# Understanding Growth for Engineered Living Materials by simulating induced Gall Growth with an extended VirtualLeaf

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The relentless expansion of primary material extraction underscores the urgency of addressing escalating resource consumption and waste generation challenges. Despite substantial investment in recycling methodologies, the proportion of recycled materials remains disparity underscores the pressing need for transformative approaches to alleviate resource consumption. By drawing inspiration from nature's efficient construction and recycling mechanisms, biomimetic technology has shown promise in transferring natural principles applications. However, sustainability considerations are often overlooked in these endeavors. The emerging field of Engineered Living Materials (ELMs) focuses on self-repairing, self-supporting materials that emphasize sustainability. ELMs incorporate living components, novel approach to material design. By harnessing the self-regenerative capabilities of living organisms, ELMs hold promise for addressing the challenges posed by conventional materials.

The study introduces advancements in VirtualLeaf, a software package for modelling plant and tissue growth, including enhancements in cell form stability, cell wall adherence and simulation design, enabling more accurate modelling of plant growth processes and exploring development of growth to elucidate the formation of veins in plant leaves.

The intricate control mechanisms observed in plant galls provide insights into the minimal changes induced by organisms in plant development that result in macroscopic alterations. This study aims to answer the question: “How can minimal changes in plant development construction of macroscopic structures such as insect-induced plant galls?”

Through interdisciplinary collaboration and innovative modelling approaches, this research contributes to a deeper understanding of plant growth processes and offers insights into a sustainable material design inspired by nature's efficiency.