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ABSTRACTS
BOOK



Workshop initiated by the Community of Practice on Biodiversity and Health:



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PARALLEL SESSIONS

Thursday 6 October 2016 || Parallel sessions ||

A. Vectors and vector borne diseases

*Coordinated by Nick De Regge (CODA-CERVA), Isra Deblauwe (ITG),
& Steven Van Gucht (WIV-ISP)*

B. Zoonotic diseases

Coordinated by Marcella Mori (CODA-CERVA) & Javiera Rebolledo (WIV-ISP)

C. Cross-pollinating agro-eco-human health perspectives

Coordinated by Wim Hiemstra (ETC) & Aurélie Binot (CIRAD)

D. Environmental and internal microbiome

Coordinated by Lucette Flandroy (DG Environment Belgium) & Ellen Decaestecker (KULeuven)

E. Nature health benefits

Coordinated by Sjerp de Vries (Alterra) & Hans Keune (BBPF-COPBH)

Friday 7 October 2016 || Parallel sessions ||

A. Evaluation and challenges/limitations of One Health

*Coordinated by Barbara Haesler (Royal Veterinary College, London) & Simon Rüegg
(University of Zürich)*

B. Social science, transdisciplinarity and traditional knowledge systems session

Coordinated by Séverine Thys (ITG) & Hans Keune (BBPF-COPBH)

C. Education & capacity building

Coordinated by Nicolas Antoine-Moussiaux (ULG) & Maarten Vanhove (RBINS)

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VECTORS AND VECTOR BORNE DISEASES

Albert Godal	Presentation
Entomological surveillance in France and vector control around imported cases	
The outermost regions of France have always been confronted with vector-borne diseases, malaria, yellow fever, Chagas disease, dengue, chikungunya and finally Zika. The presence of mosquitoes in these territories is permanent. Vector diseases are present either endemically or in epidemics. These can be brutal if people are exposed to new arboviruses as it was the case for chikungunya in 2006 (Reunion, Mayotte) and in 2014 (Antilles, French Guiana) and, for Zika, in 2016 (Antilles, French Guiana). Locally competent vector control services are in permanent activity, to limit the proliferation of vectors and fight against epidemics. France has long been legislated on the subject, to give it a legal framework to plan the fight against vectors in allocating roles and financing between local and national public authorities. Since 2004 the mosquito vector <i>Aedes albopictus</i> settled in France. This mosquito is able of transmitting the main arboviruses. The state regulatory obligations originally established for the outermost regions is also applied on the mainland. The device is intended to prevent the development of indigenous transmission cycles. It is	based on a first stage, controlled directly by the Ministry of Health, in recognition of the departments colonized by the mosquito vector. The information on this colonization comes from a network of ovitraps and collection of reports by individuals. In departments where new detections occur and if the entomological situation allows it, treatments are implemented to eliminate mosquitoes <i>Aedes albopictus</i> and thus, prevent colonization. When the installation of the mosquito vector <i>Aedes albopictus</i> is final, epidemiological monitoring is enabled. Arbovirus infections are notifiable diseases: doctors and testing laboratories report cases to the health administration. This triggers actions of vector control around the living spaces of the patients who stayed where mosquitoes are during their period of viremia. If, despite this first phase of prevention an indigenous transmission of episode occurs, control measures under the national plan, involving many local and national actors, are enabled. From an epidemiological point of view it consists of an active case research; from an entomological point of view it is both, mosquito breeding destruction and treatment, as well as adulticide treatment.

VECTORS AND VECTOR BORNE DISEASES

Wim Van Bortel	Presentation
Challenges of vector-borne disease surveillance and control from a European perspective	
Vector-borne diseases are a specific group of infections that represent a (re-)emerging threat to Europe requiring particular attention. Vector-borne diseases pose a special challenge to ECDC and national public health authorities due to their complex nature, i.e. the biological complexity of the transmission system, and many aspects of the transmission cycle are under strong influence of environmental conditions which are changing (including climate, agricultural practices, land use and urbanisation). Moreover, vector-borne diseases tend to spread globally by the increasing population mobility and migration, travel and trade, which contribute to the fast and worldwide spread of vectors and the pathogens they transmit. Human behavioural changes (outdoor activities, habitat encroachment) have also a major impact on the exposure to vectors. In this presentation, I will review the situation of vector-borne diseases in the EU and present examples that demonstrate the challenges related to	vector-borne disease surveillance and control from a European perspective. In recent years, several vector-borne disease outbreaks have occurred in Europe such as the dengue outbreak in Madeira, the outbreak of West Nile virus infection in large parts of Europe, and chikungunya in Italy. Furthermore an increased establishment and spread of invasive mosquitoes has been observed. Also, known diseases such as Crimean-Congo Haemorrhagic Fever emerge in new areas and changes in the distribution of indigenous vector species are observed. The changing epidemiology of vector-borne diseases in the EU will challenge the public health authorities. Collaboration between multiple disciplines including human and animal health, and environmental authorities will be pivotal for early detection, effective surveillance, adequate risk assessment, communication, response and control of vector-borne diseases.

VECTORS AND VECTOR BORNE DISEASES

Veerle Vanlerberghe – Luc Tsachoua	Presentation
Epidemiological aspects of the current Zika virus outbreak and preparedness of Belgium	
An epidemic of Zika virus infection initiated in 2015 in South and Central America and the Caribbean, with more than a million suspected cases over a few months' time. In February 2016, based on recommendations of the International Health Regulations Emergency Committee, WHO declared the increasing cases of neonatal (microcephaly) and neurological disorders, amid the growing Zika outbreak in the Americas, a Public Health Emergency of International Concern. The virus is, for the vast majority of infections, transmitted through the bite of a female Aedes mosquito, but can also be transmitted from mother to child during pregnancy or through sexual intercourse. It continues spreading and is nowadays also detected in South-East Asia and Europe. In this presentation, we will discuss the epidemiology of this emerging virus and the challenges for its control. In a second part of the presentation, we will focus on the measures that are implemented in Belgium in preparation for this emerging threat. As of today, a lot of countries and territories (more than 60) are touched around the world, including numerous of European countries. This threat is taken very seriously in the continent, since competent vectors (Aedes) are present in some countries. With 15 probable and confirmed cases notified, up to 06 may 2016, Belgium is not spare. Therefore, in concert with the international community, Belgian Public Health authorities organized their response strategy, in order to be prepared for any eventualities.	

VECTORS AND VECTOR BORNE DISEASES

Deblauwe I., Demeulemeester J., Sohier C., Van Loo T., De Witte J., Madder M., Coosemans M.	Presentation
Invasive mosquito surveillance implemented in Belgium since 2012: still need for a permanent structure and a clear control plan	
Mosquitoes and mosquito-borne diseases pose an increasing threat to animal and human health in temperate regions. Important drivers for their emergence and spread include climatic changes, environmental changes and a significant increase in international trade, tourism and travel. Strengthening surveillance of invasive mosquito species (IMS) and their pathogens in areas at risk of importation or spread and risk of pathogen transmission is therefore required. For Belgium, the following IMS pose the main risk: the Asian tiger mosquito (<i>Aedes albopictus</i>), the Asian rock pool mosquito (<i>Aedes japonicus japonicus</i>) and <i>Aedes koreicus</i>. The last two species are already locally established of which <i>Aedes japonicus japonicus</i> has been recently controlled. Following the implementation of invasive mosquito surveillance in Belgium in 2012 (financed by the regions and the federal government), to evaluate the guidelines of the European Centre for Disease Prevention and Control (ECDC), the routine surveillance continued in 2013, 2014, 2015 and partly in 2016 (temporarily financed by the Federal Agency for the Safety of the food Chain (FASFC)) with as main aim the early detection of any introduction of IMS into Belgium. The surveillance was implemented in Belgium at 12 potential points of entry (PoE) each year, except in 2016 only three high risk PoE were surveyed. Each year <i>Aedes albopictus</i> has been detected, but control measures were not always implemented, or implementation was delayed because an exemption on the biocide legislation was not obtained in time. However, when control measures were implemented, these were successful until now. No national/regional protocols for IMS management are available in Belgium. These protocols should state who is responsible for the implementation and costs of control measures, and the manner in which such measures should be implemented. However, a national Belgian mosquito surveillance policy is being discussed, and awareness is growing. We urge the Belgian authorities not to wait too long with the implementation of this permanent vector surveillance and control plan, especially with the growing epidemic of the Zika virus, which can be transmitted by <i>Ae. albopictus</i>.	

VECTORS AND VECTOR BORNE DISEASES

Sanne Ruyts	Presentation
Longitudinal survey of the effect of forest types on the abundance of Ixodes ricinus ticks	
The tick <i>Ixodes ricinus</i>, which is a vector species for <i>Borrelia burgdorferi</i> sl. that causes Lyme disease in humans, occurs predominantly in forests. Moreover, our research has shown that the abundance of ticks is higher in oak than in pine forests. In a temporal study, we investigated tick abundances in different forest types in 2009, 2010, 2013 and 2014 and noticed that the abundance of <i>I. ricinus</i> did not increase from 2009 to 2014 but fluctuates year to year. More research on the cause of these fluctuations is needed but previous research at our lab already showed that the abundance of ticks can increase in some years due to increasing abundances of mice after a masting event of oak.	

VECTORS AND VECTOR BORNE DISEASES

Tinne Lernout	Presentation
Monitoring of tick borne diseases in Belgium: need for a One Health approach	
Ticks are important vectors of diseases affecting human and animal health worldwide. Because of the involvement of both vertebrate hosts and ticks, which interact in a constantly changing environment, surveillance, prevention and control of these diseases need a One Health approach. In Belgium, monitoring of diseases in humans is carried out by the Scientific Institute of Public Health (WIV-ISP). Routine surveillance of Lyme disease, the most common tick-borne disease in Europe, is based on three sources of information. A network of sentinel laboratories performs laboratory surveillance by weekly reporting the number of positive serological tests for <i>Borrelia burgdorferi</i>. The yearly number of persons hospitalized for Lyme disease is monitored through the hospitals' minimum clinical datasets. Finally, the incidence of erythema migrans (EM) is estimated based on repeated studies carried out by a sentinel network of general practitioners (GP). Other diseases transmitted by ticks and for which data on human infections are collected in Belgium include anaplasmosis, tick-borne encephalitis, tularemia and rickettsioses. Their surveillance relies on data from the respective National reference centers (NRC) and reference laboratories. In addition to disease	

surveillance, the WIV-ISP started in June 2016 a research project (HUMTICK) on the cost and burden of Lyme borreliosis and the occurrence of other tick-borne diseases.

Surveillance and research activities regarding the vector are still scarce and fragmented, and should be further developed. The mapping of tick bites in Belgium was initiated in June 2015, with the launch of an online citizen-based platform (TiquesNet). In addition, research studies on ticks and their hosts are being performed by private institutes and universities, but a coordinated research plan is missing.

Therefore, enhanced collaboration between veterinary and human medicine and ecology research is needed to strengthen the knowledge on tick-borne diseases in Belgium. Interaction between clinicians, veterinarians, researchers and (governmental) agencies may take place at many levels - from surveillance of disease in humans and animals and joint research programs to policy making and communication to the public. Within the National Environment and Health Action Plan (NEHAP) an interdisciplinary group is working on a plan for prevention and control of tick-borne diseases in Belgium.

VECTORS AND VECTOR BORNE DISEASES

Dadi Falay Sadiki	Presentation
High prevalence of <i>Rickettsia typhi</i> and <i>Bartonella</i> species in rats and fleas, Kisangani, Democratic Republic of the Congo	
The prevalence and identity of <i>Rickettsia</i> and <i>Bartonella</i> in urban rat and flea populations were evaluated in Kisangani, Democratic Republic of the Congo (DRC) by molecular tools. An overall prevalence of 17% <i>Bartonella</i> species and 13% <i>Rickettsia typhi</i>, the agent of murine typhus, was found in the cosmopolitan rat species, <i>Rattus rattus</i> and <i>Rattus norvegicus</i> that were infested by a majority of <i>Xenopsylla cheopis</i> fleas. <i>Bartonella queenslandensis</i>, <i>Bartonella elizabethae</i>, and three <i>Bartonella</i> genotypes were identified by sequencing in rat specimens, mostly in <i>R. rattus</i>. <i>Rickettsia typhi</i> was detected in 72% of <i>X. cheopis</i> pools, the main vector and reservoir of this zoonotic pathogen. Co-infections were observed in rodents, suggesting a common mammalian host shared by <i>R. typhi</i> and <i>Bartonella</i> spp. Thus, both infections are endemic in DRC and the medical staffs need to be aware knowing the high prevalence of impoverished populations or immunocompromised inhabitants in this area.	

VECTORS AND VECTOR BORNE DISEASES

Nick De Regge	Presentation
Culicoides and Culicoides borne diseases in Belgium	
Biting midges are small hematophagous Diptera belonging to the family Ceratopogonidae, genus <i>Culicoides</i>. In 2011, a longitudinal monitoring of <i>Culicoides</i> was done at 16 locations covering four regions of Belgium with Onderstepoort Veterinary Institute (OVI) traps and at two locations with Rothamsted suction traps (RST). Quantification of the collections and morphological identification showed that 41 different species were found. Species belonging to the subgenus <i>Avaritia</i> (<i>C. obsolutus</i>, <i>C. scoticus</i>, <i>C. dewulfi</i>, <i>C. chiopterus</i>) together with <i>C. pulicaris</i> (subgenus <i>Culicoides</i>) were the most abundant, accounting for 80 and 96% of the total number of midges collected with RST and OVI traps respectively. <i>Culicoides</i> were present during most of the year, with <i>C. obsolutus</i> complex midges found from February 9th till December 27th. Most <i>Culicoides</i> were however caught between April and November. Important variation existed in abundance and species diversity between individual collection sites, even if these were located in the same region. Besides the nuisance they cause in some countries, <i>Culicoides</i> are mostly known as vectors of different arboviruses (e.g. African horse sickness virus, Akabane virus (AKAV), bluetongue virus (BTV), epizootic hemorrhagic disease virus and equine encephalosis virus). In Belgium and most of Europe, indigenous <i>Culicoides</i> were responsible for the transmission of BTV-8 and Schmallenberg virus after their emergence during the last decade. Both veterinary viruses had an important economic impact and remain under constant surveillance, certainly seen the recent re-emergence of BTV in France.	

ZOONOTIC DISEASES

Prof. Sally Cutler	Presentation
Blurring the boundaries – zoonoses in the twenty-first century (1)	
Our increasingly connected world has been accompanied by changes in the dynamics of zoonotic infections facilitating both speed of spread and introduction into unfamiliar populations, typified by West Nile and now Zika virus. Increasing human population sizes coupled with increased demands for protein have impacted upon our agricultural practices, again providing opportunities for zoonotic infections such as the Q fever outbreak in the Netherlands. This is further compounded by our food supply changes with associated problems of salmonella, campylobacter and listeria. Though back yard production is no longer commonplace in the industrialised nations, proximity with animals remains frequent through our	desire to keep companion animals, with resulting zoonoses ranging from monkey and cow pox viruses, to leptospirosis. Travel to exotic locations has become the norm with holiday makers frequently partaking in outside activities that put them at risk of zoonoses such as water sports. Eating local exotic gastronomical delicacies again presents risks through infections such as brucellosis. Amid these multi-factorial risk factors largely resulting from changed human behaviour we also need to consider pathogen factors such as the evolutionary bottlenecks and constraints imposed by depletion of natural reservoirs and increased human numbers. Infections such as HIV serve as stark reminders here. International trade, for example used tyres, has been incriminated

ZOONOTIC DISEASES

Prof. Sally Cutler	Presentation
Blurring the boundaries – zoonoses in the twenty-first century (2)	
in the ease of spread on invasive mosquito species and their zoonoses. An additional level of complexity is facilitated by climatic change, possibly accounting for recent upsurges of leptospirosis and vector-borne zoonoses. So, what can we do? Control of human movement has proven challenging as seen during SARS and swine flu outbreaks. Prediction and modelling has shown variable success challenged by having base these models on assumptions that may not encompass the nuisances of particularly adapted genotypes. Vaccines have resulted in some remarkable achievements but we are now seeing consequences of the "vacuum effect" left in their wake.	

ZOONOTIC DISEASES

John E. Fa & Robert Nasi	Poster
Reservoir Species and Ebola: What do you know and where to go from here	
In this paper, we review and present available information on the species that are likely to be linked to Ebola virus disease in Africa. We show that there is a larger potential pool of species that may be associated with Ebola virus.	

ZOONOTIC DISEASES

Marius Gilbert	Presentation
The emergence of avian influenza, a One Health epitome	
A full understanding of avian influenza ecology and epidemiology requires a detailed understanding of how the virus can spread between wildlife, domestic birds and people. It is hence a perfect example to illustrate the rationale of One Health approaches to prevent and control other emerging zoonoses. The talk will focus on the social, ecological and epidemiological drivers that lead to the emergence and spread of recent avian influenza epidemics by H7N3, H5N1, H7N9, H5Nx clade 2.3.4.4 viruses. We will illustrate how emergences are linked to modifications to the extent of interfaces (wild / domestic hosts, domestic hosts / humans), to the changing density and global connectivity of wild, domestic and human populations, and how targeted interventions have been	

ZOONOTIC DISEASES

Sophie Quoilin	Presentation
Zoonoses in humans: not so many under surveillance	
WHO defines zoonoses like <i>"common diseases both to animal and human"</i> and classified about 200 diseases corresponding to this definition. Other definitions are published like <i>"Any disease or infection that is naturally transmissible from vertebrate animals to humans and vice-versa"</i> and the first question is indeed what is a zoonose? In order to describe properly the impact of a disease, to propose adapted control measures, it seems coherent to distinguish diseases following the main route of transmission: food-, vector-, rodent-, water-borne and to define zoonoses like those diseases transmitted by direct contact between vertebrates and human. If we use this definition, zoonoses under surveillance for public health purposes in Belgium are not so many; probably less than 10. Routine surveillance systems used to describe their epidemiology are	mainly based on laboratory diagnosis, data are gathered through the sentinel laboratory network and the national reference centres. Most of the zoonoses are rare diseases even if they can emerge like major problems imposing then to adapt the surveillance systems according to the needs. Considering the burden of diseases, compared to other human health problems, infectious diseases as such have nowadays a marginal impact. Nevertheless it seems also important to have a transversal approach of infectious diseases because the main factors influencing the emergence infectious diseases as public health problems are actually 'human induced infectious diseases'. Identifying and interpreting appropriately these factors will allow a better prevention of the infectious diseases.

ZOONOTIC DISEASES

Claude Saegerman	Presentation
Animal surveillance: a key component of zoonosis surveillance (1)	
Several national networks/systems/plans of epidemiological animal surveillance exist in Member States (MS) of the European Union. The purpose of surveillance may include detecting an emerging disease (e.g. West Nile Fever, Tick-borne encephalitis, Crimean-Congo haemorrhagic fever), alerting the public of the presence of a disease in animal populations (e.g. avian influenza, hantavirus, WNF virus), determining the real importance (prevalence, incidence) of disease(s), estimating the results of control plans and to prioritize the importance of different diseases among others. For zoonoses in particular, the prevalence of infection in animal reservoirs determines the incidence of human cases (e.g. brucellosis). In addition, surveillance of a zoonosis in animal populations can be very useful for human awareness (e.g. hantavirus or West Nile fever virus).	Conversely, for the case of zoonoses, results of public surveillance are also important for animal surveillance because humans can transmit zoonotic agents to animal populations (e.g. tuberculosis due to <i>Mycobacterium tuberculosis</i> or cysticercosis due to <i>Taenia saginata</i>). For all these veterinary public health reasons, the quality of the national networks/systems/plans of epidemiological animal surveillance is of prime importance and merits appropriate investments and considerations. However, the quality of these networks/systems/plans of epidemiological animal surveillance has not been regularly assessed. Nevertheless, this assessment is strongly recommended. Indeed, some operational tools to evaluate a surveillance network already exist, such as the OASIS method [10] and participatory epidemiology [11]. Therefore, these tools should be widely

ZOONOTIC DISEASES

Claude Saegerman	Presentation
Animal surveillance: a key component of zoonosis surveillance (2)	
used as to ensure the link between objective(s) of the surveillance system. In addition, results of epidemiological networks give added value for the community. Furthermore, economics and social sciences should also be considered in order to enhance the evaluation of the system. A platform of information and exchange could be initiated like the existing Platform of Animal Health Surveillance in France (http://www.plateforme-esa.fr/). A first action that could be carried out is an inventory of the existing epidemiological surveillance systems (networks, systems, plans and other tools) available for both animal and human sectors. A second action could perform a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) in order to consider a common veterinary public health strategy of action throughout all Member States (harmonization,	synergy, rationalisation, adaptation to new challenges, assessment and development). These procedures should have a desirable structuring effect and gain in the future more resilience against zoonotic diseases in the country. Lastly, at the European level, a centre of animal epidemiological intelligence with a veterinary public health perspective could be created. Animal epidemiological intelligence is the process of detecting, verifying, analysing, assessing, and investigating signals that may represent a threat to animal health. The tasks of this centre would be the sanitary survey of emerging events, information to Member states on these risks, control of field investigation allowing to identify potentially serious risks for animal and human health, analysis and interpretation of epidemiological surveillance data and to support Member States that require assistance.

ZOONOTIC DISEASES

Jacques Godfroid	Presentation
From Brucellosis Control in Livestock to Brucella Ecology in Wildlife	
Brucellosis is a neglected zoonosis affecting the livelihood and health of poor rural communities in Africa as well as first nation people in the Arctic. The talk will focus on the transmission of <i>Brucella</i> spp. at the livestock/wildlife/human interface. Strategies related to animal brucellosis control and eradication, brucellosis veterinary public health will be highlighted and a One Health conceptual framework for brucellosis will be presented. The ecological niche of <i>Brucella</i> spp. has dramatically expanded with new species being described in marine mammals, rodents, carnivores, monkeys and recently ectotherms (frogs and fish). Lastly the impact of anthropogenic drivers, like climate change and pollution, on the ecology of wildlife brucellosis in a changing Arctic will be discussed.	

ZOONOTIC DISEASES

Sousa J, Müller V, Vandamme A-M	Presentation
Societal changes at the origins of HIV	
Despite the progress made in understanding HIV origins, uncertainties remain over how to explain the timing and biogeography of HIV strains, and over what processes permitted just a few human Simian Immunodeficiency Virus (SIV) infections to become epidemic. SIV interspecies transmissions from apes and monkeys to humans are not uncommon in areas where humans hunt and butcher them for their meat, but SIV cannot usually survive in the human body because it is not adapted. Suddenly, in the early 20th century, 5 such interspecies transmission events sparked HIV epidemics, one of which reached pandemic proportions. The initial spread of this pandemic HIV-1 group M can be tracked back to Kinshasa, immediately after the turn of the century. We studied demographic, ethnographic and colonial medical literature in order to map out the major risk factors for HIV emergence, such as genital ulcer diseases (GUD), male circumcision,	urbanization, health systems, the gender ratio in cities, commercial sex work, and the use of unsafe needles. The colonial rule disrupted the traditional society, which created an environment permissive for high prevalence of GUDs, a group of sexually transmitted diseases that still today greatly facilitate infection with HIV. There was a narrow time window of massive GUDs in emerging colonial cities, which were absent from pre-colonial villages in territories of bush meat hunting, and better controlled by medical intervention at the peak growth of colonial cities. Such GUD conditions could have allowed serial passage of unadapted SIV in highly susceptible humans. We propose that the zoonotic origin of HIV is due to a transition in the colonial society, sparking massive GUD outbreaks, permitting at the same time the adaption of SIV to HIV through enhanced transmission in humans.

ZOONOTIC DISEASES

Martine Peeters	Presentation
HIV drivers and genetic diversity/adaptation	
Human Immunodeficiency Virus (HIV), the causative agents of AIDS, are the results of multiple viral cross-species transmissions from Non-Human Primates (NHP) to Pan troglodytes (troglodytes) and western lowland gorillas (<i>Gorilla gorilla gorilla</i>) from Cameroon have crossed the species barrier on at least four occasions leading respectively to HIV-1 groups M and N and HIV-1 groups O and P in humans. HIV-2 viruses result from at least nine independent transmissions of SIVs infecting sooty mangabeys (<i>Cercocebus atys</i>) from West Africa, leading to HIV-2 groups A to I. These HIV variants have different virological and epidemiological histories. Some have remained restricted to a few cases of human infections, others have spread locally but only HIV-1	group M is responsible for the global pandemic affecting today almost 37 million people. Zoonotic emergence of new lentiviruses has to be considered given the prevalence of SIVs in some primate species, the increased contact between humans and wild primates through hunting and bushmeat preparation, and the socio-economic and demographic factors predisposing global expansion of viral infections. The geographic origin and host species of all HIV-1 and HIV-2 groups are now clearly identified, together with the role of certain viral, host and social factors that were associated with adaptation and epidemic spread in the human population.

ZOONOTIC DISEASES

Laudisoit Anne, Gryseels Sophie, Mussaw Moise, Rouquette Olivier, Van Houtte Natalie, Musaba Prescott, Chantrey Julian, Begon Mike, Muyembe Jean Jacques, Leirs Herwig and Verheyen Erik

Presentation

Broadening host range in a globalizing world : Monkeypox virus emergence and threat

While the world is watching the 27th unprecedented known outbreak of Ebola virus disease other silent epidemics are on-going. In the decade preceding the victory of WHO on smallpox (1970-80) - the prevalence of a similar eruptive skin disease, also caused by an Orthopoxvirus, started to increase in the heart of Africa. The Monkeypox (MKPX) virus, a smallpox-like virus endemic to the African region, emerged in 1970 in human populations and - to the contrary of smallpox - seems to have several zoonotic reservoirs. Ecological studies of candidate reservoir have repeatedly pointed towards squirrels as potentials reservoir hosts but the range of hosts is much wider and the ecological relationships between them poorly studied, nor are the routes of human contamination.

The Biodiversity Monitoring Centre (CSB) at the University of Kisangani has been contributing to the search of Monkeypox reservoirs providing ecological data and samples from a series of remote locations and reserves in the Orientale Province. Human and animal samples and screened by PCR targeting and compared to sequences of human MKPX available in Genbank. A retrospective

prevalence study was also performed in Yahuma health area in 2014 and an outbreak investigation was also performed in Aketi health zone in 2016.

DNA evidence of Monkeypox virus was found 14 mammal species. All sequences grouped with either the Central African clade or the Western clade ; homology between human and animal sequences ranged from 97 to 100%. During the Aketi outbreak human and animal strains were identical while in Yahuma the pattern was not so clear (mixture of WB and CA clade).

The dramatic increase in prevalence in MKPX in the last 3 decades has been associated to the cessation of smallpox vaccination and decreasing immunity against Orthopoxvirus and reported in populations relying on bushmeat for survival. The strong relationship between the animal and human strains show an active circulation of the virus among wildlife and humans, and illustrates how wide the host range is. Looking at those results through the lens of viral emergence and public health risk, there is an urgent need to consider this viral threat.

ZOONOTIC DISEASES

Chaber AL, Lignereux Y, Temman S4, Desnues C, Cunningham AA

Presentation

Illegal meat trade: a threat to both biodiversity and public health

Concerns have been raised about the illegal import of bushmeat from Africa into Europe. We highlight that illegal bushmeat traffic is an important threat to biodiversity conservation with CITES species being not only imported for personal consumption but also as part of a lucrative organized trade. Seemingly this trade is also posing health risks to people and livestock that have not been thoroughly assessed yet. After estimating the scale of this international trade, finding around five tonnes of bushmeat per week smuggled in personal baggage through Paris Roissy-Charles de Gaulle airport, we sampled 18 illegal African bushmeat consignments and tested them for the presence of bacteria. Additionally, five smuggled smoked fish were analysed for polycyclic aromatic hydrocarbons, which are known carcinogens. All bushmeat

samples had viable counts of aerobic bacteria above levels considered safe for human consumption. We also identified zoonotic bacterial pathogens in bushmeat and unsafe levels of carcinogens in fish. In addition, African simian bushmeat seized by French customs at Toulouse-Blagnac airport were screened for viral pathogens. Epifluorescence microscopy revealed the presence of virus-like particles in the samples. Although viral nucleic acids were detected in smoked simian meat, it is so far not possible to conclude if it contained any infectious viral particles. The illegal importation of meat is a potential risk for the introduction of pathogens into Europe and the implementation of pathogen surveillance is urgently needed to assess disease risks and to prevent the onset or spread of EIDs.

ZOONOTIC DISEASES

Steven Belmain	Presentation
Can human incidence of Leptospirosis be reduced through implementing ecologically-based rodent management?	
Leptospirosis continues to be one of the top six infectious hazards reported in the WHO Event Management System globally. Recent efforts to evaluate the burden of leptospirosis have shown how the disease continues to be neglected in terms of clinical recognition and diagnosis with low awareness of the chronic and acute impacts. With a range of animal hosts and environments involved in perpetuating the disease to both humans and livestock, leptospirosis is a classic example where multidisciplinary research in a One Health framework is urgently required. Experts recognise that rodents are fundamental in perpetuating leptospirosis in the environment and in promoting human cases. The dynamics of rodent populations and their density is closely linked to rainfall and habitat availability, and research is desperately needed to correlate the seasonal dynamics of rodent abundance with leptospira prevalence/incidence. The general assumption explaining leptospirosis outbreaks with rainfall need to be put in context of rodent breeding (seasonality of infection in chronic annual outbreaks) and rodent migration (extreme climatic	events such as flooding that increase rodent density), both pathways leading to increased rodent-human interactions. Highly effective tools and strategies exist for managing rodent pest populations. However, more often than not, these tools are poorly applied, adapted and monitored which leads to treatment failure and widespread apathy among the people who are suffering rodent problems. The new paradigm of Ecologically-Based Rodent Management has made significant strides in overcoming these misguided beliefs and the inherent problems of implementing effective rodent control, particularly in developing countries. Demonstrating the benefits of fewer rodent pests and their proximity to people will be relevant to many serious diseases including leptospirosis. The cost-benefits of fewer rodent pests is even more significant when considering the multiple impacts of rodents on crop production and food security. Thus, improving rodent management could be one of the most important interventions of the 21st century across the Tropics to reduce poverty and improve people's livelihoods.

ZOONOTIC DISEASES

Floor Haalboom	Presentation
Policy responses to livestock-associated zoonotic threats in historical perspective (the Netherlands, 1880-2010)	
In discussions about One Health, the need for collaboration between different scientific disciplines is often put central. This paper puts the supposed lack of interdisciplinary collaboration on One Health issues in context. It argues another problem is more in need of attention, by studying how policy responses to livestock-associated zoonoses have been shaped in the recent past, and how stakeholders from the public health and agricultural domain related to one another. The argument is based on historical evidence on dealings with livestock-associated zoonoses in the Netherlands during the twentieth century. The speaker is historian of science (medicine and veterinary medicine in particular), and is currently finishing her PhD thesis on twentieth century dealings with livestock-associated zoonoses	in the Netherlands at the Julius Centre UMC Utrecht, supervised by prof. dr. Frank Huisman (historian of medicine, Julius Centre UMC Utrecht), prof. dr. Peter Koolmees (historian of veterinary medicine, Utrecht University) and prof. dr. Roel Coutinho (medical microbiologist and epidemiologist, Julius Centre UMC Utrecht).

ZOONOTIC DISEASES

Nebesse Mololo Casimir, Fatima Mwanapunda Annie, Gambalemoke Mbalitini Sylvestre, Gembu Tungaluna Guy-Crispin, Erik Verheyen and Dudu Akaibe.

Poster

The bushmeat flow markets on the river-port of Kisangani (D.R.Congo, Kisangani)

The research has been done on "Flow of bushmeat on fluvial ports markets of Kisangani town" from December 2014 to may 2015. The aim of this study is to generate the database on the flow level of bushmeat through the river-port markets of the city of Kisangani. We surveyed 4097 game carcasses (in 5 orders, 8 families and 16 species) by using interview, counting and weighing methods to the sellers.

The most exploited animals are Artiodactyla (42.03%) whose species Cephalophus dorsalis and Cephalophus monticola are abundant, rodents (32%) with the species and Cricetomys emini, Atherurus africanus and then comes the Primates (19%) whose Cercopithecus sp species Cercopithecus ascanius. Carcasses are more salt on smokes state of 98, 02% than flames state 1,8%.

The main roads feed the fluvial port of Kisangani markets are:

At Djubudjuba market : Kisangani-Lileko (45%) and Kisangani- Mongadjo (25%) are two main roads who provides bushmeat.

At IAT market : busmeats provided at Kisangani- Basoko (78, 35%) and Kisangani- Ubundu (20, 65%) are main roads.

The bats game are only provided from Maele (38,07%) and Mafi (31,72%) isalands at Kikongo market.

The prices of all bushmeat species are not constant over the three river-port markets (IAT, Djubudjuba and on the fluvial-port markets) in Kisangani. The average price of the game increases from one month to the other and depending on the species and their stock. Except the bat that is constant throughout the period of our survey- river port market Kikongo.

ZOONOTIC DISEASES

Huyse, T.

Poster

Dam constructions and disease outbreak: the case of human and veterinary schistosomiasis in Senegal

The construction of two dams in the Senegal River Basin in the mid '80s resulted in one of the most severe epidemics of intestinal schistosomiasis ever described. The Diama dam on the Senegal River was constructed in 1985 to prevent saltwater intrusion from to sea, in order to facilitate agriculture and increase the production of rice and sugar cane. The subsequent ecological changes favored the spread of freshwater snails, which act as an intermediate host for schistosome parasites. These are the causative agents of schistosomiasis, a neglected tropical disease that affects over 200 million people worldwide, especially young children in poor rural areas. The presence of these snails, in combination with immigration of agricultural workers from neighboring areas where schistosomiasis was endemic, resulted in successful introduction of *Schistosoma mansoni*, which was previously not present in the Senegal River Basin. This led to one of the biggest epidemics of intestinal

schistosomiasis worldwide. Using molecular markers we aimed to reconstruct the colonization history of these parasites in a spatiotemporal framework. The observed high genetic diversity of the parasite populations demonstrate how anthropogenic environmental changes may lead to genetically diverse parasite populations in a short time frame, allowing them to quickly adapt to their new environment.

The creation of open permanent water bodies and irrigation canals increased human water contact through agriculture & recreation, but also created more sites commonly used by livestock & humans. This might have created the necessary conditions for hybridization event to occur. Indeed, subsequent molecular studies demonstrated the presence of a new hybrid schistosome species in this area being a cross between *S. haematobium* and *S. bovis*. The latter species infects livestock while the former species is only found in humans.

ZOONOTIC DISEASES

Vanwambeke SO, Hartemink N., Purse B.V., Gilbert M., Van Dyck H.	Poster
Assessing human risk of infection with functional ecology	
Environmental and epidemiological data that can feed into ever more elaborated quantitative models of the association between environmental factors and the risk of infection by vector-borne and zoonotic disease are booming. We explore two issues associated to this context and propose ideas drawn from functional ecology. First, the profusion of results, that are sometimes contradictory, suggests that an organism-centered approach, in a perspective of functional ecology, would usefully support broad conceptual approaches such as Ecohealth and One Health. Focusing on the pathogen as the organism of study, elements of humans (as an ecological resource for the vector or the pathogen), including in terms of land use and risk behavior, can be introduced in the conceptual approach. Second, the very diverse ways in which pathogens, vectors and hosts can use environmental resources need to be accommodated in environmental proxies used to represent them. We propose to explore these two ideas based on diverse concrete examples of zoonotic and vector-borne diseases and the environmental data and models used to represent them, with a view on how disease ecology, in the broad sense of the term, can make optimal use of the potential of current data and models.	

CROSS-POLLINATING AGRO-ECO-HUMAN HEALTH PERSPECTIVES

Katrien van 't Hooft, B.M.R. Nair, G. Gebru, E. Katushabe	Presentation
Practical Experiences With A One Health Approach In Dairy Farming: International Collaboration Towards Responsible Antibiotic Use And Improved Milk Quality	
Dairy farming is regarded as one of the ways to satisfy the growing demand for high-quality animal protein worldwide. Growing intensification of dairy production systems has also lead to increased use of antibiotics and other chemicals. This negatively affects food quality and the environment, while AMR (Anti Microbial Resistance) is rapidly becoming one of the main challenges for human and animal health. Since 2014 Dutch Farm Experience is collaborating with international partners on improving milk quality and responsible use of antibiotics in dairy farming. Organized as the international Natural Livestock Farming (NLF) network farmers, veterinarians and other experts are developing practical solutions, combining the expertise from four countries: India, the Netherlands, Ethiopia and Uganda. After two years of successful exchange programs the so-called NLF five-layered approach was developed: improved animal health practices, strategic use of local breeds, herbal medicine, milk quality control and extra payment to farmers for residue-free milk. Based on a One Health Approach a joint initiative was formulated for the coming years: 'Healthy Cows - Healthy Food - Healthy Environment: Developing the One-Health approach to reduce the use of antibiotics and other chemicals in dairy farming through the implementation of the Natural Livestock Farming five-layered strategy'.	

CROSS-POLLINATING AGRO-ECO-HUMAN HEALTH PERSPECTIVES

Tiago Santos, Catarina Marinho, Patrícia Poeta, Gilberto Igrejas	Poster
Battling antimicrobial resistance where it counts: an extended proteome research of 5 bacterial species	
Proteomics is the large-scale study of proteins and it is often considered the next step in the study of biological systems. Unlike the genome, the proteome is dynamic: it varies according to cell type and its functional state and the evaluation of protein profiles in response to various stress mechanisms, such as sensitivity to antibiotics or modifications related to antimicrobial resistance, which represents a valid and integrating approach for the development of new therapeutic strategies. Antimicrobial resistance presents a significant challenge to scientists in the field of infectious diseases. The identification of protein determinants for resistance not only provides biomarkers for resistance to a particular drug, but also aids in the understanding of the mechanisms of antibiotic function and resistance. The full knowledge of how antibiotics resistance evolves and is transmitted between potential hosts of different ecosystems takes on great importance. The Functional Genomics and Proteomics Unit, based at the University of Trás-os-Montes and Alto Douro (UTAD) in	Vila Real, Portugal, has recently completed 10 years of proteomic research related to antimicrobial resistance. During this time, 5 different bacterial species and 32 bacterial strains were studied, isolated from clinical and wildlife samples, 2770 protein spots were characterized, through 2-DE and MALDI-TOF MS, and 392 proteins identified by shotgun proteomics (LC-MS/MS). The group has accomplished the evaluation of ESBL-producing <i>Escherichia coli</i> strain protein profiles, proteome comparison of vancomycin-resistant <i>Enterococcus</i> spp. strains compared to the proteome of the same strain without antimicrobial stress, whole proteome analysis of quinolone-resistant <i>Salmonella</i> strains, a sub-proteome analysis of a methicillin-resistant <i>Staphylococcus aureus</i> strain and several other proteomic approaches which we intend to overview in this review. With the intention of connecting the dots between this large protein database and other antimicrobial resistance published results and determining a metabolic pathway which results in antimicrobial behavior.

CROSS-POLLINATING AGRO-ECO-HUMAN HEALTH PERSPECTIVES

Serge Morand	Poster
Antimicrobial resistance, zoonotic infectious diseases, pandemics: Why Southeast and East Asia?	
The recent emergence of a unique <i>mcr1</i> colistin-resistance gene in China in 2015, already detected few years ago in non-patients in rural areas of northern Laos and Thailand, followed by its dissemination in Europe by travelers, but also by global trade of meat and vegetables, raises questions, and among them: why East and Southeast Asia? Why the global emergence of antimicrobial resistance (AMR) occurs in similar socio-ecosystems than those of global emerging zoonotic diseases such as avian flu or swine flu? The outbreak of AMR, very similar to outbreaks of zoonotic diseases, is an ecological problem that results from both farming intensification and global trade. The level of farming intensification and the associated increasing number of animals raised are far beyond the ecological capacities of local ecosystems. Moreover, the farming intensification needs to convert more lands to animal feed crops	with increasing uses of fertilizers and pesticides on one hand, and overuse of antibiotics to face the diseases and stresses occasioned by crowded animals often in poor conditions, on the other hand. Although the farming intensification impacts the socio-ecosystems locally, the origins and purposes of the farming intensification is a consequence of the globalization. The control of AMR cannot be tackled independently by each country or even by regional political entities, but needs radical actions at both local and global levels. More specifically, we show how the rise of AMR is ecologically and locally contextualized but economically and politically disseminated worldwide. We advocate that the global emergence of AMR is a by-product direct consequence of the increasing fragility of our socio-ecosystems. To be able to tackle the AMR, we need to think in terms of ecology, evolution, animal welfare and socio-ecosystem resilience.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Lasse Ruokolainen	Presentation
Ilkka Hanski's legacy to allergy research: the environment- microbiota-health axis	
The incidence of inflammatory disorders—such as allergies, asthma, diabetes, obesity, etc.—is increasing rapidly in developed countries. This megatrend has been linked to alteration in diet and life-style, but also to reduced contact with the natural environment and its rich microbiota, especially in the soil. It is becoming clear that our microbiota plays an active role in the development of our immune system, and that environmental input of microbiota is instrumental, especially in early life. This suggests that there is a link between our living environment (and the way it is used), microbiota, and health, which is at the core of the biodiversity hypothesis of allergic disease. The existence of an environment-microbiota-health axis is supported by several observations and experimental results. Firstly, there is a clear signature of the living environment in the skin microbiota in children. This observation is corroborated by experimental evidence from mice, demonstrating an effect of the living environment on the composition of the microbiota.	Secondly, increased exposure to green environments tends to protect against atopic sensitization in children. Thirdly, both patient material and experimental data suggest that healthy individuals exhibit a robust balance between anti-inflammatory and TH1/TH2 gene expression, related to the composition of the skin microbiota. Furthermore, the living environment also translates, presumably via the microbiota, to different immunological profiles in mice. Together these findings lend support to the hypothesis that there is a potential link between our living environment, the composition of our microbiota, and our health. While the evidence for the environment-microbiota-health axis looks strong, causality is not easy to establish for humans. This is due to a temporal mismatch between the microbiota-mediated immune priming in early life and the realisation of atopic diseases several years after. This calls for long-term follow-up studies, considering microbial exposure, colonisation, and immune system development.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Jeroen Raes	Presentation
About normal variability of human intestinal microbiome: Towards population-level microbiome monitoring: the Flemish gut flora project	
Alterations in the gut microbiota have been linked to various pathologies, ranging from inflammatory bowel disease and diabetes to cancer. Although large numbers of clinical studies aiming at microbiome-based disease markers are currently being performed, our basic knowledge about the normal variability of the human intestinal microbiota and the factors that determine this still remain limited. Here, I will present a large-scale study of the gut microbiome variation in a geographically confined region (Flanders, Belgium).	cross-sectional study of microbiome variability in relation to health as well as parameters associated to microbiome composition is being performed. In this presentation, I will discuss our experiences in large-scale microbiome monitoring, show how the development of dedicated computational approaches can assist in microbiome analysis and interpretation, and first results coming out of this effort.
A cohort of >5000 individuals from the normal population is sampled for microbiome analysis and extensive metadata covering demographic, health- and lifestyle-related parameters is collected. Based on this cohort, a large-scale	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Hubert Plovier, Patrice Cani	Presentation
Cross-talks between gut microbiome & host physiology – Focus on metabolic diseases	
Obesity is associated with a cluster of metabolic alterations including a low-grade inflammation and gut barrier dysfunction. We and others have demonstrated that the gut microbiota contribute to the regulation of energy, glucose and lipid homeostasis. The mechanisms by which specific gut microbes control nutrients absorption and host biology in the context of obesity and associated disorders remain poorly understood. We and others have discovered that the gut microbiota contribute to metabolic inflammation, fat mass development and energy homeostasis via several mechanisms such as metabolic endotoxemia, changes in gut barrier function (e.g., antimicrobial peptides production, mucus layer thickness, immune system) or altered endocannabinoid system tone. We have also identified a novel bacterial	candidate, Akkermansia muciniphila, as putative therapeutic tool to target cardiometabolic risk factors. By using preclinical and clinical approaches, we found that this bacterium plays a major role upon obesity, diabetes and inflammation. Finally, our recent data and unpublished data showing microbiota-host interaction will be discussed in the context of obesity, diabetes and low-grade inflammation.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Maria-Carlotta Dao	Presentation
Gut microbiota and cardiometabolic disease risk	
Obesity is characterized by various compositional and functional changes in the gut microbiota. It has been shown through human and animal studies that gut microbiota may be involved in the development of cardiometabolic diseases associated with obesity. At the Institute of Cardiometabolism and Nutrition (ICAN) we are interested in studying the mechanisms linking gut microbiota, environmental patterns and health, with an emphasis on obesity and associated metabolic risks. In an effort to enhance the potential of obesity treatments, our aim is also to understand the impact of weight loss interventions on gut microbiota and determine how elements from environment and microbiota could be modified to optimize the response to such interventions. Within this framework, the European project	MetaCardis aims at investigating the role of gut microbiota in the progression from a healthy state to various stages of cardiometabolic disease in populations across Europe. The implications of these findings for patient care would include development of new approaches to reduce the burden of obesity, and discovery of markers and mechanisms that could be used in prevention and diagnostic of obesity-associated comorbidities.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Theofilos Poutahidis	Presentation
Gut bacteria & Carcinogenesis	
Early neoplastic lesions depend on their tissue environment in order to thrive and evolve. Consequently, the tumor environment has emerged as a tractable target to modulate cancer. The immune system status, the metabolic profile and the psychological condition of the host, which influence each other at the whole organism level, are the most important determinants of the tumor environment. The important question consequently arising is whether effective modalities that could modulate these determinants towards shaping an overall systemic non-tumor promoting status may exist. Accumulating evidence from gut microbiota research suggests this may be achievable. We now know that the effects of gut bacteria expand beyond the local boundaries of the gastrointestinal tract to include distant tissues and overall health. In a series of studies using mice we have shown that the prototype probiotic bacterium <i>L. reuteri</i> imparts an array of health benefits. The	probiotic has positive effects on the immune and hormonal profile of the host, including the downregulation of systemic inflammatory tone and upregulation of oxytocin. Interestingly, oxytocin has been shown to have favorable psychotropic properties. We find that mice consuming <i>L. reuteri</i> live longer and resist to diet-induced obesity and age-associated atrophic changes of skeletal muscle, testis and thyroid and thymus glands. They also have luxuriant fur coats and heal their skin wounds faster. Importantly they are resistant not only to intestinal but mammary gland, liver and lung cancers as well. Gut microbiota research points to novel strategies for the prevention and treatment of disease, including cancer. Gut bacteria could be used to activate powerful but latent health-promoting genetic programs, stemming from the co-evolution of mammals and their microbiome.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Gerard Clarke	Presentation
The Gut Microbiome & Brain function	
Bacterial colonisation of the gut plays a major role in postnatal development and maturation of key systems that have the capacity to influence central nervous system (CNS) programming and signalling, including the immune and endocrine systems. Individually, these systems have been implicated in the neurobiology of many CNS disorders and collectively they form an important bidirectional pathway of communication between the microbiota and the brain in health and disease. Regulation of the microbiome-brain-gut axis is essential for maintaining homeostasis, including that of the CNS. Moreover, there is now expanding evidence for the view that these gut microorganisms both respond to stress and are influential in determining stress responses. The evidence for this view is underpinned by studies in germ-free animals and in animals exposed to pathogenic bacterial infections, probiotic agents or	antibiotics. Collectively, these studies indicate a role for the gut microbiota in the expression of stress-related behaviours relevant to depression, cognition and pain. Many fundamental aspects of brain function, including myelination, microglial activation states and dendritic morphology may also be regulated to some extent by the gut microbiome. Understanding the neurobiological mechanisms underpinning the control exerted by the gut microbiota on brain function and behaviour has become a key research priority. Microbial regulation of tryptophan metabolism has become a focal point in this regard. Efforts to develop this knowledge will markedly increase our understanding of how the gut microbiome shapes brain and behaviour and provide new insights towards successful translation of microbiome-gut-brain axis research from bench to bedside.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Xavier Stephenne	Presentation
Fecal transplantation and multi-resistant germs (1)	
The multi-antibiotic resistance in intestinal bacteria of hospitalized patients is a public health problem, affecting both adult and pediatric populations. We wish decolonize the intestine of holders individuals (adult and pediatric except neonatal period) of multi-resistant bacteria, intestinal flora via fecal microbiota transplantation. Porting multi-antibiotic resistant germs predisposes to infections with multi-resistant bacteria and lead to prolonged hospitalization, in quota, more expensive, and burdened with greater morbidity and even mortality. At present, antibiotics very broad spectrum or combination of antibiotics should be used for the treatment of these patients, exposing them to germs increasingly resistant. Indeed, multi-resistant germs can share their resistance genes to other bacteria, increasing the likelihood of infection	and stabilizing resistant strains in the commensal flora, making it more difficult to decontaminate. Some infections caused by multi-resistant bacteria could no longer be treated by conventional antibiotic. Fecal transplant from a healthy donor should help eradicate porting intestinal germs resistant to antibiotics. Fecal transplantation is recognized and used in the treatment of Clostridium difficile colitis in case of treatment failure with antibiotics. As recommended by the Supreme Council of Health (No. 9202), fecal transplantation should be considered as human body material transplant. This implies that these intestinal flora transplants should be performed from a central bank of fecal material. This will offer quality and security guarantees in the selection and monitoring of donor and recipient. The intestinal microbiota can alter multiple biological parameters

ENVIRONMENTAL AND INTERNAL MICROBIOME

Xavier Stephenne	Presentation
Fecal transplantation and multi-resistant germs (2)	
including insulin resistance and predisposition to obesity, it is important therefore to identify the donors or super donors, who will give the recipient a maximum metabolic advantage but also reduce the risk of transmission of diseases. We want to offer a clinical study investigating the benefits of a healthy intestinal flora transplant to change the porting of multi-resistant intestinal bacteria in pediatric and adult population. It will be a, prospective, multicenter and randomized study with control group. This implies : -The identification of fecal flora donors meeting the diverse security criteria (infectious, immune, ...), free of communicable disease. -Biological, bacteriological and genetic testing both on the donor stool and in the blood will be made in particular to obtain a signature of the graft necessary for monitoring of the	recipient. -The creation of a fecal material bank offering guarantees of quality and safety. Freezing faecal material will be supported initially. -The development of a screening of multi-resistant germs in hospitalized or not individuals.. Moreover, previous hospitalization in a foreign country where the prevalence of multi-resistant pathogens is increasing, is another major porting risk of multi-resistant germs. It was also reported that travelers in countries with high prevalence of multi-resistant organisms are at risk of multi-resistant germs porting, increased risk if they have received antibiotics through a traveler's diarrhea. -The development of clinical monitoring, biological (blood and stool) and microbiological testing of patients over a long period to assess the safety and efficacy of the intervention.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Gabriele Berg	Presentation
The impact of microbial diversity of plants for health	
The plant microbiome is a key determinant of plant health and productivity. The microbiomes associated with plants form tight networks, which revealed strong species and niche specialization. Analyzing microbiome networks from healthy and diseased plants led to the identification of health indicators and pathogen-supporting microorganisms as well. This approach thus serves to open new opportunities for future targeted biocontrol studies and could fuel progress in sustainable agriculture, such as the development of microbial inoculants as biofertilizers, biocontrol, or stress protection products. The plant microbiome has not only an impact on plant health, it also influences the human microbiome, e.g. by raw-eaten fruits, vegetables and herbs. Moreover, it can have a positive impact on the microbiome of our built environment. Taken together, plant microbial networks are powerful networks with an impact on ecohealth.	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Gilles Kergourlay, Mathieu Gand, Sabrina Labrozzi, Assia Tahiri, Bernard Taminiau & Georges Daube	Presentation
FLORPRO project: Selection of beneficial bacteria from chilled foodstuffs to protect them from bacterial spoilage and increase their shelf life	
Microbial food spoilage is a major issue in the food industry. It has been estimated to be responsible for 25 % of the world's food supply losses. Meanwhile, the desire of industrials to reduce the use of preservatives in their food preparation is becoming stronger. In this context the FLORPRO project was developed in partnership with Belgian food industrial partners. The original approach is to study, select and promote beneficial bacterial flora from chilled food products in order to protect them from spoilage and increase their shelf life. A wide range of food products has been selected for this project: fresh and cooked meat, pasta, cheese, and prepared dishes. The strategy implemented was, first, to characterise microbiota of different batches of naturally contaminated food products and to monitor the development of the main species using a 16S rDNA metagenetic approach. Then, we isolated potential bio-preservative species from these products according to bibliography and their abilities to grow at the required temperature gradient standing for consumer's fridge. During challenge-tests in our pilot plant, selected strains were, then, inoculated in naturally contaminated food products and their impact on the organoleptic quality were assessed with sensory and biochemical analysis. The dynamic of these strains in the microbial ecosystem and, especially, their impact on spoilers was evaluated with metagenetic analysis. Finally, some biopreserved food products showed a better sensory evaluation than those naturally contaminated at the end of the shelf life. The potential of these strains as biopreservative was confirmed with the implementation of challenge-test in real processing conditions on the production line of the industrial partners and complemented in pilot plant with antagonist activity tests of these strains against food pathogens.	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Kathleen D' Hondt	Presentation
Policy messages from the workshop on "The Microbiome Diet & Health: Assessing Gaps in Science & Innovation"	
The OECD Working Party on Biotechnology, Nanotechnology, and Converging Technologies and the Department of Economy, Science and Innovation of the Flemish Government of Belgium jointly organised an international workshop on 'The Microbiome, Diet and Health: Assessing Gaps in Science and Innovation'. Only since access to omics technologies, combined with integrative systems approaches, it became within reach to understand how a complex system like the gut microbiota is functioning as an organ as part of the body. Understanding the interaction between diet, gut flora composition and health, will not only have a positive effect on health and wellbeing, but also on the healthcare economic, while offering significant opportunities to pharma and food industries. To further develop this field and grasp the opportunities offered, there is a need for supporting policy measures. The workshop gave an overview of current developments related to gut microbiome and the potential of dietary interventions targeting the microbiome. Experts from academic environment, industries and regulatory institutions discussed on policy gaps and needs to build on the new insights generated. An overview of the workshop goals and outcome will be presented.	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Emilie Macke, Martijn Callens, Luc De Meester, Koenraad Muylaert and Ellen Decaestecker	Presentation
Genotype-dependent gut microbiota drives zooplankton resistance to toxic cyanobacteria	
Eutrophication and climate change have caused a widespread occurrence of cyanobacterial harmful algal blooms (cyanoHABs) in lakes, ponds and reservoirs worldwide. Due to the release of powerful toxins in the water, CyanoHABs pose severe threats on livestock and human health, causing diseases from gastrointestinal symptoms to liver cancer. In aquatic ecosystems, cyanoHABs have a strong negative impact on zooplankton grazers, and through the food web, disrupt the whole freshwater community. Deciphering the mechanisms underlying resistance to toxic cyanobacteria in these grazers is thus essential to predict how cyanoHABs can be prevented or controlled. In the freshwater crustacean <i>Daphnia</i>, resistance is influenced by prior exposure to cyanobacteria and genotype, but the underlying mechanisms remain unclear. Through gut microbiota transplants, we here show that the gut microbiota plays a crucial role, and might mediate both genetic adaptation and acclimatization to cyanoHABs. Next generation sequencing of 16S rDNA shows that resistance is associated with changes in microbiota structure: cyanobacterial exposure favored bacterial taxa involved in digestion of cyanobacterial cells and detoxification of cyanobacterial toxins. Our results provide evidence that resistance to toxic cyanobacteria in <i>Daphnia</i> is driven by the gut microbiota, which might thus be an important mediator of the genetic mosaic of coevolution between toxic cyanobacteria and their grazers, and a key determinant of how freshwater ecosystems respond to climate warming.	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Eeva Furman	Presentation
The biodiversity hypothesis: how to operationalize it? (1)	
In the biodiversity hypothesis two megatrends are expected to be linked: the loss of biodiversity and the increase of allergies. The reason for this is that, due to changes in our living environments and lifestyles, we have less contact with nature. Natural environments hold rich microbiota, which again support the development of our immunological tolerance and protect humans from inflammatory illnesses, as heard by the other speakers. What are the contacts that we need to gain a healthy microbiota? Based on studies by Hanski and Haahtela, we know that agricultural and forest environments as well as natural waters are suitable environments to live in. But the story starts already earlier: we gain a rich microbiota from our mothers when entering to this world in vaginal delivery. In addition, close connection to other humans and animals are situations where our body is able to gain healthy microbiota. The loss of biodiversity and the increase of inflammatory illnesses are major societal challenges. Both of them have serious economic, social and cultural consequences, both in short and long term perspective. Therefore, we need solutions to tackle both of them. And as both of the problems are highly complex, we need holistic solutions. We need to ensure that viable natural ecosystems are maintained and new are generated globally. However, we also need to ensure viability of socio-ecological systems, systems where humans and ecosystems are physically in close contact. This requires a transition towards nature based solutions. They include 1) vaginal delivery, 2) breastfeeding and keeping the child against another	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Eeva Furman	Presentation
The biodiversity hypothesis: how to operationalize it? (2)	
individual's body, 3) connection with animals that act as vectors between natural environment and humans, 4) a living environment which holds nature in the form of housing, daycares, schools, hospitals - land use planning as a whole - including green and blue infrastructure wisely in the urban form is important. However, it has been shown that structures alone do not necessarily foster the nature contact. We need also rules and routines at schools, daycares and homes for spending time in nature and for cultivating vegetables and fruits. Nudging is one way to facilitate the routines to evolve. One way of nudging is to make nature activities more attractive to the group at stake. Involving children to plan the activities is one way to do this. The popularity of the PokemonGo-game showed that experts are not necessarily the right people to identify which places are going to be the most attractive and most visited nature surroundings in the future. Finally, we need to understand that although there is clear evidence of the link between environmental microbiota and human health, the complexity and non-linearity urges us to take a broader approach and focus on nature and human health in general. Nature fosters human health through many ways. E.g. well-planned green and blue infrastructure inspires us to do physical exercise, releases stress, enhances self-confidence, activates memory and allows emotional sensitivity.	

ENVIRONMENTAL AND INTERNAL MICROBIOME

Alfonso Benítez-Páez, Yolanda Sanz	Poster
MyNewGut Project: Microbiome Influence on Energy Balance and Brain Development-Function Put into Action to Tackle Diet-related Diseases and Behaviour	
The MyNewGut Project, which receives funding from the European Union's Seventh Framework Programme, will research the composite lifestyle factors that influence the human gut microbiota and its genome (microbiome) and their impact on diet-related disorders, such as obesity and the associated co-morbidities. One of the specific objectives of the project is to progress in the identification of the consortium of bacteria and pathways involved in nutrient metabolism and, thereby, in energy balance in humans. The role of the microbiota in the breakdown of indigestible carbohydrates is the best characterized to date but controversy exists about the physiological consequences of their fermentation and the specific role of the generated products (e.g. short-chain fatty acids). Gut microbiota is also likely to participate in the catabolism of peptides and amino acids and in the utilization of ammonium for amino acid biosynthesis. The gut microbiota could also participate indirectly in lipid metabolism by interfering with the enterohepatic circulation of bile acids and directly by utilizing dietary fat that escapes digestion as reflected in metagenomics studies. Nevertheless, the understanding of the role of the microbiota in protein and lipid metabolism and their physiological consequences is by far more limited. Moreover, in last years gut microbiota has been characterized to contribute to modulate the Central Nervous System through production of neurotransmitters that seems to pivotal a role in the Gut-Brain axis to attenuate stress and its physiological side-effects. To progress in the understanding of diet-gut microbiota interactions, we will develop a multidisciplinary research approach, using functional omics-technologies and systems biology, in well-controlled human trials. This information will be used to develop microbiome-based dietary recommendations and interventions to ultimately reduce the socioeconomic burden of diet-related disorders in the EU.	

Benítez-Páez A., Brigidi P., Dinan, T., Hingstrup, L., Blachier, F., Delzenne, N., Haller, D., Roeseleers, G., Nieuwdorp, M., Schmitz, G., Claus, S., Holzer, P., Ahrens, W., Campoy, C., Ilie, N., Fernandez, L., McKenna, B., Pons, R., Bosscher, D., Carnevali, P., Tompkins, T., Terroba, D., Roper, J., Loman, S., Memisi, N., Lockett, T., Petrosino, J., Lin, N., Murphy, R., Petrof, E., Sanz, Y.

ENVIRONMENTAL AND INTERNAL MICROBIOME

Sébastien Massart	Poster
Insights gained from metagenomic sequencing of apple fruit surface	
Plant microbial communities (microbiota) living at the surface of fruit have been the source of the majority of biocontrol agents (BCAs). Despite this interest, their role as a community has been poorly studied so far. They holistic study was an unattainable objective due to the absence of techniques to survey microbial communities and their evolution. The recent developments in high-throughput sequencing (HTS) have now enabled the holistic analysis of the microbiota genomes. A pioneering assay has been carried out to get insight into the microbiota of apple surface through metagenome sequencing. Apple from Pinova cultivar have been sampled in orchard and the microbiota isolated. After DNA extraction, the HTS assay generated 14.5 Gbases which were assembled in 133,888 contigs. These contigs provided useful information on taxonomic composition of the microbiota. A total of 1398 bacterial species and 397 Fungal species have been identified. Among them, 26 species corresponded to known plant pathogens. In addition, several contigs were assigned to species or genus of known BCA strains. In any case, these results underline a very diverse microbial community whose role needs to be characterized. In this line, the functional analysis (gene function determination) of the contigs is ongoing.	

NATURE HEALTH BENEFITS

ten Brink P., Mutafoğlu K., Schweitzer J-P., Kettunen M., Twigger-Ross C., Baker J., Kuipers Y., Emonts M., Tyrväinen L., Hujala T., and Ojala A.	Presentation
Health and Social Benefits of biodiversity and Nature Protection	
In an increasingly urban Europe with an aging population, health and wellbeing is a rising priority. Citizens face multiple challenges – air pollution and noise from traffic, heat stress through heat island effects and climate change, sedentary lifestyles, a lack social integration and cohesion. Investing in nature can contribute significantly to meeting these challenges. Scientific evidence and practical cases illustrate the multiple synergies that investment in nature can have for addressing health, social and cultural challenges, while contributing to economic objectives. Parks, green roofs and tree-lined streets are associated with contributing to cooling, addressing noise and air pollution, and making areas more appealing for exercise. Natura 2000 areas in and around cities and in rural areas are increasingly seen as types of "health-hubs" that attract direct health sector engagement	and help in both preventive health care and treatment. There remains significant untapped potential in European cities, in peri-urban areas and rural areas for investing in nature to contribute to health, social and economic objectives that also benefit biodiversity objectives. Improving awareness of the benefits and cost-effectiveness of nature based solutions to contemporary challenges, then integrating these into policy and investments are key steps to un-tapping the potential of nature and developing progressive, thriving, and resilient cities as well as viable, sustainable rural areas that support - directly and indirectly - both rural and urban communities. There is a need for the health-benefits of nature to be integrated into wider health strategies and plans that seek cost-effective, preventative and innovative solutions to our growing health challenges in Europe.

NATURE HEALTH BENEFITS

Sjerp de Vries	Presentation
Possible pathways linking nearby nature to human health and their relative importance	
An overview of a number of possible pathways linking nearby nature to human health and well-being will be given, more specifically improving air quality, stimulating physical activity and reducing stress. Based on empirical evidence, the relative strength of the different pathways will be assessed. Subsequently, the implications of the different pathways for which type of nature is likely to generate the most health benefits will be discussed. This has also implications for how to best assess (urban) green infrastructures with regard to their health benefits. Two types of accessibility metrics for contact with nature will be introduced: residential proximity based metrics and cumulative opportunity based ones. Empirical data regarding their validity will be reviewed.	

NATURE HEALTH BENEFITS

Peter van den Hazel, Hanneke Kruize	Presentation
Green and health in cities	
In general long term exposure to green space has a range of beneficial health effects including e.g. a reduction in premature mortality, cardiovascular disease and mental health problems in adults; a reduction in blood pressure in adults and pregnant women; a reduction in obesity and sedentary behaviour, an increase in birth weight, and improvement of cognitive function in children. Mixed results for asthma in children, depending on the type of green space were found. There are indications that the lower socio-economic groups seem to benefit more, and that surrounding greenness is more beneficial than access to green spaces further away. Also short term exposure to green space has beneficial effects including for example an improvement of mood and reduction of stress levels. Furthermore, it helps for physical rehabilitation after cardiovascular disease events. Spending more time in the natural environment is associated with higher mental health scores, higher frequency of social contacts and more physical exercise, but the extent of this association varies by country. The perception of the	natural environment is also important in the observed effects, and perceived quality characteristics of natural environments seem to influence restoration of stress. The exact role of amount and type of green space needed is still not fully clarified. However, the health determinants do show an association with use and perception of the natural environment. Based on these results, we recommend that policy makers and professional practitioners should encourage the presence of green space but broaden their approach about the recommended size of public green space. There is no validated norm or standard for the size of public green space. Instead, PHENOTYPE has formulated nine key variables of the characteristics of public green spaces that define their attractiveness. These key variables are: 1) Ownership; 2) Size and shape; 3) Biological characteristics; 4) Functional uses; 5) Localisation; 6) Management; 7) Community identity; 8) Climate/weather; 9) Nuisances. These variables were validated by stakeholders in both the public and private sectors in four European countries.

NATURE HEALTH BENEFITS

Patrick Van Damme	Presentation
Developing global medicinal plant markets: panacea or disaster?	
Worldwide people have been, are still and will continue to use medicinal plants to cure all types of human (and animal) diseases. Numerous plants have compounds of interest to the pharmaceutical industry. However, overexploitation/overharvesting from the wild, driven by 'promising' markets and prospects of quick benefits may alter and even annihilate the often precarious natural resource basis. Through a number of telling examples from the field (with an emphasis on perennials from the tropics), we will try to address/define strengths, weaknesses, opportunities and threats (SWOT) to developing medicinal plant markets. We will also highlight the respective roles of ethnobotany, correct plant characterisation (at botanical, but also biochemistry/compound level), plant ecology and vegetation studies, value chain development, and 'correct'	information provision to both policy, customer, and all stakeholders involved.

NATURE HEALTH BENEFITS

C. Shalukoma, P. Duez, J. Bigirimana, J. Bogaert, C. Stévigny, C. Pongombo, M.Visser	Presentation
Typology of healers in traditional medicine around the Kahuzi-Biega national Park, DR Congo	
Several ethnobotanical surveys have demonstrated links between the folk medicinal practices with ethnic and geographic identity of healers, while many others concluded the opposite. Given this contrast, the present study aimed to establish a categorization that could organize healers, treated pathologies and profiles of used medicinal plants based on their ethnic origin and area of practice. A secondary goal was to evaluate whether certain medicinal species could be in danger, especially those considered essential both for healers and for gorillas of the park. A total of 88 healers, recognized as ‘specialists’ in their communities, were involved in the study. Multivariate analyses showed that the ethnic belonging and geographical	
location did not explain practices and knowledge of healers. However, using the IndVal method, differences were observed in their degree of specialization. Non-specialized healers (70 %) could be distinguished from healers specialized in the care of bone traumatism and those specialized in reproductive organs (30 %). The Mantel correlation has shown a positive association ($r = 0.134$, $p < 0.05$) between the ‘healers-plants’ and ‘healers-diseases’ matrices. Forest species were the most collected (83 %), of which 47 % are also consumed by lowland gorillas. This indicates that healers who treat similar diseases often use similar herbs.	

NATURE HEALTH BENEFITS

Bakari Amuri, Meerts Pierre, Vandenput Sandrine, Okombe Victor, Ngoy Edouard, Ngoy Shutchu Mylor, Kahola Tabu Olivier, Kampemba Mujinga Florence, Nkulu Fyama Jules, Duez Pierre	Presentation
The project PhytoKat in Lubumbashi, D.R. Congo: conditions for the integration of traditional medicine in modern healthcare	
The D.R. Congo still faces multiple health problems. Notably the access to conventional medicine is limited; as in most Sub-Saharan countries, traditional medicine is the primary, and often the only, source of care for a majority of the population and the WHO advocates its recognition and modernization for primary health care. This pilot project aims to establish the necessary foundation for progress in this direction in Katanga: -The conditions for the introduction of traditional practices in modern medicine will be evaluated (quality of the practitioners and diagnostics; quality, efficiency, safety of treatments); -Many plants used in traditional medicine have already been documented in Katanga; certain traditional practices have been validated by the identification of active	
compounds. The project proposes to deepen the botanical, pharmacological, chemical and agronomic study of these interesting species; -In the context of regional erosion of plant diversity, excessive harvesting of some vulnerable medicinal species could represent a serious threat; developing a conservation strategy is urgent and requires an inventory of their current distribution. Through 5 doctoral theses in pharmacognosy, biomedical and agronomic sciences, the project will aim at correcting the weaknesses identified by the recent Joint Context Analysis, performed in R.D. Congo at DGD initiative, for the domain environment / natural resources: "Lack of information, knowledge and awareness among decision makers and local communities on the benefits of biodiversity-related development".	

NATURE HEALTH BENEFITS

Garnier, J. and Kock, R.	Presentation
One Health and Conservation Areas: Benefits of Gender Sensitive Approach	
The 2030 Agenda for Sustainable Development recognizes that human health and wellbeing depend on healthy ecosystems which provide the basis for sustainable development. Globally, ecosystems deteriorate and lose resilience from land and marine degradation and overexploitation, pollution, expansion of agriculture and human infrastructures. These changes are driven by rising human and domestic animal demographics and the prevailing political economy. Key One Health indicators include; anthropogenic climate change, declining species populations and what appears to be an increase in the emergence of novel diseases. Strategies for mitigating against biodiversity loss rely on establishing Protected Areas (PAs) which, in theory, cover 15.4% and 3.4% of the world's land and ocean area respectively. A consequence of this policy has been opportunity cost to adjacent communities where the most vulnerable are entangled into poverty cycles leading to further environmental degradation. By examining women's roles and responsibilities in managing resources at the human/animal/environment interface, we show how women and children are disproportionately affected by a wide range of health concerns. The underlying drivers of disease in these remote areas are complex, including political marginalisation, limited health care, poor housing, restricted access to natural resource and limited employment opportunities. People around PAs are often condemned to poverty with women and children bearing the brunt of these challenges. The supreme irony is that most of the ecosystem services of PAs were, at one time, indigenous communities natural right, but these now accrue to others and local people are left with only human and animal conflict. Not surprising therefore that one consequence is illegal killing of wildlife or at the least, tacit support for commercial poaching. With a case study from a developing country, we suggest that adopting a One Health and gender sensitive approach provides a new paradigm for successful conservation and sustainable development around PAs.	

NATURE HEALTH BENEFITS

Aerts, R., Van Orshoven, J., Dendoncker, N., Linard, C., Hendrickx, M., Van Nieuwenhuyse, A., Nawrot, T., Delcloo, A., Hamdi, R., Aerts, J.M., Somers, B.	Presentation
Assessing spatio-temporal relationships between respiratory health and biodiversity using individual wearable technology - the Respirit project	
There is growing evidence that changes in land use and vegetation composition - driven by climate change and human intervention - may increase the emission, dispersion and allergenicity of airborne allergenic pollen grains, prompting a further decline in the quality of life of allergy-sufferers as well as increasing socio-economic costs. Green spaces are generally assumed to have a negative effect on allergy-sufferers due to the higher pollen levels they emit. Yet, the role that plants and plant assemblages play in the complex interaction between pollen, environmental conditions and allergy symptoms, is still partly unknown and ambiguous. Although recent studies indicate that plant diversity might also have a mitigating effect on the prevalence of allergies and asthma as well as on the severity of its symptoms, quantitative evidence is still lacking. This study aims at exploring and understanding the spatial and temporal effects of plant diversity on allergic asthma and allergenic rhinitis. We will apply an innovative data assimilation approach in which the whereabouts and symptom severity of individual patients is continuously tracked using individual wearable technology (via smartphones, smartwatches) and linked to spatially explicit and regularly updated information on plant diversity, air quality, microclimate and pollen concentrations. The results of this project will not only provide new scientific insights into the complex spatio-temporal relationships between respiratory health and plant diversity, thereby pinpointing avenues for further investigation, but the results will also be exploited to identify possible strategies towards respiratory health mitigation and adaptation through plant diversity and for early spatially explicit warning of patients.	

NATURE HEALTH BENEFITS

Mariska Bauwelinck	Presentation
Green space – health GRESP-H project Belgium	
Living in green/blue areas is associated with better health. This may be due to low air/noise pollution, opportunities for physical activity, facilitation of social contacts, and/or promotion of recovery from fatigue and stress. Yet, socio-economic (SE) factors also explain inequalities in both health and access to green/blue spaces. The GRESP-HEALTH (Impact of green/blue spaces on specific morbidity and cause-specific mortality in Belgium) project intends to evaluate the associations between living in/close to a green or a blue area on morbidity and mortality in Belgium, at different stages of life (infancy to elderly). It assesses all-cause and cause-specific mortality, specific morbidities and perceived health and takes into account environmental pollutants and SE factors at different levels of spatial aggregation.	

NATURE HEALTH BENEFITS

Xianwen Chen	Presentation
Urban Nature's Health Effects and Monetary Valuation: A Systematic Review	
Extensive research has demonstrated that urban nature has positive effects to human health. However, the monetary values of these health effects have not been much studied. Through a systematic literature search, I find ten articles, of which four are peer-reviewed journal articles, one is a book chapter, whilst the rest five are grey literature. These articles are reviewed here. In the reviewed literature, large economic values have been estimated from urban nature's health effects. For example, Wolf et al. (2015) estimate an annual monetary value between US\$ 2.7 and 6.8 billion (2012 US\$), when accounting urban nature's health benefits to newborns, ADHD, high school performance, crime reduction, cardiovascular disease, and Alzheimer's disease. Nowak et al. (2014) estimate that urban trees in conterminous US generates a monetary value of US\$ 6.8 billion through its removal of air pollutants and the associated health effects. Great research efforts are required in future research. First, more research are required to estimate monetary values of other health effects from urban nature, for example, on depression and on obesity. Second, cases studies outside of the US, the UK, and South Korea are needed, as well as a global monetary estimate of urban nature's health effects. Third, more innovative research methods are required, particularly to identify the causal links between urban nature and its health effects. The health benefits and their monetary values of urban nature shall be considered together with other benefits of urban nature, including conventional non-market monetary values of urban nature. The ultimate goal is to provide a comprehensive and holistic valuation of urban nature.	

NATURE HEALTH BENEFITS

Timo Assmuth	Presentation
Multi-dimensional assessment of benefits and risks of nature to health – human and non-human	
Health benefits from nature are in focus also in new contexts, and are seen to offer great promise also as a generic therapy for ills of the EU and the globe. While the potential is undeniable, some of the takes on them have been narrow. To clarify the health benefits of nature, I scrutinize related key concepts and framings, including ontological, epistemic and political questions of whose and what health. Drawing on benefit-risk analyses, strategic evaluation, social scientific studies of health, and readings of OneHealth and EcoHealth concepts, I outline premises and opportunities for multi-dimensional assessment of health benefits from engagement with nature, using context-sensitive framing of health (human, non-human, ecological), of benefits (direct and indirect, tangible and intangible) and of risks (from humans and nature,	

NATURE HEALTH BENEFITS

Vitalija Povilaityte-Petri, Pierre Duez	Poster
Sustainable use of medicinal plants and their products	
In our days when the society's afflictions have shifted from infectious to chronic diseases, health is understood in a broader way: not simply the absence of disease, but as a total state of physical, mental and social well-being. When public health moves towards salutogenic practices, the nature and exposure to it is more often seen as a very important determinant of health. With increasing empowerment of the patients and implementation of personalized medicine, herbal medicinal products in the form of raw materials, cosmetics, medical devices, herbal medicines and botanical food supplements are often used for well-being and self-medication purposes which bring new challenges. Public awareness process carried out by the professionals is necessary to assure safe, sustainable and rational use of herbal products at the same time protecting genetic resources and biodiversity of medicinal plants.	

NATURE HEALTH BENEFITS

Daniela Penafiel, Celine Termote, Ramon Espinel, Patrick Van Damme	Poster
Traditional Foods in Guasaganda- Ecuador, Counting To The Nutrition Indicator for Biodiversity	
Forest foods supply people with a number of foods which contribute to dietary diversification The aim of this study is to list foods, from plant and animal origin, which are found in the forest-food system of Sacha Wiwua and quantify its consumption A combination of 3 methodologies were used. Two qualitative: an inventory of plant foods collected in the Sacha Wiwua forest and surrounding agricultural land, and interviews on animal foods that belong to the forest-food system. A quantitative food intake study of 427 food intake records was also conducted. Four categories of foods were documented: traditional foods found in the forest, purchased raw foods not found in the forests, commercial foods processes by industry, and traditional plant foods with medicinal use. A large number of traditional foods (127) were available for consumption during the rainy season of 2011, but there were also 33 purchased/processes foods. The consumption of fruits and vegetables reached its recommendation for a healthy diet. Traditional fruits were highly eaten whereas traditional vegetables were less consumed. Starchy foods were mainly purchased. Protein consumption reached the recommendations for health but ruminant intake may be not good for the environment. Bush meat is consumed rarely. There is a traditional consumption of medicinal plants which intake is not jet replaced by industrialized products. The diet of indigenous woman in Guasaganda, Ecuador is mainly based on traditional foods and meets recommendations. Poverty hampers, however, the financial access to vegetables and carbohydrates. Further research on the nutrient contribution of local foods needs to be done to assess nutrient adequacy of the diet.	

NATURE HEALTH BENEFITS

Raf Aerts	Poster
Cumulative alpha diversity dose CADD as an integrated measure of human exposure to biodiversity	
There is growing evidence that human health and human well-being are enhanced by exposure to nature and that levels of biodiversity in green spaces determine the magnitude of this positive effect. However, biodiversity quantified as observed or expected species richness is a property of the green space and it does not necessarily reflect the biodiversity perceived by the green space user. Nevertheless, perceived biodiversity has been demonstrated to be a more appropriate measure for exposure to nature, in particular in relation to mental health and psychological well-being. We argue that perceived biodiversity is determined by probabilities to encounter species, and that these probabilities are primarily determined by the expected biodiversity but also by the time spent and the distance covered in the green space. We propose the cumulative alpha diversity dose, CADD, expressed in species-hours, as a measure for human exposure to biodiversity. As the CADD objectively integrates biodiversity over space and time, we expect that it is a more robust predictor for perceived biodiversity than perceived biodiversity quantified through questionnaires and that it may therefore be a novel indicator suitable for use in biodiversity dose-human health response studies that aim to broaden the evidence base for the benefits of biodiversity on human health and well-being.	

NATURE HEALTH BENEFITS

Marianne Schlessler	Poster
Biodiversity 2020, Update of Belgium's National Strategy	
"Biodiversity 2020, Update of Belgium's National Strategy (NBS)" has been developed as a direct response to Article 6 of the Convention on Biological Diversity. It was adopted on 13 November 2013 by the Interministerial Conference for the Environment, which is composed of the competent ministers of the Federal Government and the three Regions of Belgium (Flanders, Brussels, Wallonia). This strategy is the only national framework instrument for the conservation, and sustainable and equitable use of biodiversity, in Belgium and abroad. The Strategy spells out a range of priority objectives to anticipate, prevent and reduce the causes of biodiversity loss in Belgium. It offers a framework for the policy to follow and for the subsequent implementing actions to be developed.	

NATURE HEALTH BENEFITS

Bianca Ambrose-Oji, Liz O'Brien, Jack Forster, Tom Conolly	Poster
Wild horticulture can promote wellbeing and facilitate conservation learning and education	
We report on an investigation into the impacts of the learning opportunities afforded by the act of transforming local spaces with native wild plants, actions brought about by Royal Botanic Gardens Kew's Grow Wild programme in the United Kingdom. We concentrate on outcomes for young people aged between 12-25 described as disadvantaged, and disengaged with nature. Qualitative data from six case studies identifies wellbeing impacts associated with different learning approaches. Results show wild flower growing or "wild horticulture" can increase connection to place, locality and community through formal educational interactions in schools and skills development and learning outside schools.	

EVALUATION AND CHALLENGES/
LIMITATIONS OF ONE HEALTH

Simon Ruegg	Presentation
NEOH evaluation framework, evaluating One Healthness	
One Health (OH) positions health professionals as agents for change and provides a platform to manage determinants of health that are often not comprehensively captured in medicine or public health alone. OH relies on characteristic operational principles, corresponding infrastructure and is expected to produce outcomes, which are not possible to obtain through intra-sectoral approaches. The COST-funded Action TD1404 "Network for Evaluation of One Health" (http://neoh.onehealthglobal.net/) elaborated an evaluation framework, assessing the operation and infrastructure in a One Health Index (OHI), and finally comparing this index to the outcomes of the initiative. The One Health Index is based on five aspects, namely 1) the comprehensiveness of the approach, 2) the planning, 3) the learning infrastructure, 4) the sharing infrastructure, and 5) transdisciplinarity and leadership. The expected outcomes of One Health initiatives are health and welfare of humans, animals, plants and ecosystems. Transdisciplinarity should result in better stewardship and compliance, and promote interspecies equity. One Health can also improve effectiveness across different sectors and at multiple scales. Overall, One Health is expected to result in long-term effects of policy decisions, resilience at various scales, food and feed security, and ultimately sustainable lifestyles. Confronting the OHI to these outcomes is a way to identify the conditions required to produce them and determine when such holistic approaches are appropriate.	

EVALUATION AND CHALLENGES/
LIMITATIONS OF ONE HEALTH

Sara Savic	Presentation
Preliminary results from a set of case studies evaluating One Health	
The "Network for Evaluation of One Health (NEOH)" is an EU COST funded Action that aims to evaluate One Health initiatives (http://neoh.onehealthglobal.net/). Today, One Health is a frequently used term, but evidence on its added value is scarce. Therefore, to promote the development and use of methods and frameworks for improved One Health decision making, we need standardised methods, approaches and data to evaluate One Health activities. Participants of the NEOH Action are applying a handbook for evaluation of One Health developed within the consortium to assess a set of case studies in local institutions and networks. They use available primary and secondary data from ongoing One Health projects in which they are involved in for evaluation. A total of 12 case studies were selected. The criteria for choosing a case study for evaluation were the following: impact on humans, animals (and environment); relevance at the European level; interdisciplinarity and intersectorality; measurable benefits of One Health and - if it is a disease condition, it should be on the of priority list for Europe according to EFSA and the ECDC. For each case study, the different evaluation steps in the protocol are followed to describe and measure the evaluation context, One Health characteristics, the One Health index, and to select an appropriate evaluation question and approach. In terms of metrics for outcomes, the case studies take into consideration the ecological dimension, social dimensions, resilience and sustainability as well as economic considerations. The meta-analysis of all case study findings will give a clearer pictures of the added value of One Health.	

Abstract by Sara Savic, Barbara Häder, Daniele De Meneghini, Simon Ruegg, Asta Tveit, Ingrid Volden, Ana Claudia Coelho, Sandra C. Buttigieg, Azra Roshanum, Katerina Pavlou, Paulina Horta, Sara Savic, Gaby Langer, Sabina Seiler, Harald, Nicole Borei, Ute Christian Braae, Kévin Monarhy, Anais Leger, Maurizio Alagrande, Gaby Langer, Sabina Seiler, Harald, Nicole Borei, Ute Christian Braae.

EVALUATION AND CHALLENGES/ LIMITATIONS OF ONE HEALTH

Barry J. McMahon & Jeremy S. Gray	Presentation
The role of biodiversity in the ecology of zoonotic disease transmission	
There is an urgency to understand the dynamics of zoonotics since these are key emerging infectious diseases. Biodiversity loss has been labelled as an important cause in the emergence of zoonotic diseases. We look at examples to investigate the dilution effect. We discuss how the spatial scale, geographical variation and human influences on landscape dynamics must be considered in this discussion. While in certain circumstances biodiversity may buffer against zoonotic emergence the evidence for a universal panacea is weak and to promote this, while attractive, is not helpful. In order to appreciate the divers of zoonotic infections we need to understand the ecology underpinning the biological processes (e.g. pathogens, hosts, vectors, habitat	

EVALUATION AND CHALLENGES/ LIMITATIONS OF ONE HEALTH

Alain Vandermissen	Presentation
Historical developments of the One Health Movement since 2005 - Drivers, Opportunities and Challenges -	
The involvement of the European Union (EU) in Health issues started as early as the 1960's, focusing initially on animal health. As a major international actor in the global response against the highly pathogenic influenza crisis from 2005 onwards, the EU joined forces with other key global actors, in particular the United States and the United Nations System. The EU championed the political choice to promote a One Health approach to crisis prevention and response, and more broadly, as an innovative way to boost collaborations and synergies in the interest of health security. Over the last 10 years, One Health became a global movement, with arrays of initiatives taking place on all continents. While One Health remains a great opportunity to handle health in a more effective way and to create new interdisciplinary	

health networks, challenges remain, including the risk that in some cases, One Health could be used as a slogan, without actual change of collaborative practices. The governance of the One Health movement remains unclear and it is somehow a paradox that One Health, at the same time, is an established reality, with an increasing number of supporters, but remains a fragile construction.

The author follows the historical timeline of the onset and development of the One Health movement, as a scene setter, while discussing in parallel the drivers of the movement, the opportunities it offers and the challenges that remain to be addressed to ensure the permanence of One Health.

EVALUATION AND CHALLENGES/ LIMITATIONS OF ONE HEALTH

Abbas Omaar	Presentation
Infectious Disease Risk Assessment and Management (IDRAM) Initiative	
Through the Infectious Disease Risk Assessment and Management (IDRAM) Initiative, Chatham House facilitates One Health related discussions between the extractive industry and international development actors, finance institutions, national governments and public health stakeholders. Stakeholders are encouraged to find a sense of common purpose and identify their roles and responsibilities in assessing, managing and tackling the risk of emerging infectious diseases (EIDs) through One Health approaches. Chatham House facilitates this by developing tools, and generating evidence, to enable the extractive industry to better prepare for these events. IDRAM regularly runs simulation exercises that allow those working in the extractive sector to gain experience of the risks associated with EID outbreaks. These exercises illustrate how outbreaks can challenge business operations and how collaborative, multi-sector efforts	between national health systems and ministries of agriculture can create appropriate and successful response strategies. IDRAM has recently completed a qualitative study exploring the mining industry's understanding of One Health and the sector's perceptions around EID risk assessment and management. The study findings complement other EID preparedness self-assessment tools and industry standard guidelines that companies use to improve risk assessment. IDRAM also recently evaluated the economic impact of the West Africa Ebola outbreak on selected mining companies and is building an evidence base for investment in controlling and preventing EID outbreaks. The project also involves a study investigating the barriers and opportunities to develop integrated outbreak response plans between extractive companies and public health sectors.

EVALUATION AND CHALLENGES/ LIMITATIONS OF ONE HEALTH

Susan Welburn & Anna Okello	Poster
Possible pathways linking nearby nature to human health and their relative importance	
One Health offers a paradigm shift in our approach towards zoonotic diseases, and is essential to meet 21st century challenges arising from globalisation, climate change and population growth. It goes beyond comparative medicine to link animal and human health together with the ecosystems in which they live, focusing on the current and potential movements of zoonotic diseases among human, domestic animal and wildlife populations and recognising that human, animal and ecosystem health are inextricably linked. The intimate connectivity between animals, humans and the environment requires cooperation and collaboration between medical, veterinary, public health, environmental and ecosystem professionals. Closer collaboration between veterinary, medical and ecological disciplines for diagnosis, surveillance and control of zoonotic infections is a priority but this requires agreement on the political and	financial aspects of implementation of One Health. The practical challenge lies in the realisation of One Health, particularly but not exclusively in lower and middle income countries where ecosystem services are perceived to be most vulnerable and where transmission risks are heightened. The justification of cross-disciplinary collaborations and interdisciplinary interventions involving veterinary, medical, ecological and public health authorities is undisputed, given the complex nature of zoonotic disease control. However, the realities of combining even just animal and human health disciplines is complicated; progress to date has been slow. Support for global One Health interventions, policy frameworks and institutional collaboration is growing but roles and responsibilities need to be more clearly defined if One Health is to become effective in the long term.

EVALUATION AND CHALLENGES/ LIMITATIONS OF ONE HEALTH

De Meneghi D., Savic S., Chiesa F., Modry D., Mihalca A., Haesler B.	Poster
Preliminary results from an European survey on One Health collaborations in animal health, human health, environmental health in EU COST Member Countries, Associated and Near-Neighbor Countries.	
A survey on <i>One Health</i> (OH) collaboration in Animal, Human and Environmental health has been promoted under the initiatives of the COST Actions TD1404 "<i>Network of Evaluation of One Health-NEOH</i>" and TD1303 "<i>European Network for Neglected Vectors and Vector-Borne Infections - EURNEGVEC</i>". An online questionnaire was designed and being distributed (starting by early June, 2016) to collect information and data on the existence/implementation of OH actions/initiatives in EU COST Member Countries, Associated and Near-Neighbor Countries. The OH questionnaire is expected to be answered by key respondents representing all three OH components: Animal Health, Human Health/Public Health and Environmental Health. At least nine respondents per Country should answer the questionnaire, representing the following 3 main sub-sets of Institutions/stakeholders relevant for OH: i. public institutions/ministries; ii. academia/ research; iii. private sector/stakeholders.	Additional respondents from the civil society, NGOs, associations, scientific societies etc. involved in OH initiatives/activities are also asked to participate to the survey. The questionnaire is composed by six sections: 1. General Information (3 questions); 2. About "One Health" (10 questions); 3. Zoonotic diseases, environmental health and antimicrobial resistance: examples of "burning" OH issues and OH initiatives (6 questions); 4. Aspects limiting interdisciplinarity/ intersectorality in OH (2 questions); 5. Conclusions (6 questions); 6. End of questionnaire (comments/ remarks/suggestions). Besides collecting information on existing or planned OH initiatives in European and Near-Neighbor Countries, the questionnaire will also be used to gather similar data/ information from non-EU countries/ third countries.

SOCIAL SCIENCE, TRANSDISCIPLINARITY AND TRADITIONAL KNOWLEDGE SYSTEMS

Steven R. Belmain	Presentation
The role of social science in the One Health movement	
An overview of the contributions social science can and do make to One Health will be presented. An example on how social sciences were integrated within a large multidisciplinary European-funded research project on rodent zoonoses will be reviewed. The challenges and lessons learned from the RatZooMan project will be highlighted, and opportunities for integrating natural and social science expertise will be discussed.	

SOCIAL SCIENCE, TRANSDISCIPLINARITY AND TRADITIONAL KNOWLEDGE SYSTEMS

Melissa Parker	Presentation
Biosocial Anthropology and One Health	
There is increasing recognition and support for the development of inter-disciplinary research which focuses on the intersections of human, animal and environmental health. Reflecting on endeavours to develop a biosocial approach for the control of neglected tropical diseases in East Africa, this presentation delineates some of the theoretical, methodological and political challenges which lie ahead. In particular, it foregrounds the need to avoid simplistic framings of 'the social' and to recognise that it is often counter-productive to tacitly accept a hierarchy of knowledge in which minimal or partial attention is given to ethnographic and historical research. Instead, there is a need to develop critically-engaged, iterative approaches which give equal weight to the social, biological and environmental sciences.	

SOCIAL SCIENCE, TRANSDISCIPLINARITY AND TRADITIONAL KNOWLEDGE SYSTEMS

Séverine Thys	Presentation
Added value of anthropological studies in neglected zoonotic diseases control. Report of three case studies.	
While the 'One Health' paradigm recognises the importance of social and cultural factors in disease transmission dynamics and the planning of control interventions, the significance and potential role of applied anthropology for Neglected Zoonotic Diseases (NZDs) control remains unclear. Through three anthropological case studies, respectively assessing local knowledge and perception of rabies in the Mnisi community (Mpumalanga, South Africa), echinococcosis in the Amazigh population (High Atlas, Morocco) and cysticercosis - taeniasis in the Nsenga ethnic group (East Province, Zambia), the attempt is to reveal the complex relationships between different aspects of the social and biological world at the transmission dynamics level and therefore the potential contribution of applied anthropology for a more adapted and effective control of NZDs.	

SOCIAL SCIENCE, TRANSDISCIPLINARITY AND TRADITIONAL KNOWLEDGE SYSTEMS

Hans Keune	Presentation
Complexity and social scientific decision support in the field of environmental health and ecosystem services	
In order to make scientific information about complex challenges usable for decision makers, decision support systems can be helpful. I will present experiences with one of such methods, multi-criteria decision analysis (MCDA), from the field of environmental health. MCDA is a method that can simultaneously embrace, combine, and structure various types of often incommensurable diversity: diversity of information (e.g. qualitative and quantitative data, as well as uncertainty), diversity of opinions (among experts), diversity in actor perspectives (stakes) as well as diversity in assessment/decision-making criteria. Further I will sketch briefly how w this method is also considered in the field of ecosystem services.	

EDUCATION & CAPACITY BUILDING

Kaylee Myhre Errecaborde	Presentation
USAID One Health Workforce - Planning and Assessing the future One Health Workforce	
Planning and assessment for a One Health Workforce is complex. There is a lack of standardization across formal and informal sector specific and cross-sectoral training programs globally. Through the former USAID RESPOND project (2009-2014) and the first 2 years (2015-2016) of the USAID OHW project (2015-2019), a number of training programs and ad-hoc workforce planning activities have been developed and implemented around the One Health Core Competencies (OHCC) (Appendix 1). However, OHCC are broad in scope. It remains difficult to map competencies from individual trainings to meeting aggregate national workforce needs and to fully 'operationalize' a truly OH workforce. Moreover, most OH trainings are not uniformly calibrated and individual OH worker competency doesn't necessarily translate to	
operational ability to work across sectors in professional in-service roles. A question remains – what are the most essential One Health actions or capacities that allow for a worker and an aggregate workforce to be (1) technically proficient, (2) trained in OH and (3) able to situate in an enabling environment that allows for operationalization of OHCCs in the workforce? An over-arching goal for project workforce planning and assessment is to better understand what is truly essential for the future workforce beyond OHCC and to prioritize project efforts to ensure that all healthcare workers in OHW countries have access to the most relevant trainings and operational strengthening tools so they can operationalize OH in their professional careers.	

EDUCATION & CAPACITY BUILDING

Nikol Kmentová, Milan Gelnar, Monika Mendlová, Maarten Van Steenberghe, Stephan Koblmüller, Maarten P. M. Vanhove

Poster

Decline in parasite diversity promoted by lower host densities in Lake Tanganyika

Lake Tanganyika is a remarkable freshwater ecosystem characterised by high stability and a diversified fauna. Surprisingly, despite their high importance in ecosystems, parasites have been overlooked in most of the investigations but are getting more and more attention over the last years. A recent study revealed radiation events of monogenean parasites promoted by host speciation in the littoral zone. Monogeneans mainly occurring on freshwater and marine fishes and usually display strong host specificity related to their direct life cycle and long co-evolutionary processes. The main purpose of our study was testing diversity and speciation patterns of monogeneans infecting deepwater cichlids in the lake. In total, all eight representatives of the Bathybatini tribe were examined for monogenean infection. Morphological identification was based on parasite sclerotized structures.

Geomorphometrics provided a visualization of the complex shape variation as an additional view to classical morphometrics. Molecular analyses were performed by means of established markers with different rates of molecular evolution preparing a dataset for population genetic approaches. Apparently, six out of eight studied cichlids are infected by a single monogenean species called *Cichlidogyrus casuarinus*. Significant morphological intraspecific variation related to host preference. On the other hand, no differentiation on the genetic level was documented. Monogeneans therefore have not followed speciation events of their hosts indicating an adaptation to lower host densities in this type of habitat. Our results support the previous suggestion of a decrease of parasite host specificity in the deepwater zone and form the first observation of this pattern in a freshwater ecosystem.



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