SCIENCES & BIOENGINEERING SCIENCES

The Research Groups
Microbiology & Organic Chemistry

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

Brendan Schroyen

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

Phylogenetic occurrence and mechanistic insights into polyhydroxyalkanoate synthesis in extremophiles

Supervisor:
Prof. dr. ir. Eveline Peeters (VUB)
Co-supervisor:
Prof. dr. Ulrich Hennecke (VUB)

The defence will take place on
Wednesday, January 14, 2026 at 4.30 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene, LIC, Learning Theatre

Members of the jury

Prof. dr. ir. Stefan Magez (VUB, chair)
Prof. dr. ir. Wim Versées (VUB)
Dr. ir. Nani Van Gerven (VUB)
Prof. dr. Tessa Quax (Rijksuniversiteit Groningen, NL)
Prof. dr. ir. Abram Aertsen (KULeuven)

Curriculum vitae

Brendan Schroyen obtained a Master's degree in Bioengineering Sciences: Cell and Gene Biotechnology: Molecular Biotechnology from the Vrije Universiteit Brussel in 2020 and subsequently pursued a PhD in the microbiology research group, where he investigated PHA metabolism in extremophilic microorganisms.

Throughout his PhD, he contributed to teaching activities within the bio-engineering curriculum and presented his research at several national and international conferences, including the Gordon Research Conference on Archaea in 2023 and 2025. He is the author of one first-author publication and co-author of an additional peer-reviewed paper.

Abstract of the PhD research

The increasing environmental impact of petrochemical plastics has intensified the search for sustainable alternatives. Their persistence in ecosystems and the accumulation of plastic debris highlight the need for biodegradable materials with comparable performance. Poly-hydroxyalkanoates (PHAs) are biobased, biodegradable polyesters produced by microorganisms and represent a promising alternative. However, their industrial application remains limited, mainly due to high production costs. One strategy to improve PHA competitiveness is the use of non-model microorganisms, particularly extremophiles, as production platforms within next-generation industrial biotechnology. Extremophiles offer intrinsic advantages such as robustness, reduced contamination risk, and simplified processing. This PhD research aimed to expand our understanding of PHA metabolism in extremophilic microorganisms, combining large-scale bioinformatic analyses with mechanistic and functional studies.

First, a bioinformatic pipeline was developed to screen bacterial and archaeal genomes for PHA biosynthesis pathways, with a focus on thermophilic and archaeal species. This revealed a strong association between optimal growth temperature and the presence of PHA metabolism. While PHA pathways are common in moderately thermophilic bacteria and archaea, they are rare in hyperthermophilic archaea and predominantly associated with halophilic species across the archaeal domain. These findings identified the halophilic archaeon *Haloferax mediterranei* as an ideal model organism for further investigation.

Subsequent functional and biochemical analyses uncovered growth phase–dependent regulation of PHA synthase paralogs, suggesting functional specialization. In addition, the regulatory protein PspR was shown to play a more complex role than previously assumed, potentially linking RNA-level regulation to PHA granule biology.

Overall, this work provides new insights into the organization and regulation of PHA metabolism in extremophiles and highlights the potential of halophilic archaea as robust platforms for sustainable biopolymer production.