



Research Project Proposal
Academic year 2021-2022
Máster en Investigación Biomédica

Project Nº 41

Title: Emerging Infectious Diseases: Diagnostics/Therapeutics development and assay

Department/ Laboratory Laboratory where the project will be carried out indicating Department, Area, Faculty, CUN, CIMA etc.

ISTUN Instituto de Salud Tropical Universidad de Navarra; Departamento de Microbiología y Parasitología

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Summary:

Emerging and reemerging infectious diseases (EIDs) are increasing worldwide. Among them, vector-borne zoonotic diseases are major sources of mortality and morbidity. For example, Leishmaniasis is a group of diseases caused by protozoan parasites from the genus *Leishmania* transmitted by female sand flies. According to the World Health Organization (WHO) data, these infections are endemic in 98 countries worldwide, with more than 310 million people at risk (1). The clinical manifestations range from localized skin lesions to fatal visceral parasitemia. Currently, effective vaccine does not exist and treatments are largely unsuccessful, it is therefore urgent to identify new therapeutic targets and drug therapies. On the other hand, diagnostics include invasive tests and clinical manifestations studies, which are usually unspecific. The early diagnosis of asymptomatic cases remains a priority. This project aims to develop and test molecular diagnosis tools, to identify new therapeutic targets and treatments.

Molecular Diagnosis: The knowledge of the genome of several pathogens is facilitating the development of molecular diagnosis. Our research group focuses on improving diagnostics through the search, study and characterization of genes (2, 3) that can be used as diagnostic markers for early detection of infectious diseases, including leishmaniasis.

Therapeutic targets and new treatments: Our research team also analyzes genes and proteins involved in proliferation, differentiation and infectivity of pathogens. We study their expressions throughout the lifecycle of pathogenic microorganisms (4, 5), and their implication in mechanisms of differentiation and acquisition of infectivity. This molecular knowledge will allow us to understand the transmission and progression of infectious diseases, to characterize new therapeutic targets and to design new drugs for the treatment of infections (6).

To achieve our goals, we will apply a wide range of methods. In fact, the *Methodology will include* parasite culture; cell viability assays; *In vitro* infection of macrophages; cell stain; microscopy; and different Molecular techniques (: nucleic acids extraction from biological samples, conventional PCR, Restriction Fragment Length Polymorphism (RFLP), Real-time PCR).



REFERENCES:

1. Leishmaniasis. World Health Organization, (available at https://www.who.int/health-topics/leishmaniasis#tab=tab_1).
2. Fernández-Rubio C, Campbell D, Vacas A, Ibañez E, Moreno E, Espuelas S, Calvo A, Palop JA, Plano D, Sanmartin C, Nguewa PA. Leishmanicidal activities of novel methylseleno-imidocarbamates. *Antimicrob. Agents Chemother.* 59, 5705–5713 (2015).
3. Fernández-Rubio C, Larrea E, Peña Guerrero J, Sesma Herrero E, Gamboa I, Berrio C, Plano D, Amin S, Sharma AK, Nguewa PA. Leishmanicidal Activity of Isoselenocyanate Derivatives. *Antimicrob. Agents Chemother.* 63 (2019), doi:10.1128/AAC.00904-18.
4. Vacas A, Fernández-Rubio C, Algarabel M, Peña-Guerrero J, Larrea E, Rocha Formiga F, García-Sosa AT, Nguewa PA. The Novel Serine/Threonine Protein Kinase LmjF.22.0810 from *Leishmania major* may be Involved in the Resistance to Drugs such as Paromomycin. *Biomolecules.* 9 (2019), doi:10.3390/biom9110723.
5. Vacas A, Fernández-Rubio C, Larrea E, Peña-Guerrero J, Nguewa PA. LmjF.22.0810 from *Leishmania major* Modulates the Th2-Type Immune Response and Is Involved in Leishmaniasis Outcome. *Biomedicines.* 8 (2020), doi:10.3390/biomedicines8110452.
6. Peña-Guerrero J; Nguewa PA; García-Sosa Alfonso T. Machine learning, artificial intelligence, and data science breaking into drug design and neglected diseases. *WIREs Computational Molecular Science.* 04/01/2021. DOI: <https://doi.org/10.1002/wcms.1513>

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?

yes	
no	X