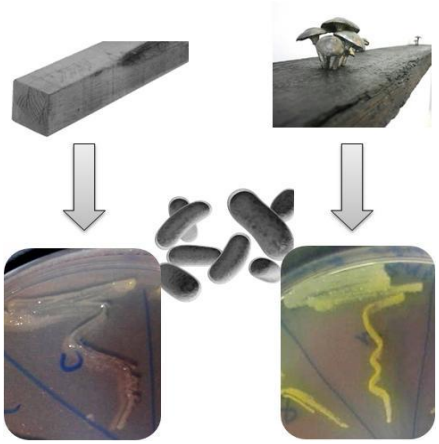
# EWoC-Biosensor



## Development of a New Tool for the Detection of Early Wood Decay

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**Context** — One major issue regarding the use of wood as a material is its susceptibility to biodegradation, especially by wood-rotting fungi. Thus, the wood industry continually seeks to improve the strength of natural wood against biological attacks by different techniques (autoclaving, modified wood, impregnation ...). The effectiveness of these treatments is validated by standardized approaches (EN113) that compare after several months the mass loss due to the action of lignolytic fungi between treated and untreated wood.

**Objectives** — The main objective of this project is to provide to the timber industry a new and quicker metrology tool able to estimate the biological attack and degradation of treated wood, and this before any mass loss can be measured (response times within days rather than months now).

**Approach** — Fungal wood degradation leads to the release of diverse and specific signal compounds that can be recognized and used by secondary lignolytic communities. The idea of this project is to twist from these communities, genes and enzymes involved in this recognition in order to construct bioindicator strains of the early wood deterioration.

**Key Results** —

- Identification of a regulator system enabling the detection of wood-decay compounds
- The CebR system has been selected for the biosensor construction as the transcriptional repression of this regulator is alleviated in presence of cellodextrines that are produced during the wood decay process. A genomic analysis has shown that this system was widely distributed and functionally conserved within *Streptomyces* and that it was possible to build a biosensor construct that could be transferred within most *Streptomyces* species and strains.
- Construction of bioindicator strains.
- The consensus regulator region recognized by CebR has been used in transcriptional fusions with marker genes. These constructions have been introduced in various model or environmental *Streptomyces* in order to enable their control by the *Streptomyces* endogenous CebRs.
- Validation of a bioindicator strain of wood degradation.

- Several transformed strains have been tested in order to evaluate their sensibility and sensitivity towards wood degradation compounds. A bioindicator strain has been selected and enabled to detect in a culture medium the presence of indicator molecules at concentrations similar to those measured in wood-decay process.
- Application of the biosensor to wood degradation.
- The biosensor has been tested in similar wood-decaying conditions as the EN113 norm and enabled a four times quicker detection.

**Main conclusions including key points of discussion** — A model biosensor of fungal wood degradation has been developed. The proof of concept and its applicability in certain wood degradation contexts has been validated.

**Future perspectives** — The proof of concept needs to be extended to other wood-rot fungi and other wood species. Kinetic experiments will be useful to estimate more precisely the detection time after fungal infection. To do so, a maturation project has been initiated with the SATTGE to contact industrial partners.

**Valorisation** —

Brevet national : M. Toussaint, C. Bontemps, P. Leblond, Biosenseur de la dégradation du bois, Patent FR1551286, publié le 19/08/2016.

Brevet international : Toussaint, C. Bontemps, P. Leblond, BACTERIAL BIOSENSOR OF WOOD DEGRADATION, Patent WO2016/131665 publié le 25/08/2016.

Toussaint M, Bontemps C, Besserer A, Hotel L, Gérardin P, Leblond P. Whole-cell biosensor of cellobiose and application to wood decay detection. J Biotechnol. 2016 Dec 10;239:39-46.