Dr. Hugo Valdivia is the head of the Epidemiology Unit at the Department of Parasitology of the U.S. Naval Medical Research Unit No. 6 (NAMRU-6) in Lima, Peru. The unit conducts surveillance of parasites important for human disease with the ultimate goals of understanding changes in circulating populations, drug resistance, host-parasite interaction, species-specific adaptations and generate data that could contribute to disease prevention, better diagnostics and vaccine development. Dr. Valdivia earned his doctoral degree in Bioinformatics at the Federal University of Minas Gerais in Brazil where he got expertise in the areas of bioinformatics, comparative/population genomics and molecular biology with a focus on malaria and leishmaniasis. Currently, Dr. Valdivia leads surveillance activities of Malaria, Leishmaniasis and Chagas...
in Peru, Colombia, Brazil and Honduras with host country collaborators such as FioCruz in Rio de Janeiro and UFMG in Brazil. As part of these studies, clinical, laboratory and genomic data are collected and integrated to assess emergence of antimalarial resistance, identify circulating species, assess the dynamics of circulating parasite populations and identify risk factors in endemic regions. With each new research we have the hypothesis of new discoveries. Leishmaniasis is a disease with wide public health importance, occurring with great frequency in the Americas and in several parts of the world. Afflicting several people, due to the continuous increase in the diseases caused by the various species of Leishmania, the respective parasite of this disease (integumentary and visceral forms) and the different epidemiological situations encountered. The research carried out by Dr. Valdivia guarantees prophylactic means, identification of affected areas, more sensitive diagnostic methods and even the development of vaccines, causing the rates of the disease to drop significantly, especially in Latin America.

1. Could you tell us about your academic and research trajectory and which challenges you face when you conducted research in Brazil?

Dr. Hugo Valdivia: I studied biology at the Universidad de San Antonio Abad of Cusco in Peru. During those years, I became involved with a local leishmaniasis research group given that this disease is highly prevalent in Peru. I interacted with patients and learned about the epidemiology of this disease and the challenges that it poses in endemic regions. Towards the end of my studies in Cusco I got accepted for an internship at the U.S Naval Medical Research Unit 6 in Lima Peru which conducts research in the field of tropical medicine. As part of this internship, I supported projects related to malaria drug resistance and leishmaniasis epidemiology. One of these projects, which was focused on detection of natural Leishmania infection in sand flies became my undergraduate project. After this internship, I continued working at NAMRU-6 and started interacting with scientists from different institution. It is at this point when I met Dr. Daniella Castanheira Bartholomeu from the UFMG and started a collaboration that lead me to applying to the UFMG doctorate program on bioinformatics.
During my doctoral studies, I focused on employing bioinformatics to for a comparative genomics study of *Leishmania peruviana* and *Leishmania braziliensis* and population genetics of *Leishmania amazonensis* and *Leishmania infantum* from samples collected in Governador Valadares in Minas Gerais. During that time, I expanded my line of research towards malaria genomics with different collaborators from Peru, Brazil and abroad. After the PhD I returned to Peru and started working at NAMRU-6 again.

2. How has the research that you conducted in Brazil affected your development? Which lines of research are you currently conducting and which are their main goals?

Dr. Hugo Valdivia: I was new to the field of bioinformatics when I started studying in Brazil and the doctorate provided me the grounds and resources to continue my professional development on this field. I am currently conducting bioinformatics in the context of tropical parasitic disease surveillance for different objectives such as detecting emergence of antimalarial resistance, study the dynamics of deletions on HRP2/HRP3 genes in malaria or assess changes in circulating *Leishmania* parasite populations in endemic regions.

It is important to highlight that the experience of living in a different country can be enriching since it opens your horizons to a different culture, people, ideas and I am sure that this experience helped me to start thinking outside the box.

3. Across the different countries where you have conducted research, which one do you think that has provided you the best tools in terms of funding and infrastructure? What do you consider that could improve in terms of research in these countries?

Dr. Hugo Valdivia: Instead of naming specific countries, I would prefer to highlight major challenges that could apply to our region. Probably the first major limitation for conducting science is accessing to funding for doing research. Funding levels in our region tends to shrink rather than increase and there is a lot of competition for funds that most of the times are insufficient. The second challenge in some cases is the shortage of specialist in certain research fields. For instance, it was difficult for me to find bioinformaticians in Peru with background on parasitic diseases given that the field is very new in the country.
Therefore, we needed to create the capacities. Another challenge that is more general to countries in the region is related to different barriers that lead to delays for conducting research. For instance, lengthy customs clearance processes, lack of local vendors or lengthy importation times, among others. I think that all these barriers might be eventually overcome but it will demand time and changes in the way that science is valued in our region.

4. We saw that you had publications in the fields of leishmaniasis and malaria. Which are your thoughts about the future of these diseases?

Dr. Hugo Valdivia: Regarding malaria, the good news is that most countries in South America are doing great efforts towards malaria elimination. Unfortunately, several situations can threat progress achieved. For instance, the risk of emergence of resistance to antimalarials is very concerning as we have a history of drug resistance to previous antimalarias. Furthermore, resistance to current antimalarials is occurring in other endemic regions such as Southeast Asia.

In the case of Leishmaniasis, my expectations are not as clear. Leishmaniasis is a neglected disease in our region and especially for the tegumentary forms that are not necessarily severe. This result in very limited funding for research or surveillance, which is reflected on the several gaps regarding reservoirs, vectors and even parasite circulating species in many endemic regions. Furthermore, there is not much progress in terms of diagnostics and treatment, which is shown in the fact that most countries in the region continue to use antimonials for treating the disease.

5. In terms of leishmaniasis, what can you tell us about the differences between Peru and Brazil?

Dr. Hugo Valdivia: The major difference between Peru and Brazil is that visceral leishmaniasis is not endemic in Peru. This difference also implies that transmission in Peru occurs in rural areas when people became exposed as part of activities such as mining, logging or agriculture. In the case of Brazil, transmission is mixed as VL cases also occur in urban settings.

6. What is it known about leishmaniasis history and transmission in South America and which is the main mechanisms of transmission?

Dr. Hugo Valdivia: Leishmaniasis is transmitted through the bite of infected
phlebotomine sand flies. In Peru, there is pre-hispanic pottery from the Moche culture that seems to depict a typical case of mucosal leishmaniasis and added to other evidence it suggests that the disease was pre-existent in South America. Parasite dispersal across the regions could likely have occurred by reservoirs who spread the disease long before humans arrived.

7. In our opinion, which are the main challenges to control the leishmaniasis in Brazil and Peru?

Dr. Hugo Valdivia: I think that the major challenge in Peru and probably Brazil is that we are not focusing on the social determinants that puts people at a higher risk. Leishmaniasis has been associated with poverty and limited access to health care and other services. For instance, most cases in Peru come from regions where illegal mining, drug trafficking, illegal logging or agriculture are conducted. Usually, people go to these regions looking for a job or move to previous virgin rainforest where they became exposed. In the case of Brazil, there is the increasingly concerning urbanization of leishmaniasis which leads to hotspots of urban transmission. In these cases active surveillance and control is needed to mitigate the impact of the disease.

8. What suggestions would you give to someone that is just embarking on leishmaniasis research? Which are the main challenges in the field?

Dr. Hugo Valdivia: My suggestions for someone starting in the field is to engage with local research groups and be up to date with recent literature. Leishmaniasis is a very complex disease with many gaps on our knowledge and this makes the field very exciting because there are many question to address from basic to applied science. Funding on the field will be always a challenge, but there is a very solid leishmaniasis community that is easy to collaborate with.

9. Could you tell us about the ways to control the leishmaniasis and also prevent it?

Dr. Hugo Valdivia: As far as I know, the best way to prevent it is to limit exposure to the sand fly vector. This involves some measures when going or living in an endemic area such as using clothes that covers most of the skin, using insect repellent, spry indoors with insecticide, use bed nets and avoid going to the field or outdoors at dusk or dawn.
10. Which advices could you give our readers and students that may want to become researchers studying either abroad or within their country?

Dr. Hugo Valdivia: The first advice would be to always be open to collaborate and to not been afraid of reaching scientists working in other countries. Most people and groups are very eager to collaborate specially if there is common interest on a particular topic. The second advice is to break the language barrier, English is key since most scientific literature is on that language, but also other languages can be helpful. In my case, Portuguese has been important not only for my studies in Brazil but also to reach people and establish collaborations. Brazil has very strong groups and conducts high quality research on the field of tropical diseases and as such, I continue to work with Brazilian groups in surveillance of tropical diseases.

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