SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Cellular and Molecular Immunology (CMIM)

has the honour to invite you to the public defence of the PhD thesis of

Julie GOOSSENS

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

Development of a Nanobody-based rapid antigen test to detect active Trypanosoma infections in livestock

Promotor:

Prof. Dr. ir. Stefan Magez

The defence will take place on

Friday December 15 2017 at 16:00 h

in Auditorium D.2.01 at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. Dr. Daniel Charlier (chairman, VUB)
Prof. Dr. Luc Leyns (secretary, VUB)
Dr. ir. Inge Van Molle (VUB)
Prof. Dr. Guy Caljon (UA)
Dr. Philippe Holzmuller
(CIRAD, Montpellier, France)

Curriculum vitae

Julie Goossens obtained a Master of Biochemistry and Biotechnology at the University of Ghent (2013). She was granted an IWT PhD mandate to perform scientific research in the group of Structural and Functional Immunoparasitology at the CMIM lab. Her work resulted in two first-author publications in peer reviewed journals, 3 oral presentations and 1 poster presentation at national and international scientific conferences. She collaborated in a FWO bilateral project which included visits to the Institute of Parasitic Diseases (China) and obtained a NSE travel grant to conduct experiments in Clinvet (South-Africa). Mrs Goossens supervised 2 master thesis projects and guided 1 PhD student.

Abstract of the PhD research

Animal trypanosomosis is a general term for parasitic infections in domestic livestock caused by the hemoflagellates *Trypanosoma congolense*, *Trypanosoma vivax*, *Trypanosoma brucei* or *Trypanosoma evansi* and has a negative economic impact on agricultural development in many developing countries. Since vaccination strategies consistently fail, disease control relies solely on a combination of fly vector eradication and the use of drugs for prophylactic or curative therapy. Direct diagnosis of the host's blood is essential to confirm animals are suffering from a trypanosome infection and received an effective drug during treatment follow-up. Traditionally, microscopy is the preferred diagnostic method in the field but its sensitivity is often low and trained personnel is needed. A lateral flow assay (LFA), also known as immunochromatographic test, does not require technical expertise, electricity or instrumentation. As such it is a useful auxiliary tool at the point-of-care. Currently a commercial LFA is based on the detection of host antibodies against trypanosomes, but it does not lead to conclusive diagnosis due to the fact that antibodies circulate longtime after the infection has been cured or cleared naturally. A sandwich immunoassay that recognizes trypanosome antigen in the animal's blood is more favourable but is unavailable to date.

The main objective of this study was the generation of a rapid diagnostic test device (LFA) that can either be used as a screening tool or as a test-of-cure by local farmers and veterinarians to evaluate the trypanosome infection status on livestock in endemic and non-endemic areas.

We initiated a development pipeline for novel sandwich immunoassays for *T. congolense* and *T. evansi*. Hereby new diagnostic biomarkers were identified from the secreted proteins of the parasite and specific affinity proteins, called Nanobodies, were generated against the given trypanosome antigens. For the first time, we described in detail the incorporation of these Nanobodies as assay reagents into the LFA format. Several parameters were analyzed to ensure the analytical sensitivity of the detection system was improved. Ultimately a diagnostic LFA prototype was constructed to detect *T. congolense* in animal plasma which showed initial promising results as a screening test and test-of-cure in both mice and cattle studies.