The Laboratory of Neurobiology focuses on the mechanisms of acute and chronic axonal and neuronal degeneration and regeneration, aiming to contribute to new therapeutic strategies for neurodegenerative disorders. The researchers study motor neuron diseases – such as amyotrophic lateral sclerosis (ALS) and hereditary motor neuropathies – alongside frontotemporal dementia (FTD) and stroke.

“We mimic aspects of amyotrophic lateral sclerosis (ALS) in various models to better understand the disease process. Insights into genetic ALS variants may also shed light on sporadic cases,” explains Professor Dr. Ludo Van Den Bosch, who leads the lab.

Professor Dr. Ludo Van Den Bosch. © Rob Stevens

Stem Cells

We use induced pluripotent stem cells (iPSCs) that are created by reprogramming skin cells from patients into stem cells. These can then be converted into motor neurons and muscle cells for our research,” says Van Den Bosch. “We work closely with the Stem Cell Institute Leuven (SCIL). The beauty of this approach is that we can study patient-specific cells in a controlled environment, creating human models in a culture dish.”

Research Subjects

Besides stem cells, the lab also uses fruit flies, zebrafish, and rodents to model the diseases and to study disease mechanisms. “Because we know the genetic causes of ALS, we can examine the effects of specific mutations in laboratory animals and identify what goes wrong. Our goal is to counteract these harmful effects on the motor system through targeted treatments,” Van Den Bosch explains. “Zebrafish are particularly useful, as they develop quickly and have transparent embryos, allowing us to observe motor neuron development effectively.”

Professor Van Den Bosch was work package leader in the FP7 project Euro-Motor, a partner in the Interuniversity Attraction Poles P7/16 of the Belgian Government, and participated in the European PhasAGE training initiative. He is also part of the ‘European

ALS consortium' and of the 'Robert Packard Center for ALS Research' (John's Hopkins University, Baltimore, USA). He is part of the program committee of the annual ENCALS meeting and is head of the discovery science program of the My name'5 Doddie Foundation (UK).

The Laboratory of Neurobiology-team. © Rob Stevens

Team

Van Den Bosch has been part of the lab since its founding by Wim Robberecht in 1996. "Back then, I was the first and only postdoc," he recalls. "Today, we are four professors—Philip Van Damme, Robin Lemmens, Jelle Demeestere, and myself. Our team also includes seventeen PhD students, ten postdocs, and a technical and administrative staff of eight people." Since 2007, the research group of Van Den Bosch also belongs to VIB, the leading research institute in the life sciences of Flanders. Currently, Van Den Bosch is Group Leader in the Center for Brain & Disease Research (CBD). Since its start, the Laboratory of Neurobiology intensively collaborates with the ALS Liga – Ligue ALS, the Belgian patient organization.

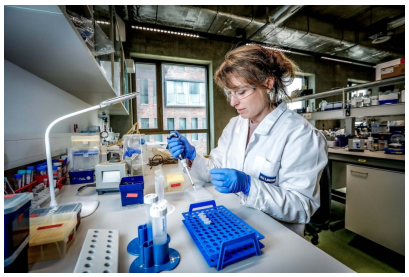
Recognition

In 2002, Van Den Bosch received the Generet Prize for Rare Diseases from the King Baudouin Foundation for his research on the mechanisms underlying ALS. "In 90% of patients, the cause of ALS is unknown. In the remaining 10%, it is genetically determined and affects multiple family members," he explains.

Axonal Transport

Van Den Bosch and his team discovered that axonal transport—critical for connecting spinal cord motor neurons to muscles—breaks down in ALS patients. "Some of these axons can be over a meter long. Normal transport is vital for the motor system's

function. We found that inhibiting the enzyme HDAC6 can restore this transport. This inhibition also promotes the maturation of motor axons and the formation of neuromuscular junctions—the vital connections between motor neurons and muscles."



© Rob Stevens

Unique Collaborations

The lab fosters unique interdisciplinary collaborations. "Alongside basic research, Philip Van Damme leads clinical studies with ALS patients," says Van Den Bosch. "We also collaborate with KU Leuven engineers who develop advanced microfluidic chambers for our human cell studies. These custom 3D-printed devices allow us to culture motor neurons and muscle cells in separate compartments, connected by channels, allowing us to study each cell type independently while maintaining their interactions." In addition, research center IMEC is creating electrode-integrated chips that simulate motor neurons and that can measure muscle contractions. "This will make our models even more useful," Van Den Bosch concludes.

Laboratory of Neurobiology

Campus Gasthuisberg, O&N5

Herestraat 49 – box 602

B-3000 Leuven

T: 32 (0)16 33 06 81

E: Ludo.Vandenbosch@kuleuven.be

W: Van Den Bosch Lab

W: Laboratory of Neurobiology — Department of Neurosciences