

The Research Group  
**Amphibian Evolution Lab (AMFI)**

has the honor to invite you to the public defense of the PhD thesis of

**Severine MATTHIJS**

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

*Diversity and Evolution of Host-Defense Peptides in Frogs  
(Amphibia: Anura): a Phylogenomic Approach*

Promotor:

**Prof. dr. Kim Roelants**

The defense will take place on

**Thursday May 4 2017 at 16.00h**

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. Luc Leyns (chairman)  
Prof. Dr. Kim Roelants (secretary)  
Prof. Dr. Franky Bossuyt (co-promotor)  
Prof. Dr. Em. Jean-Pierre Hernalsteens  
Prof. Dr. ir. Eveline Peeters  
Prof. Dr. An Martel (Univ. Gent)  
Prof. Dr. J. Michael Conlon  
(Univ. of Ulster, UK)

**Curriculum vitae**

Severine Matthijs studied biology at the Vrije Universiteit Brussel. She was a researcher at the Royal Belgian Institute of Natural Sciences for three years before returning to the Vrije Universiteit Brussel. Severine started research on pheromones in frogs and newts as part of the ERC program TAPAS (Tracing Antimicrobial peptides and Pheromones in the Amphibian Skin) and continued to focus on host-defense peptides, mainly in frogs of the family Pipidae. The combination of transcriptome data, antimicrobial tests, genome screening and phylogenetic analyses led to interesting insights into the host defense system of frogs. She is co-author of seven papers in international peer reviewed journals.

**Abstract of the PhD research**

Host-defense peptides and proteins (HDPs) are considered a vital part of the innate immune system, protecting surfaces and tissues against a broad diversity of pathogenic microorganisms. Whereas some classes of vertebrate HDPs (vHDPs) are shared by lineages as diverse as teleost fishes and placental mammals, amphibian skin secretions contain unique HDPs (aHDPs) that represent a unique class of cytolytic peptides. I combined transcriptomic, genomic and phylogenetic analyses with functional tests to provide new insights in the diversity and evolution of the amphibian HDP arsenal.

First, through a transcriptome study of the pipid frog *Hymenochirus boettgeri*, several peptide and protein families were identified as candidate aHDPs and/or sex pheromones. Two new protein families were described, with domains unlike those in any other species. More detailed analyses revealed that this frog species secretes at least 15 aHDPs with surprisingly low structural variation. This pattern is in remarkable contrast to the broad aHDP diversity observed in other frogs, including closely related pipid genera, and may be explained by purifying selection, recent duplications or concerted gene evolution.

Besides newly evolved aHDPs, many amphibians may have also retained evolutionary ancient vHDPs. Using genome screening, I show that four of the major vHDP families are represented by a similar number of genes in the genome of the pipid frog *Silurana tropicalis* as in amniote genomes, indicating that amphibian-specific aHDPs did not make these ancient vHDPs redundant as their genes have been coexisting in the pipid genome for over 100 million years. However, the vHDP family of defensins, which has undergone considerable duplication in most amniotes, is only represented by few genes in amphibians. Additionally, I show that the defensin genes of *S. tropicalis* belong to two different gene lineages that diverged early in tetrapod evolution. A similar phylogenomic study led to the discovery in amphibians of an orthologue of S100A7, an HDP that was only known from mammals. Functional assays indicate that the cytolytic activity in this HDP evolved early in tetrapod evolution.