al. doi: 10.3390/microorganisms9091806</p>
<p>● Purification and characterization of exosomes in Portuguese patients chronically infected with HDV</p>	<p>Project concluded, manuscript in preparation.</p>	
<p>● Determination of the transcriptomic alterations in HDV-induced hepatocellular carcinoma (FCT)</p>	<p>(Delayed/Ongoing)</p>	
<p>In collaboration with the VBD group</p>		
<p>● Detection of pathogens in mosquitoes</p>		<p>● Guarido et al. doi: 10.3390/v13112148 ● Manoj et al. doi: 10.1111/mve.12524</p>
<p>● Animal Health - Detection of pathogens in companion animals</p>		<p>● Vioti et al. doi: 10.1111/tbed.14216 Pereira & Maia. doi: 10.1016/j.crvbd.2021.100035</p>
<p>● Human Health – Neglected diseases</p>		<p>● Ortiz et al. doi: 10.36660/ABC.20201236</p>
<p>● Environmental Health (external collaborations beyond vector borne diseases)</p>		<p>● Filipa-Silva et al. doi: 10.1016/j.aquaculture.2021.736693</p>
<p>NEW ACTIVITIES 2020/2021 WITH RGS AND INFRASTRUCTURES:</p>		
<p>New research Projects</p>		
<p>● New tools for point of care diagnosis of SARS-CoV-2 [with THOP]</p>	<p>Evaluation of the Lolli Method: a randomized cluster intervention study to evaluate the effectiveness of the use of the pooled saliva test strategy called "Lolli"</p>	



	Method" within the scope of the EuCare Horizon Europe Research Project (ongoing)	
● New tools for point of care diagnosis of MDRTB, Malaria and HIV –Rapid, cost-effective detection of infectious disease and antibiotic resistance -RIDAR [with THOP]	submitted LaCaixa 2021	
● Diagnostics of Low-density malaria infections: a threat to malaria elimination efforts? (FCT) [VBD]	● PhD project ongoing (GHTM PhD grant Ronise Silva, DTSG) ● PTDC/SAU-EPI/0094/2021 not funded; submission to GHTM PEx2022	
<p>CONGRESSES//EVENTS:</p> <p>● / ● Organization of conference/workshop on Universal access to health care for the populations - Molecular Testing in Infectious Diseases" Organization of a webinar on Diagnosis of neglected tropical diseases: differential diagnosis of febrile syndromes</p> <p>PUBLICATIONS/TRAINING:</p> <p>Capacity building:</p> <p>● Internal scientific sessions – GHTM sessions (Investing in diagnostics towards better health)</p>	<p>Postponed, to be carried out in 2022 or 2023</p> <p>Please see above (Evidence column)</p> <p>Transfer of knowledge and technology between GHTM researchers Season 1 (17 March – 22 September; 11 sessions; all RGs) Season 2 (ongoing; start on the 12th of January, 5 sessions, 4 more; external researchers)</p>	



CCI - DRUG DISCOVERY & RESISTANCE (DDR)

Objective: to identify new therapeutic drugs (including single-encounter radical cure for malaria) and transmission-blocking, and timely detection and characterization of drug and insecticide resistance related to mutations, efflux or other mechanisms on key pathogens and vectors. In addition, tracking the prevalence and spread of drug resistance mutations allows national treatment policies to be adjusted.

Key subjects: Chemogenomics, Drug Repurposing; hit-to-lead discovery, Pre-clinical and clinical trials, Resistance mechanisms, Tropical Medicine

ONGOING ACTIVITIES 2020/2021 WITH RGs:	OUTCOMES	EVIDENCES
In collaboration with the IHC group		
Two therapeutic trials for the treatment of African Human Trypanosomiasis (THA) coordinated by DNDi and EDCTP funded:		
<ul style="list-style-type: none"> ● Clinical Trial on the "Efficacy of Fexinidazole in the treatment of patients with infection caused by T.b. rhodesiense in Malawi and Uganda 	Patient enrolment was completed in October 2021. Last patient-last follow up visit should be completed in October 2022.	
<ul style="list-style-type: none"> ● Clinical trial with the new oral drug (Acoziborole), in a single dose, for the treatment of THA caused by T.b. gambiense in children (<14 years), coordinated by DNDi, was approved by the EDCTP for funding 	This study was expected to start enrolling patients from The Democratic Republic of Congo and Guinea in 2021. Due to unexpected difficulties in the development of the paediatric formulation, the clinical trial could only be started in January 2022 in the DRC.	
<ul style="list-style-type: none"> ● Doctoral Thesis of a student in Tropical Medicine, will determine the prevalence of asymptomatic human VL in Portugal 	Thesis title: Prevalence of asymptomatic leishmaniasis in Portugal. Started in July 2021	
<ul style="list-style-type: none"> ● Doctoral Thesis of a student in Tropical Medicine and Global Health, will evaluate the presence of miltefosine resistance genetic markers, in isolates of L. infantum, obtained from dogs with signs and symptoms of visceral leishmaniasis. 	Prospective supervisor resigned with GHTM	
In collaboration with the THOP group		
<ul style="list-style-type: none"> ● Drug design and development against mycobacterial drug resistant infections (FCT, EUCAST and EU-MepAnti Marie Skłodowska-Curie action) 		<ul style="list-style-type: none"> ● Gómez-González, P. J., et al. Scientific reports, 11(1), 19431. https://doi.org/10.1038/s41598-021-98862-4 ● Schön, T., et al. CMI, 27(2), 288.e1–288.e4. https://doi.org/10.1016/j.cmi.2020.10.019



<p>● Computational drug discovery and drug repurposing for <i>M. tuberculosis</i> and <i>Neisseria</i> (EU-Marie Curie Action)</p>	<p>1 paper in preparation. 2 MSc Theses started in 2021: “Drug repositioning to decrease resistance mediated by efflux pumps in <i>Neisseria gonorrhoeae</i> and other Gram-negative bacteria.” “Evaluation of the antimicrobial activity of compounds that inhibit energy metabolism in Gram-negative bacteria.”</p>	<p>MSc thesis concluded in 2022: “Identification of new drugs for <i>N. gonorrhoeae</i> through a strategy of <i>in silico</i> repositioning” Posters: ● André Pina, Filomena Pereira, Liliana Rodrigues. Identification of new drugs for <i>N. gonorrhoeae</i> using an <i>in silico</i> repurposing strategy. ECCMID2021 & Microbiotec21.</p>
<p>● QSAR modelling and molecular docking for drug design for <i>M. tuberculosis</i> and <i>Neisseria</i></p>	<p>Project not funded by FCT One outcome from a 2017 FCT project this subject regarding <i>M. tuberculosis</i></p>	<p>Articles in peer-reviewed journals: ● de Faria, C. F et al. Biomedicine & pharmacotherapy 144, 112362. https://doi.org/10.1016/j.biopha.2021.112362</p>
<p>● Antibiotic and biocide resistance profiling in major human and veterinary staphylococcal pathogens (FEDER/FCT)</p>	<p>Antibiotic and biocide profiling for >400 staphylococci.</p>	<p>● 2 posters ECCMID2021, 4 posters MicroBiotec2021</p>
<p>● Proposal of new criteria for identification of antibiotic resistant staphylococcal populations (FEDER/FCT, in collaboration with the COST Action ENOVAT).</p>	<p>ECOFF proposed for 2 antibiotics</p>	<p>Articles in peer-reviewed journals: ● Costa et al. Microb Drug Resist. 2021 27:1555-59 doi: 10.1089/mdr.2020.0402.</p>
<p>● Evaluation of efflux-mediated resistance in the major veterinary pathogen <i>S. pseudintermedius</i>.</p>	<p>Workplan delayed due to the pandemics. Expected to be completed by end 2022.</p>	<p>● 2 Msc Thesis, Ramos B, Msc Biomedical Sciences Dec 2021; Leal M, Msc Biomedical Sciences (to be defended March 2022). ● 2 posters MicroBiotec2021</p>
<p>● Antimicrobial resistance in <i>S. aureus</i> causing bloodstream infections in children in Mozambique</p>	<p>Workplan delayed due to the pandemics. Expected to be completed by mid 2022.</p>	<p>● 1 poster MicroBiotec2021</p>
<p>● Antifungal activity of novel chemical compounds against <i>Candida albicans</i> and other pathogenic yeasts</p>	<p>No information</p>	<p>-</p>
<p>● Resistance to antiretrovirals</p>	<p>Minimal information provided</p>	<p>2 papers integrase inhibitors drug resistance with THOP</p>
<p>● Drug repurposing for inhibition of SARS-Cov-2 replication (FCT).</p>	<p>Project completed in 2021 - Delayed - 1 article submitted in march 2022: “Drug repurposing for COVID-19: a review and a novel strategy to identify new targets and potential drug candidates.” 1 article in preparation.</p>	<p>● Bento-Cunha, et al. Submitted to Molecules ● 1 poster MicroBiotec2021</p>



In collaboration with the <u>VBD</u> group		
<ul style="list-style-type: none"> ● Identification of new antimalarial treatments through a target-centred "drug repositioning" approach (FCT) 	<p>FCT project ongoing – To end in 2022</p>	<ul style="list-style-type: none"> ● Targeting malaria protein kinases. <i>Adv Protein Chem Struct Biol.</i> 2021; 124:225-274. ● Violacein-Induced Chaperone System Collapse Underlies Multistage Antiplasmodial Activity. <i>ACS Infect Dis.</i> 2021 Apr 9;7(4):759-776 ● Artificial Intelligence Applied to the Rapid Identification of New Antimalarial Candidates with Dual-Stage Activity. <i>ChemMedChem.</i> 2021 Apr 8;16(7):1093-1103 ● Computational Chemogenomics Drug Repositioning Strategy Enables the Discovery of Epirubicin as a New Repurposed Hit for <i>Plasmodium falciparum</i> and <i>P. vivax</i>. <i>Antimicrob Agents Chemother.</i> 2020 Aug 20;64(9):e02041-19 ● Deep Learning-driven research for drug discovery: Tackling Malaria. <i>PLoS Comput Biol.</i> 2020 Feb 18;16(2):e1007025
<ul style="list-style-type: none"> ● Exploring the tick-host interactome: on the path to vaccine development (FCT) 	<p>FCT project ongoing – To end in 2022</p>	<ul style="list-style-type: none"> ● Comparative analysis of <i>Rhipicephalus</i> tick salivary gland and cement elementome. <i>Heliyon.</i> Volume 7, Issue 4, April 2021, e06721 ● Probing the <i>Rhipicephalus bursa</i> Sialomes in Potential ● Anti-Tick Vaccine Candidates: A Reverse Vaccinology Approach. <i>Biomedicines</i> 2021, 9, 363 ● Characterization of the <i>Rhipicephalus</i> (<i>Boophilus</i>) microplu Sialotranscriptome Profile in Response to <i>Theileria equi</i> Infection. <i>Pathogens</i> 2021, 10, 167. ● Comparative Proteomic Analysis of <i>Rhipicephalus sanguineus sensu lato</i> (Acari: Ixodidae) Tropical and Temperate Lineages: Uncovering Differences During <i>Ehrlichia canis</i> Infection. <i>Front. Cell. Infect. Microbiol.</i>, 29 January 2021 <p>Oral presentations:</p> <ul style="list-style-type: none"> ● Velez R, et al. 14th International Symposium on Ticks and Tick-borne Diseases, 24-26 Março 2021. Organizado pela Freie Universität Berlin. Digital.



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		<p>● Moreira L, et al. Tick-borne pathogens from wild Ixodes ricinus and an insight of its microbiota from Portugal mainland. MicroBiotec, Dezembro, 2021</p>
<p>● Vaccine for Prevention and Treatment of <i>Trypanosoma cruzi</i> Infection (H2020)</p>	<p>Experimental immunization of dog model (prophylactic setting) and humoral and cellular immune evaluation completed.</p>	<p>NA</p>
<p>● Synthetic peroxides as new potential anti-Leishmania Chemotypes (FCT)</p>	<p>FCT project ongoing – To end in 2022</p>	<p>● Manuscript submitted to Pharmaceuticals (under review)</p>



CCI – PUBLIC HEALTH INFORMATION (PHI)

Objective: To support public health decision making through the production of information and political decision-making tools, namely in the area of epidemiological surveillance and early detection systems.

Key-subjects: epidemiologic intelligence & surveillance; knowledge translation; health literacy; health communication - Knowledge translation through effective communication and promotion of health literacy [public health intelligence center].

ONGOING ACTIVITIES 2020/2021 WITH RGS:	OUTCOMES	EVIDENCES
<p>In collaboration with the THOP group</p> <ul style="list-style-type: none"> ● Screening for infectious diseases in mobile populations and travelers, with monitoring and risks of introducing pathogens that cause STDs and diarrhea of travelers from Lusophone countries and their antibiotic resistance profile. ● BCG vaccine to reduce unplanned absenteeism due to illness of health care workers during the COVID-19 pandemic. A multi-center randomized controlled trial. ● Participation of members in at least 3 initiatives raising general public comprehension on COVID 	<ul style="list-style-type: none"> Number of tracing/epidemiological surveys performed Number of epidemiological surveillance alerts / notifications According to the deliverables contracted with the financing agencies Public information and awareness related to COVID-19 Pandemics 	<ul style="list-style-type: none"> ● THOP, IHC and PPS members, among others: Regular presence in the Media – TSF radio, SIC, RTP and TVI Networks, Newspapers and magazines (see 2021 IHMT Report for further details). Several GHTM member participated in media coverage of COVID-19 pandemics Number of scientific publications on COVID in Q1 journals Report for 2021
<p>In collaboration with the PPS group.</p> <ul style="list-style-type: none"> ● Initiatives supporting efforts from the public health authorities and CPLP related to the ongoing pandemics. ● / ● Create an Intelligence center until December 31, 2021 	<ul style="list-style-type: none"> VAX-TRUST - Addressing vaccine hesitancy in Europe BCG vaccine to reduce unplanned absenteeism due to illness of health care workers during the COVID-19 pandemic. A multi-center randomized controlled trial. ● / ● Bylaws of the created intelligence center containing at least the definition of the mission, the objectives and general lines of operation. Discussion not yet started. Communication strategy needs to be reinforced 	<ul style="list-style-type: none"> ● At least one partnership protocol for analysis and strengthening of information systems established with a CPLP health institution by December 31 ACSS from PT.



<ul style="list-style-type: none"> ● Develop and strengthen the training / capacity building of human resources in the area of public health information systems, with a particular focus on those related to epidemiological surveillance and early intervention. ●/ ● Create a GHTM data repository that allows to enhance the ability to answer public health issues through Big Data Analysis and artificial intelligence (AI) methods 	<ul style="list-style-type: none"> ● At least one training course in the field of clinical trial management <p>Creation of the repository until December 31 As been mentioned but not discussed in the SC</p> <p>Establishment of partnerships with other academic institutions of the CPLP and the EU with a view to training in the areas of Big Data Analysis and IA Some potential partners have been identified</p>	<ul style="list-style-type: none"> ● 80% of GHTM members with GCP certificate ● Conducting at least one training in the field of epidemiological surveillance for members of the GHTM and IHMT NOVA community ● Course on Fundamentals of epidemics (BCG_RCT). Foresaw for May 2022 (BCG_RCT)
<p>In collaboration with the VBD group</p>		
<ul style="list-style-type: none"> ● Initiatives supporting efforts from the public health authorities and CPLP countries related to the new and emerging epidemics and future pandemics. 		<ul style="list-style-type: none"> ● MosquitoWeb (NOVA Health): in 2021, this initiative will evolve into an integrated Iberian network of citizen science for mosquito surveillance, in collaboration with INSA and Mosquito Alert (Spain) ● Health Risk and social vulnerability to Arboviral Diseases in mainland Portugal
<p>In collaboration with the IHC group,</p>		



<ul style="list-style-type: none"> ● Organization of at least 1 training event 		<ul style="list-style-type: none"> ● Rute Marcelino - PhD
In collaboration with the PPS group,		
<p>Subjects related to mobility of populations and migrants and on the determinants of emergence of pathogens, particularly we will address the problems of deforestation and vaccine hesitancy:</p> <ul style="list-style-type: none"> ● Impact of deforestation for the emergence of new emergent infectious diseases ● Acculturation, lifestyle and health of migrants in different CPLP contexts ● Addressing vaccine hesitancy in Europe 	<p>Two EU projects approved in 2021 and already started</p> <p>One paper in Preprints:</p>	<ul style="list-style-type: none"> ● Implementation of a children cohort in the archipelagos of Cape Verde and São Tomé e Príncipe (PPS) - EDCTP ● Mertens, T.; Abecasis, A. Time to See the Forest for the Trees: Protecting Forests Could Prevent Future Pandemics and Help Preserve a Common Planetary Future. <i>Preprints</i> 2020, 2020060316 (https://www.preprints.org/manuscript/202006.0316/v1) ● VAX-TRUST - Addressing vaccine hesitancy in Europe– HORIZON EUROPE
In collaboration with the VBD group		
<p>We will investigate determinants of pathogen dispersion in different CPLP contexts, through three independent projects:</p> <ul style="list-style-type: none"> ● Modelling the risk of introduction of Aedes invasive species and the establishment of arboviral vector-borne infections in Europe ● Epidemiology of leishmaniasis as a reemerging disease in Europe ● Malaria in PALOP countries 	<p>One project approved in 2021 and already started</p> <p>One EU project finalized</p>	<ul style="list-style-type: none"> ● Phylogenomics of Malaria parasites and socio-cultural determinants of malaria dispersal in PALOP countries (VBD) ● MosquitoWeb ● Zikalliance: a global alliance for Zika virus control and prevention
In collaboration with the IHC group,		
<p>we will continue the previously implemented projects with the largest Travelers clinic in Portugal, established at IHMT</p>		<ul style="list-style-type: none"> ● Tracking infectious diseases in mobile populations and travelers, with monitoring and risks of introducing pathogens that cause STDs and diarrhea of travelers from Lusophone countries and their antibiotic resistance profile (IHC). ● Molecular markers of resistance in parasitic populations collected in malaria endemic areas (VBD+IHC).



CCI – FAIR RESEARCH PARTNERSHIPS (FRP)

Objective: To actively promote fair and equitable partnerships - with the assumption that we can contribute to increased productivity if: the definition of the research agenda results from joint work; clarification of responsibilities and promotion of mutual learning (“reverse innovation”); there is data sharing and research networks.

Key subjects: institutional practices to promote research integrity; knowledge co-production strategies; reverse innovation;

ONGOING ACTIVITIES 2020/2021 WITH RGS:	OUTCOMES	EVIDENCES
In collaboration with the THOP group		
In collaboration with the VBD and THOP group		
<p>● Learning to Investigate by Field Experiment for Southeast Asia Emerging Diseases (Erasmus+)</p>		
In collaboration with the PPS group		
<p>● 2 important partnerships: - between the United Kingdom, Portugal and Mozambique as part of an investigation into health literacy standards and men's health care search in Mozambique - between Portugal, Mozambique, Cape Verde and Angola on strengthening the capacity of bioethics committees.</p>		
In collaboration with the IHC group		
In collaboration with all RG group		
<p>● Monitoring and support to the first PhD program in Biomedical Sciences in Angola – Faculty of Medicine Universidade Agostinho Neto (in collaboration with Universidade NOVA de Lisboa).</p>	<p>Analysis of ongoing partnerships (namely, PhD Course in Biomedical Sciences Faculty of Medicine UAN Angola (+NOVA) - results until 31 December 2021</p>	<p>● 2021 - Master of Public Health and Development Thesis: “Analysis of the mechanisms for implementing the PhD program in Biomedical Sciences in Angola, in partnership with IHMT-NOVA”, Carolina Valério, Instituto de Higiene e Medicina Tropical, UNL. (supervisor António Carvalho, co-supervisor Isabel Craveiro).</p> <p>● 2021 - Valério C, Carvalho A & Craveiro I (2021). Capacity building and north/south partnerships in health: the example of the implementation of the doctoral program in biomedical sciences in Angola. Annals of the Institute of Hygiene and Tropical Medicine - v. 20: Supplement nº 1 - Perspectives on medical education in Angola.</p>



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<p>New activities 2020/2021 with RGs and infrastructures:</p> <p>● / ● Develop and strengthen institutional capacity building in the area of fair and equitable partnerships</p>		<p>● / ● Guidelines for standardization of protocols on Fair and Equitable Partnerships (e.g. co-authorship rules, data sharing) - until 31 December (Ongoing)</p>
<p>Capacity building: Organization of training actions.</p> <ul style="list-style-type: none"> ● Workshop on knowledge management ● Workshop on communication strategies 	<p>Organization of at least 2 training events</p>	<ul style="list-style-type: none"> ● PhD Tropical Diseases and Global Health, UC Rotação Temática – Fair Research Partnerships (20 students enrolled; final output: 4 papers on the subject) ● Scientific Writing Workshop by Joana Pais Zózimo, PhD Lancaster University
<p>Congresses/Events:</p> <ul style="list-style-type: none"> ● GHTM sessions 	<p>Organization of at least 2 meeting events</p>	<ul style="list-style-type: none"> ● Extra GHTM Session on 15-06-21 “Developing an Individual-Based Social Practice Approach to International Partnerships”, by the researcher Joana Pais Zózimo, PhD Lancaster University



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STRATEGIC GHTM / IHMT / NOVA INFRASTRUCTURES

● BIOLOGICAL RESOURCE CENTER (BRC) / BIOBANK

Nowadays, BRC and biobanks are central structures for innovation on global health and advance of precision health care. Through biobanks, a variety of biological specimens may be conserved under exceptional quality conditions, anticipating collection needs for prospective applications, mainly related with development or application of new biomarkers, new therapies, or diagnostic methods. The BRC/biobank of GHTM/IHMT – Biotropical Resources, BIOTROP – was created in 2016 to improve research in tropical medicine and infectious diseases, allowing the supply of high-quality biological resources to researchers.

After a long period dealing with structural (facilities, equipment), operational (governance, elaboration of standard procedures, SOP, and forms) and legal issues (protection of individual data, and conservation of biological resources), BIOTROP is now ready to receive, preserve, and distribute biological samples strictly following the ethical and legal issues, under the Nagoya protocol and the international best practice guidelines. Its data management good practices and confidentiality were recognized by the Data Privacy Impact Assessment (DPIA) evaluation performed by NOVA Data Protection Officer (DPO) (2019). Very recently, in 2019, BIOTROP integrated the Portuguese Roadmap of Research Infrastructures, as member of two networks - Portuguese microBiological Resources Center Network [Pt-mBRCN / MIRRI-PT - Portuguese microBiological Resources Center Network [<https://www.mbrcn.pt/>] / Microbial Resource Research Infrastructure– Portugal [<https://www.mirri.org/>] and National Biobanks Infrastructure (Biobanco.pt, <http://biobanco.pt>).

BIOTROP has now around 21,000 samples of microorganisms (or derived products) associated to both human and animal health, vectors, and reservoirs. These collections were donated by the principal investigators of both recent and past research projects. A web catalogue is being elaborated to facilitate the exchange of resources between investigators. To obtain prospective collections of infectious agents of tropical diseases from endemic areas, positive samples collected during the routine diagnostics procedures at the central IHMT's laboratory, from patients coming to ADMT's Travel Medicine Appointment, will be stored. The procedures and flowchart of collection and storage of this material are currently under appreciation of IHMT's Ethical Commission and will be implemented during the next year.

In addition to depositing and distributing samples, BIOTROP has given support to researchers and students to elaborate SOPs of collection and processing of isolates and further services, such as pathogen molecular typing or phylogenetic analysis will be put in practice.

Active participation in dissemination activities will continue as well as seek of national and international collaborations in order to gain visibility and gathering funds.

A Strategic Plan for 2021-2023 detailing all these activities was prepared to be implemented at the beginning of 2021.

<https://www.ihmt.unl.pt/investigacao/biobanco/>

http://ihmtweb.ihmt.unl.pt/download/comunicacao/BIOTROP_Annual_Report_2021_v21-12-2021.pdf

http://ihmtweb.ihmt.unl.pt/Download/BIOTROP/BIOTROP_2021-2023_STRATEGIC_PLAN_vsf.pdf

<https://impact.webview.pt/2021/03/05/biotrop-biotropical-resources-biobank/>

<http://biotropical.ihmt.unl.pt#>



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● BIOINFORMATICS HUB

The GHTM/IHMT Bioinformatics Hub represents a significant opportunity to improve bioinformatics skills and support research for the entire GHTM scientific community.

The high processing and data storage capacity of this infrastructure has been essential to follow the intense speed, complexity and volume of data that have been produced in light of recent technological advances, especially in the area of genome-wide sequencing.

This infrastructure intends to act at four levels in 2021: sequencing, data management, support for research projects and enhancement of collaborative networks.

More specifically:

I. SEQUENCING:

Nanopore sequencing – MinION

Several GHTM researchers expressed their interest to carry out high-throughput sequencing in-house, as well as in fieldwork situations (refer to the Report on the analysis of the questionnaire for the purchase of MinION equipment and technology, from “Oxford Nanopore Technologies”). After evaluation of the available options, the portable equipment for nanopore sequencing MinION Mk1C, from “Oxford Nanopore Technologies”, was purchased in 2020. The management of MinION usage, namely concerning the schedule and storage space verification, will be performed by the coordinator of the Bioinformatics Hub, with the support of the other members of the Hub.

Action proposals:

- Implementation of the MinION usage regulation;
- Initial support in the use of the MinION equipment to ensure good application practices;

- Management of usage and timing;
- Reassessment of data storage needs

II. DATA MANAGEMENT:

Research data produced at GHTM/IHMT has been managed individually by each research group, mainly resorting to ad hoc storage and sharing options.

Action proposals:

- To define a general standard operating procedure for data storage and management;
- To develop data management plans, as well as integration in data analysis systems, for particular GHTM/IHMT projects that require it;
- To regularly reassess the needs for computer infrastructure or access to remote platforms.

III. SUPPORTING RESEARCH PROJECTS:

Bioinformatics support in the areas of genomics and transcriptomics was given, between 2019 and 2020, to 6 projects on HIV, HPV, Hepatitis, antibiotic resistance, Zika and other arboviruses.

Action proposals:

- To continue to support the development of projects and the analysis of genomics and transcriptomics data within the scope of ongoing research activities at GHTM;

- To manage all the bioinformatics equipment usage, assuring access and good practices, and proposing new acquisitions of computer material according to the research needs.



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IV. COLLABORATIVE NETWORKS:

IHMT is part of collaborative networks within the scope of bioinformatics applied to health. The reinforcement of the existing bioinformatics infrastructure will allow to expand the networks and look for new collaborations and funding.

Action proposals:

- To continue to boost interaction and collaboration with national and international infrastructures and networks, namely, maintaining the participation in the PT-OPENSOURCE Infrastructure, in the REDCap (Research Electronic Data Capture) consortium, in the PrimaryCare@Covid19 and Lab-BioBanco digital platforms and in networks WANETAM-3 (West African Network for TB, AIDS, Malaria) and TB WGseq & Bioinformatic network (London School of Hygiene and Tropical Medicine);
- To strengthen partnerships and collaborative networks and prepare applications for funding;
- To develop exchange programs with CPLP partners.



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/ VIASEF

The “In Vivo Arthropod Security Facility (VIASEF)” is part of the Roteiro Nacional de Infraestruturas de Investigação since 2014. This infrastructure, hosted at the Instituto de Higiene e Medicina Tropical/NOVA, is devoted to the study of arthropods and the pathogens they transmit. VIASEF is specifically adapted to rear and maintain invasive and non-invasive arthropod vector species, transgenic strains and to perform transmission studies of pathogens of human and animal diseases that need to be handled in BSL-3 laboratories.

Access to VIASEF is universal to the scientific and industry communities. This research facility with ACL-2 and 3 insectaries and laboratories (including a BSL-3 lab) provides access to a wide variety of services. Some of these services are standardized offers that can be purchased for either research or commercial purposes. There is also the possibility of submitting proposals for the development of specific studies. Insectaries and laboratories can be rent, with or without technical support.

This ACL-3 facility offers national and international researchers, new opportunities for the development of scientific activities focusing vector-borne diseases such as malaria, dengue and West Nile fevers, leishmaniasis, Chagas or Lyme disease. Many of these infections are neglected and/or (re)emerging diseases of increasing global health concern. This is of particular relevance in the present context of climate, environmental and social changes which tend to expand the geographic ranges and epidemiological patterns of vector-borne diseases. VIASEF, by promoting fundamental and translational research, as well as the development of new products and services addressing these issues, can significantly contribute to the improvement of health, social and economic status of populations. Furthermore, by fostering the training of researchers, health specialists and human resources for industry, VIASEF is also promoting the creation of new jobs and highly differentiated human resources. In this context, the outcomes of the activity of VIASEF will impact the following United Nations Sustainable Development Goals (SDGs):

- SDG 1 (no poverty), as many vector-borne diseases affect primarily the poorest fractions of both urban and rural human populations.
- SDG 2 (zero hunger), as vector-borne diseases of veterinary importance such as animal trypanosomiasis or tick-transmitted protozoans have major impacts in livestock.
- SDG 3 (good health and well-being), due to the enormous impact that vector-borne diseases such as malaria or Aedes borne arboviruses have in human populations worldwide.
- SDG 4 (quality education), being embedded in a University, VIASEF will accommodate students for experimental training in the scope of their (post-)graduate work programs.
- SDG 8 (decent work and economic growth), as vector-borne disease of both medical and veterinary importance as major causes of economic loss, especially in low-income countries.
- SDG 9 (industry, innovation and infrastructure), due to its capacity for testing new products and solutions for vector-borne diseases control.
- SDG 10 (reduced inequities), as some of the major vector-borne diseases still affect primarily tropical and subtropical regions of the globe, as well as low-income countries.
- SDG 13 (climate action), by providing insectary-based controlled environments for experimental studies on the impact of climate change in transmission of vector-borne pathogens.
- SDG 17 (partnerships for the goals), due to the potential of this infrastructure to promote synergies between academy and industry, at both national and international levels.

The activity of VIASEF also aligns with two of the five priorities for Health, Clinical and Translational Research, of the FCT Research and Innovation Agenda for Health 2020-2030, namely:

- Pharmacology, Medicines and Advanced Therapies;
- Assessment of Technologies and interventions in Health and Rapid Access to Innovation.

In addition to its capacity to maintain a variety of arthropod species in contained environments, VIASEF provides safe housing for in vivo tests of vector-borne pathogens. This allows the development of experimental protocols with multiple research purposes, including:

- The study of vector competence determinants, vector pathogen interactions and immunological factors.
- Testing of new pharmacological products interfering with the development of the pathogen in the vector.
- Testing new insecticidal and repellent candidates, including novel formulations (e.g. nano-encapsulation); and studies of insecticide resistance.
- Performing bioecological and behavioral studies of arthropod vectors towards the development of innovative non-insecticidal vector control tools.