The Iby and Aladar Fleischman
Faculty of Engineering
Department of Materials Science and Engineering

אוניברסיטת תל-אביב
TEL AVIV UNIVERSITY

הפקולטה להנדסה
ע"ש איבי ואלדר פליישמן
המחלקה למדע והנדסה של חומרים

You are cordially invited to attend this seminar to be held on

Wednesday, May 4th, 16:00
Room 103, Engineering Class (Kitot) Building

Nano Bio Mimetic; Nature's Gift

Prof. Oded Shoseyov

The Robert H. Smith Faculty of Agriculture, Food and Environment,

the Hebrew University of Jerusalem

Bringing together the toughness of cellulose nano-fibers from the plant kingdom, the remarkable elasticity and resilience of resilin that enables flees to jump as high as 400 times their height from the insect kingdom combined with Human Recombinant Type I collagen produced in tobacco plants; These are the materials of the future; Nature's Gift.

Resilin is a polymeric rubber-like protein secreted by insects to specialized cuticle regions, in areas where high resilience and low stiffness are required. Resilin binds to the cuticle polysaccharide chitin via a chitin binding domain and is further polymerized through oxidation of the tyrosine residues resulting in the formation of dityrosine bridges and assembly of a high-performance protein-carbohydrate composite material. Plant cell walls also present durable composite structures made of cellulose, other polysaccharides, and structural proteins. Plant cell wall composite exhibit extraordinary strength exemplified by their ability to carry the huge mass of some forest trees. Inspired by the remarkable mechanical properties of insect cuticle and plant cell walls we have developed novel composite materials of resilin and Nano-Crystalline Cellulose (resiline-NCC) that display remarkable mechanical properties combining strength and elasticity. We produced a novel resilin protein with affinity to cellulose by genetically engineering a cellulose binding domain into the resilin. This CBD-Resilin enable, interfacing at the nano-level between the resilin; the elastic component of the composite, to the cellulose, the stiff component.

As a central element of the extracellular matrix, collagen is intimately involved in tissue development, remodeling, and repair and confers high tensile strength to tissues. Numerous medical applications, particularly, wound healing, cell therapy, and bone reconstruction, rely on its supportive and healing qualities. Its synthesis and assembly require a multitude of genes and post-translational modifications. Historically, collagen was always extracted from animal and human cadaver sources, but bare risk of contamination and allergenicity and was subjected to harsh purification conditions resulting in irreversible modifications impeding its biofunctionality. In parallel, the highly complex and stringent post-translational processing of collagen, prerequisite of its viability and proper functioning, sets significant limitations on recombinant expression systems. A tobacco plant expression platform has been recruited to effectively express human collagen, along with three modifying enzymes, critical to collagen maturation. The plant extracted recombinant human collagen type I forms thermally stable helical structures, fibrillates, and demonstrates bioactivity resembling that of native collagen. Combining collagen at the nano-scale with resilin to produce fibers resulted in super-performing fibers with mechanical properties which exceed that of natural fibers.

Biosketch

A faculty member of the Hebrew University of Jerusalem. Prof. Shoseyov's research is in plant molecular biology protein engineering and nano-biotechnology. His group focus on Bio-Inspired Nanocomposite materials. He has authored or co-authored more than 160 scientific publications and is the inventor or co-inventor of 46 patents. Prof. Shoseyov received the Outstanding Scientist Polak Award for 2002, the 1999 and 2010 Kay Award for Innovative and Applied Research and The 2012 Israel Prime Minister Citation for Entrepreneurship and Innovation. He is the scientific founder of 10 companies. Among them are:

- Collplant Ltd an agro-biotech/regenerative medicine company producing human recombinant Type I collagen in transgenic plants for medical implants used in tissue repair. www.collplant.com
- Biobetter Ltd. an agro-biotech company producing therapeutic antibodies in tobacco plants.
- Cannabi-Tech Ltd. a medical cannabis company developing products to assure product standardization.
- SP-Nano Ltd. A nao-biotech company manufacture of SP1-Carbon Nano Tube coated fabrics for the composite industry. www.fulcrumnano.com
- CBD-Technologies/FuturaGene. A forestry agro-biotech company that develop and commercialize transgenic trees for the pulp and paper and the bio-fuel industry. www.futuragene.com
- Melodea Ltd. A nano-biotech company develop and manufacture Nano Crystaline Cellulose from paper sludge for structural foam, composites and adhesives www.melodea.eu
- Valentis Nanotech. Ltd. A nanotechnology company develops and manufacture nano-bio-based transparent films for food packaging and agriculture. http://valentis-nano.com/

Paulee CleanTec Ltd. Paulee CleanTec aims to be the world leader in the collection and disposal of pet waste through its brand AshPoopie, and to branch out to human waste treatment with future products that similarly turn feces into odorless, sterile organic fertiliaer. http://www.ashpoopie.com/