The Volcani Institute: research activities in postharvest and food science

Smart Agrifood Industry 25-26 May

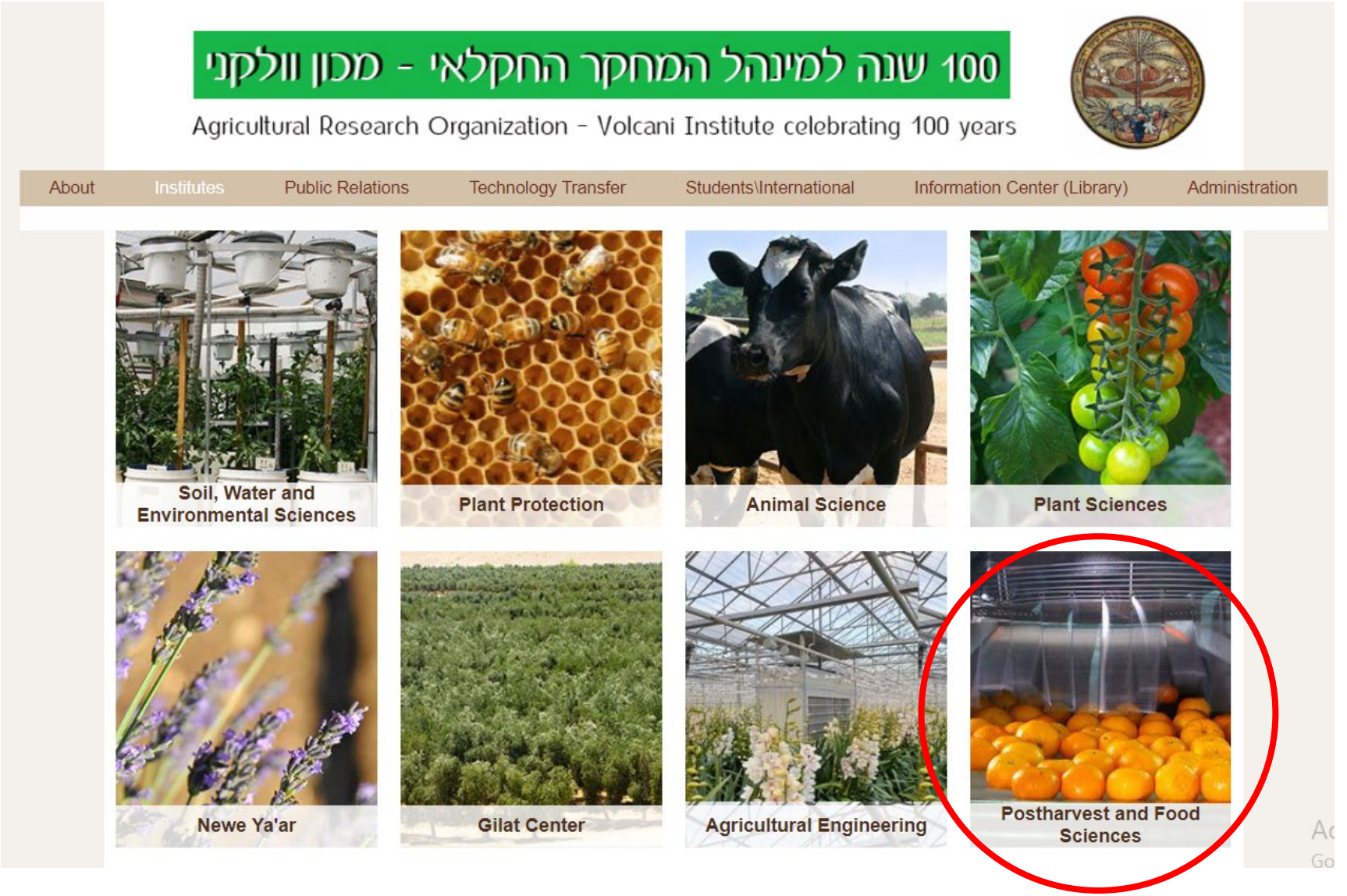
Dr. Ron Porat

Head of Institute of Postharvest and Food Science

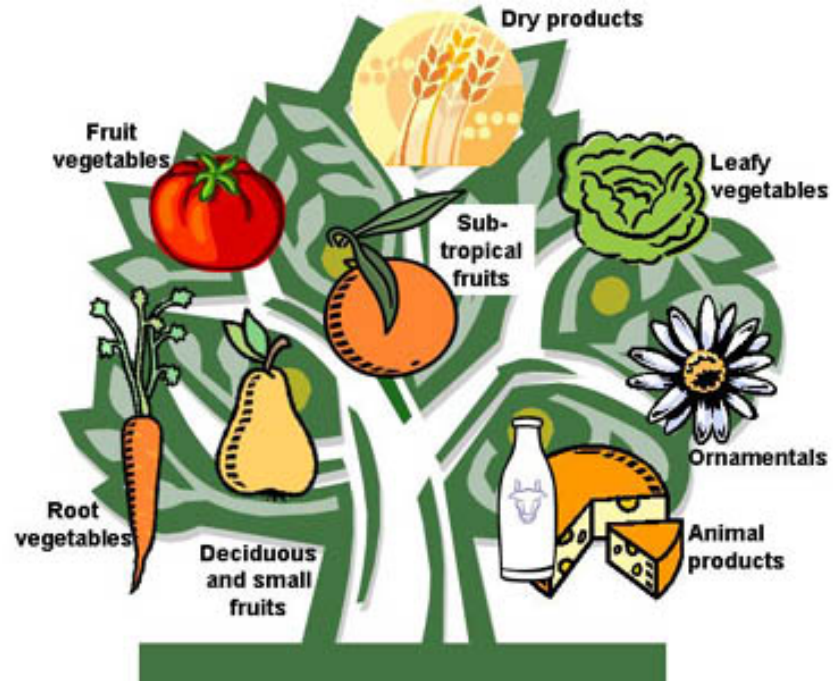
ARO, The Volcani Institute

The purpose of this presentation is to describe some of the research activities conducted in the Institute of Postharvest and Food Sciences, ARO, The Volcani Institute, in order to promote possible future collaborations and opportunities.

ARO, The Volcani Institute



The Institute of Postharvest & Food science includes two departments:

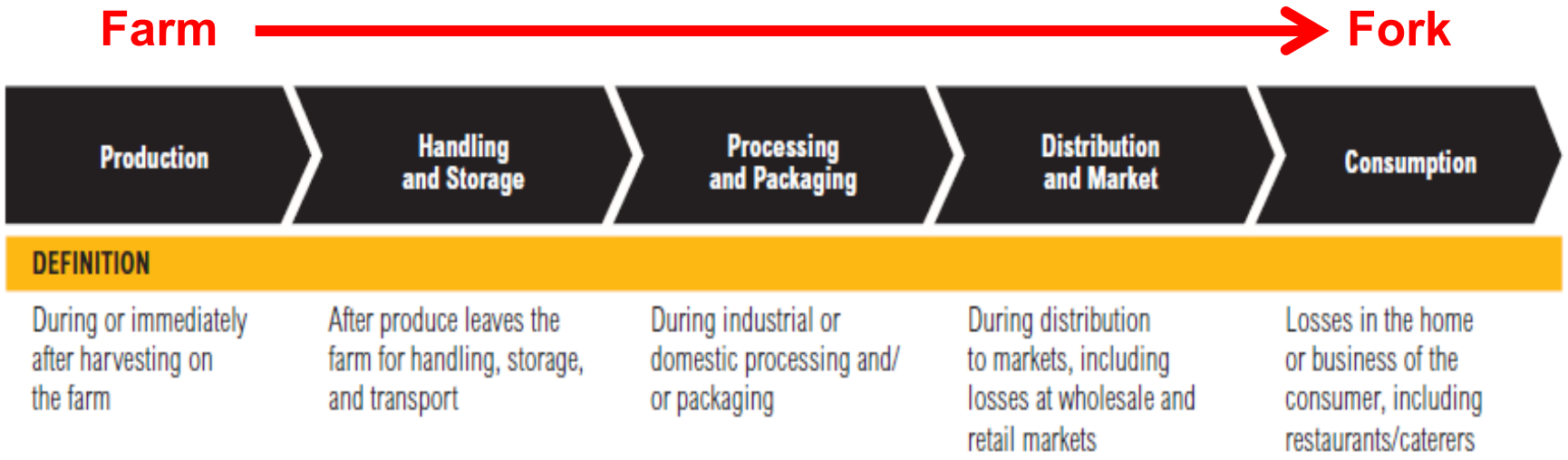


Dept. of Postharvest Science

Dept. of Food Science

Vision

Excellence and leadership in R&D in order to insure the quality and safety of agricultural produce along the food supply chain from the farmer till the consumer



Specialty of the Institute of Postharvest & Food Science

Working in the range between agricultural production and consumption

Agricultural produce

- Fresh F&V
- Partially processed F&V
- Dry produce (grains)
- Animal products (milk, fish, eggs, honey)

Research activities

Dept. of Postharvest Science

The Dept. includes 12 researchers/labs

Research areas:

- Ripening and senescence
- Postharvest decay control
- Chilling stress
- Sensory and nutritional quality
- Postharvest technologies (packaging, waxing, CA, etc.)

Vegetables

Eli Fallik
Fruit vegetables

David Kenigsbuch
תבלינים

Dani Eshel
Root vegetables

Carmit Ziv
Pumpkins

Victor Rodov
Cucumbers

Fruit

Ron Porat
Citrus, pomegranate

Haya Friedman
Deciduous, banana

Noam Alkan
Avocado, mango

Victor Rodov
Strawberry, figs

Amnon Lichter
Grapes, dates

Physiology

Amnon Lers
Senescence

Haya Friedman
Ripening

Dani Eshel
Dormancy

Amnon Lichter
Cracking

Pathology

Samir Droby

Noam Alkan

Carmit Ziv

Fresh-cut

Victor Rodov

Bio-sensors

Evgeni Eltzov

Food loss

Ron Porat

Environmental safe technologies for decay control

Hot water rinsing and brushing technology (50°C-56°C for 15-20 s)

A machine combining a short hot water rinsing and brushing treatment (~55ºC for 20 sec) was developed for cleaning and disinfection of agricultural produce.

Prof. Elli Fallik

Hot Water Rinsing and Brushing(HWRB)

HWRB- 55°C for 15-20 s

Prof. Elli Fallik

After

Before

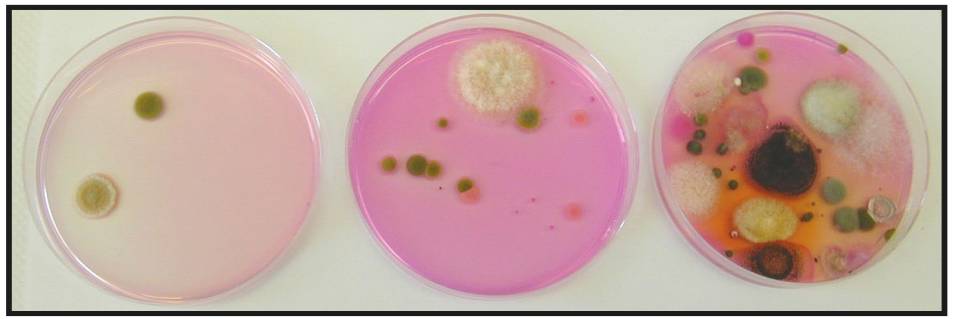
Ethanol vapor for decay reduction in grapes

Dr. Amnon Lichter

Control **Ethanol**

After 45 days

Line system for ethanol treatment

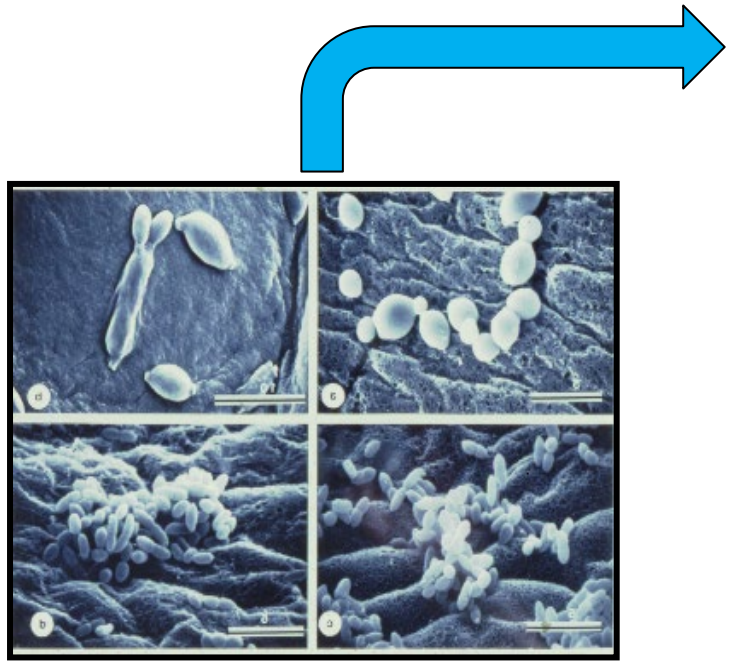


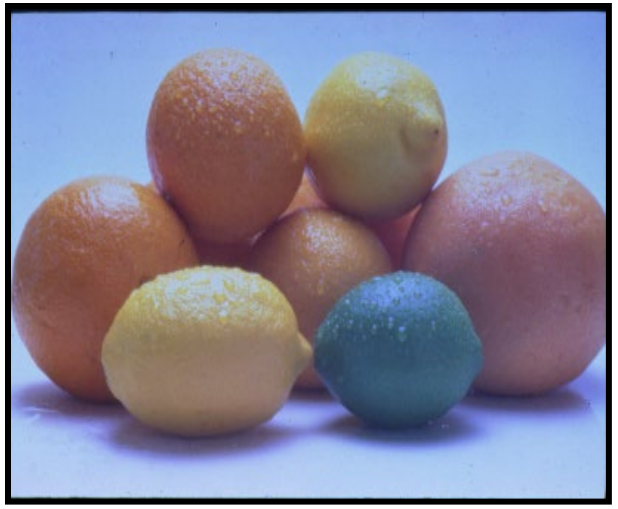
Ethanol SO_2 Control

Biological control technologies for control of postharvest diseases

Prof. Samir Droby

Naturally suppressive microorganisms on plant surface can suppress disease development.



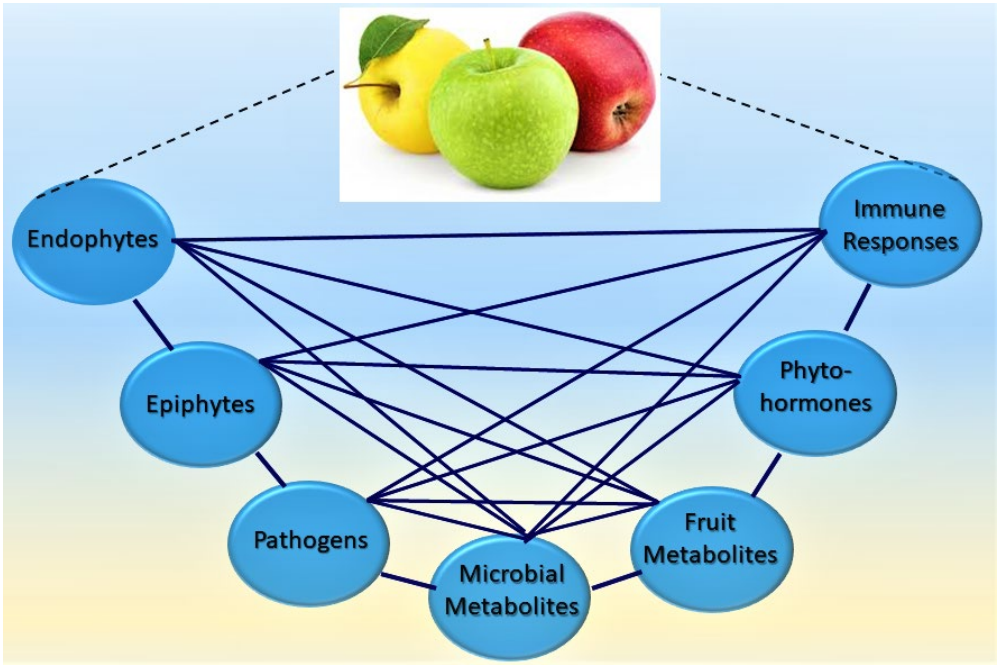


*Purchased by Bayer

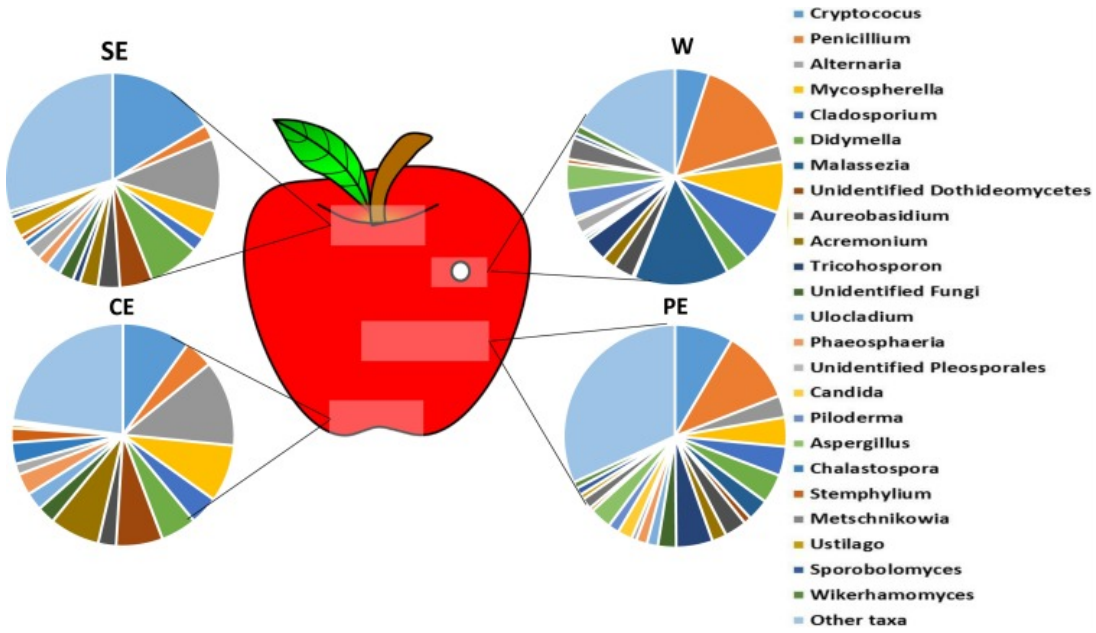
Fruit Microbiome – new Frontier in Postharvest biocontrol

Prof. Samir Droby

The Functional Fruit Microbiome Network

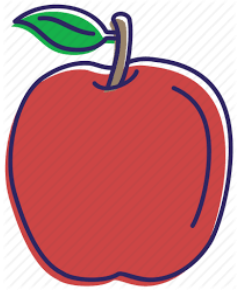


Epiphytic and endophytic microbiota play critical role in fruit resistance to biotic and abiotic stress

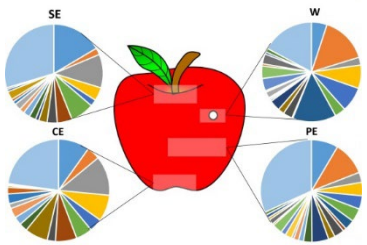


Designing beneficial microbiomes for biocontrol

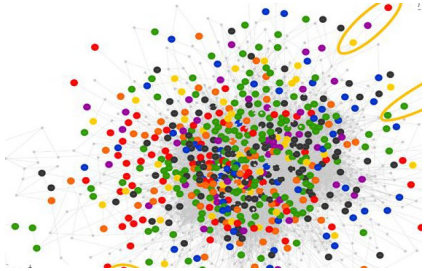
Prof. Samir Droby



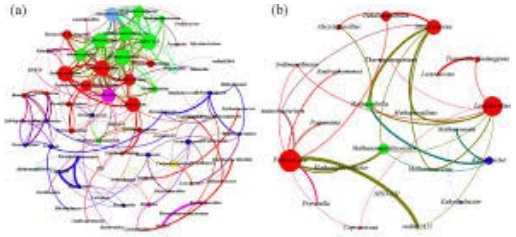
Fruit microbiome



Metagenome/amplicon sequencing

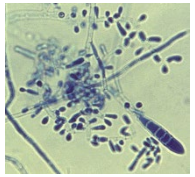


Network analysis

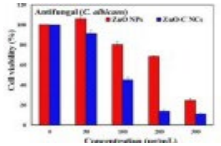


Core microbial taxa and hubs

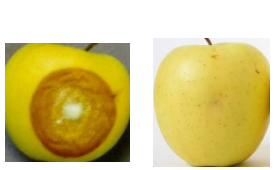
Identification of microorganisms based on function analysis

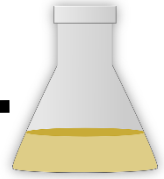


Microbial interactions - synergism



Biocontrol function of individual strains





Construction of consortia and evaluation of biocontrol function

Induced resistance to cold and decay

Dr. Noam Alkan

Induced resistance to fungal pathogens

Control Stimulant

Control Stimulant

Induce resistance to cold

Control Stimulant

Integration with coatings

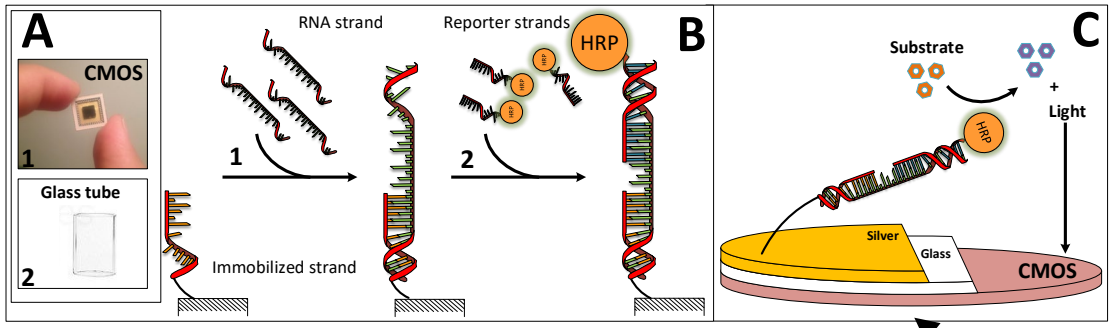
Control Stimulant

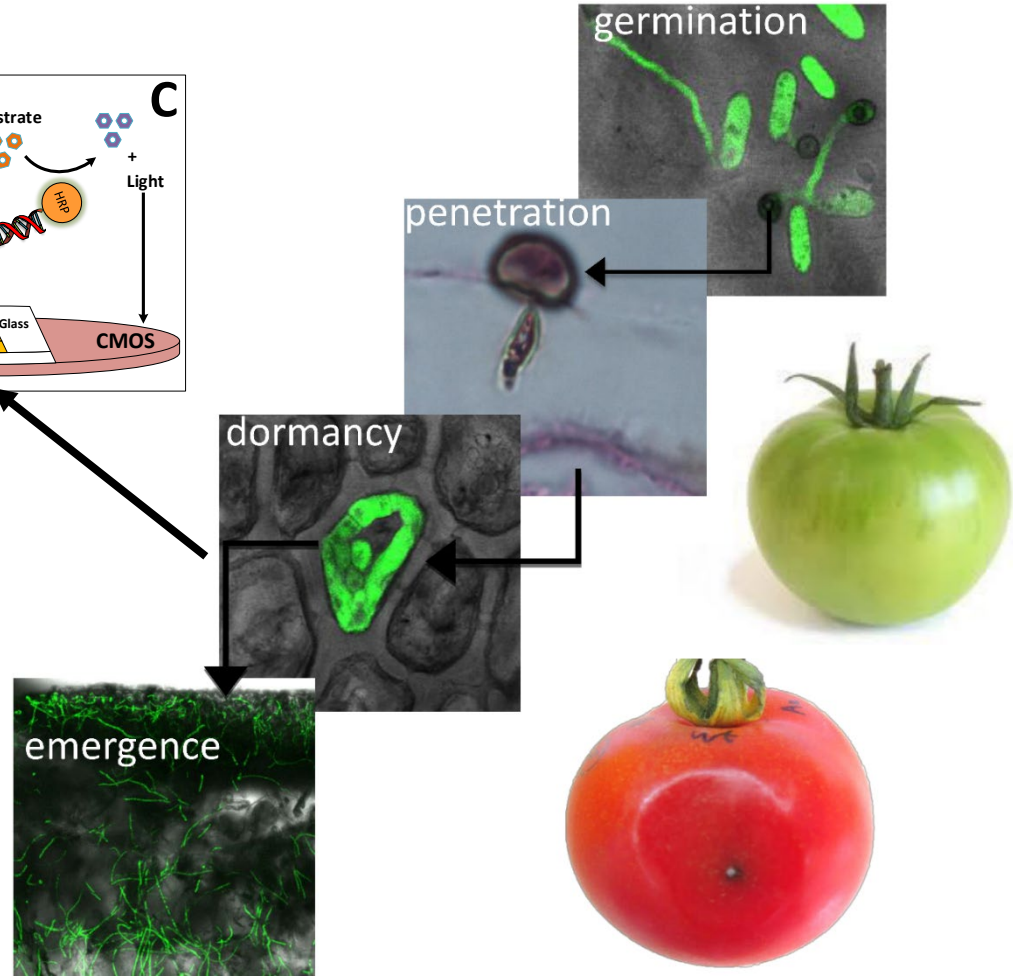
Early sensing of quiescent infections

Dr. Noam Alkan

Dr. Evgeni Eltzov

Early detection of quiescent infections by DNA sensors will allow application of fungicidal treatments to prevent losses

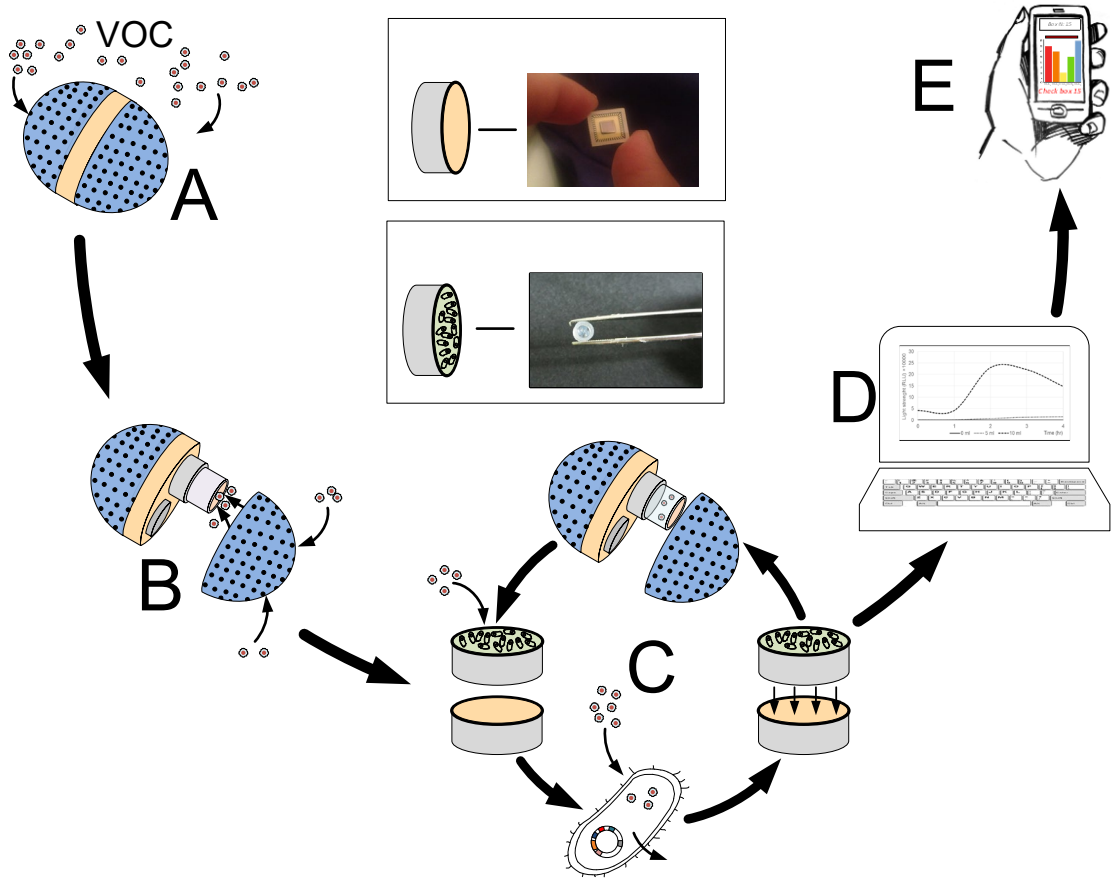


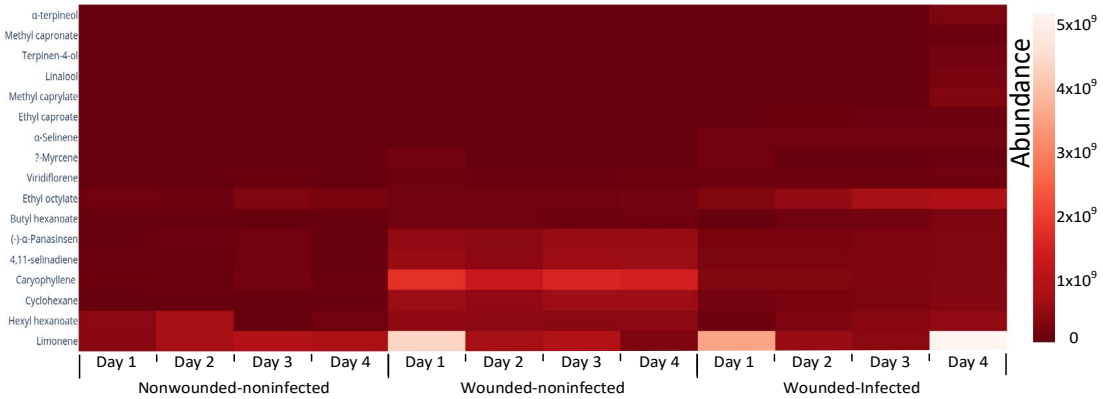


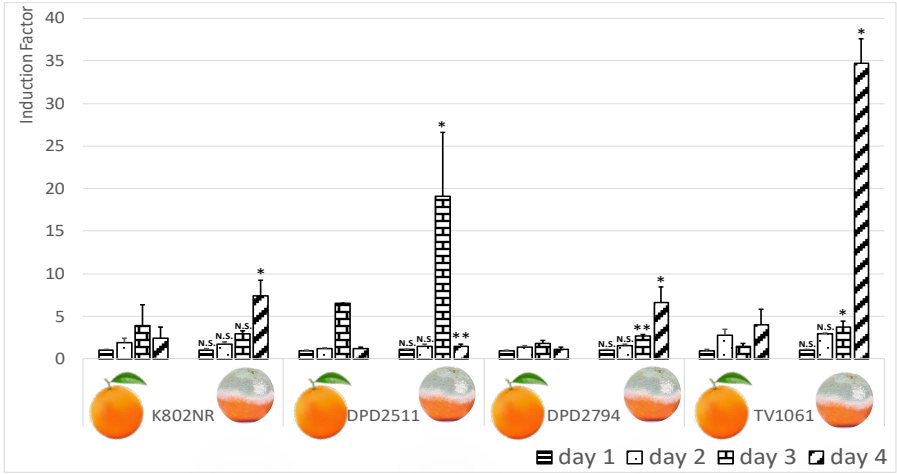
Real-time monitoring of decay appearance during storage

Dr. Evgeni Eltzov

Research goal – development of bio-sensors for detection of volatile compounds emitted from decayed fruit!







Chilling stress

Implementation of cold quarantine treatments

Dr. Noam Alkan

Development of acclimation procedures allows the produce to withstand cold quarantine treatments without chilling damage

Avocado

Control

Treated

Mango

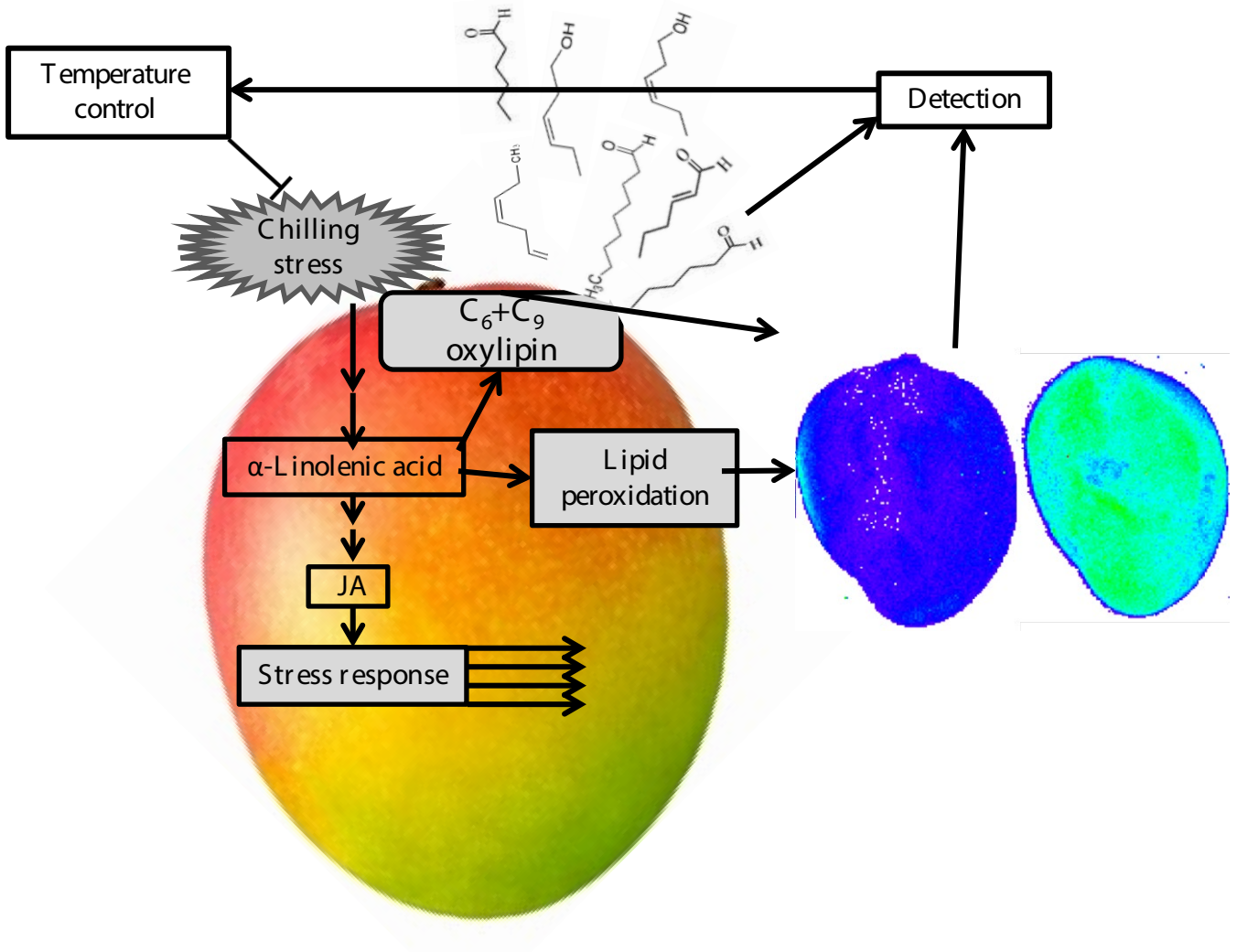
	After storage	After shelf life
Control		
Treated		

Early sensing of chilling stress

Dr. Noam Alkan

Dr. Evgeni Eltzov

Early sensing and detection of chilling stress will allow to modify storage temperature before chilling damage occurs



Modified atmosphere packaging (MAP)

Sophisticated PE bags for fresh herbs (Colored strips)

Dr. David Kenigsbush

Xtend® modified humidity bags

Dr. Nehemia Aharoni

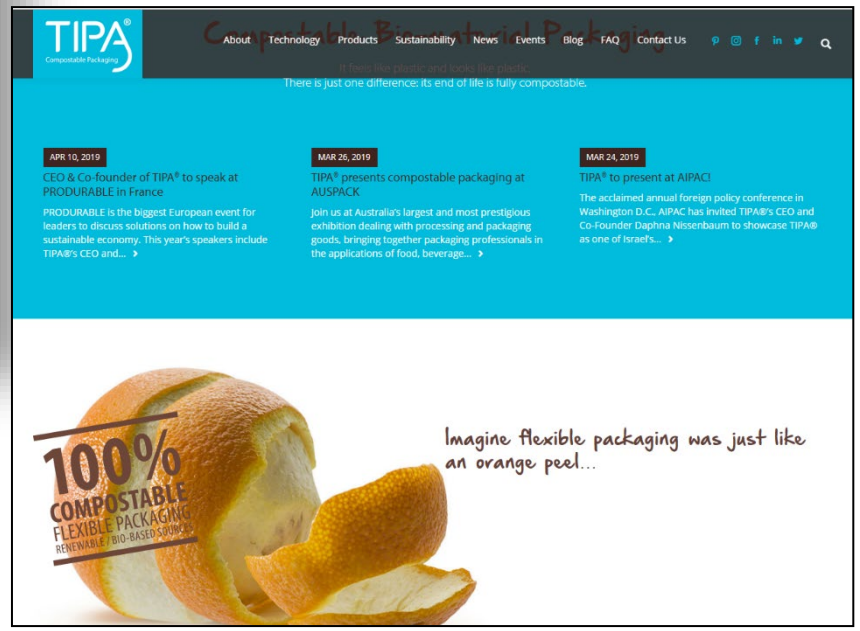
Optimization of retail packaging for F&V

Dr. Ron Porat

Dr. Victor Rodov

Compostable food packages

New Plastics Economy Global Commitment



Dept. of Food Science

The Dept. includes 10 researchers/labs

Research areas:

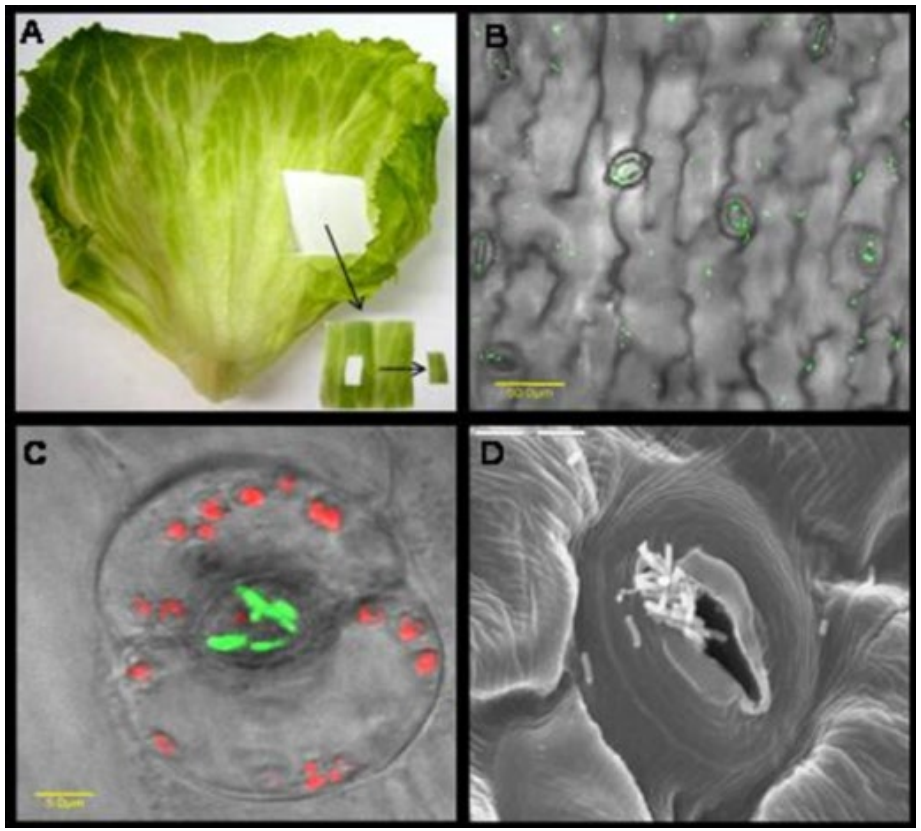
- **Chemical and microbial food safety**
- **Agro-nanotechnology measures for smart packaging's, anti-microbial surfaces and slow release of active ingredients**
- **Grain storage**
- **Health and nutritious foods**

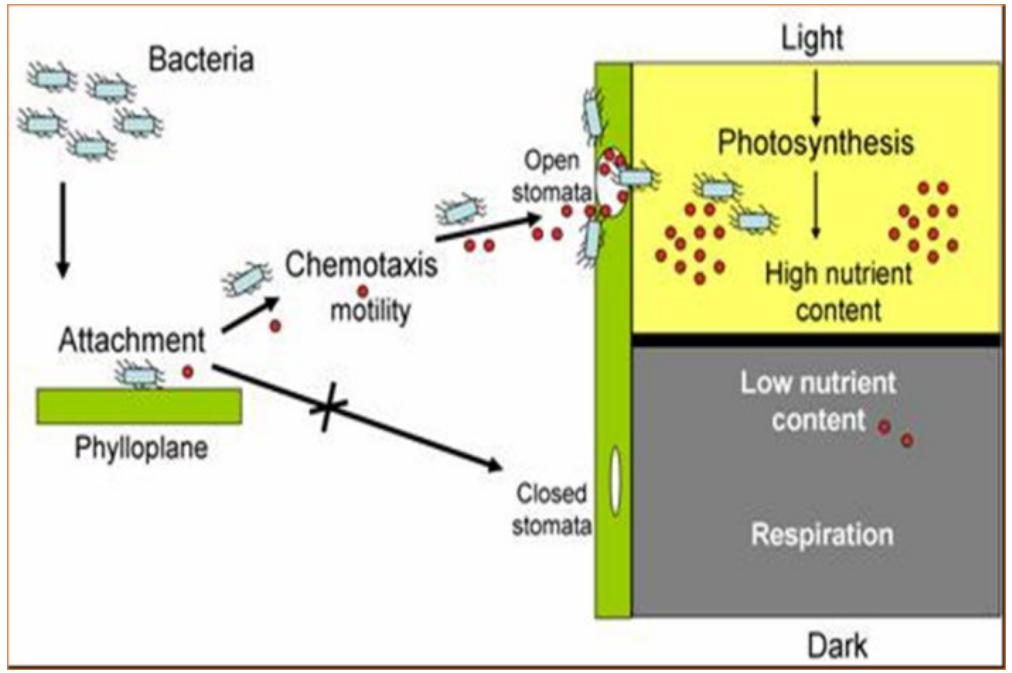
Food safety

Survival mechanisms of food-borne pathogens in plants

Prof. Shlomo Sela

Our goal is to understanding how food-borne pathogens infect plants and survive along the food-production chain

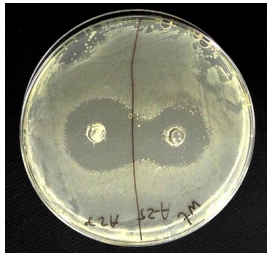


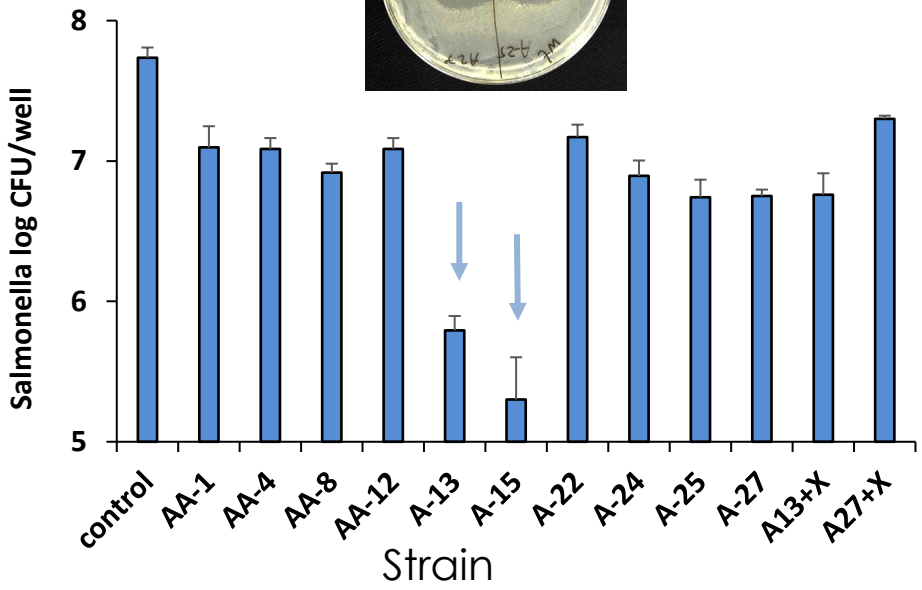


Biocontrol of Salmonella

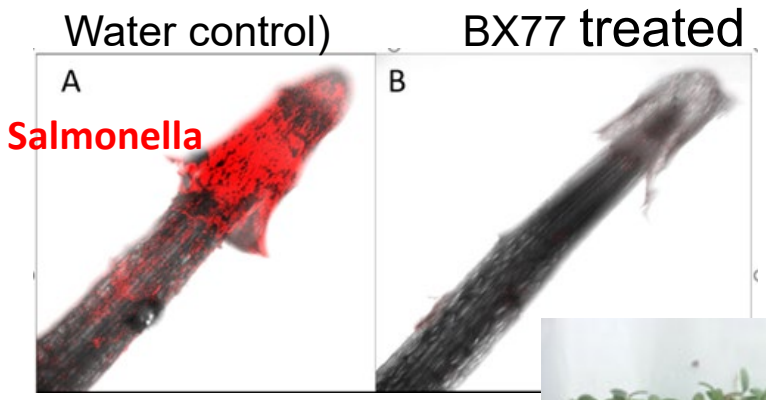
Prof. Shlomo Sela

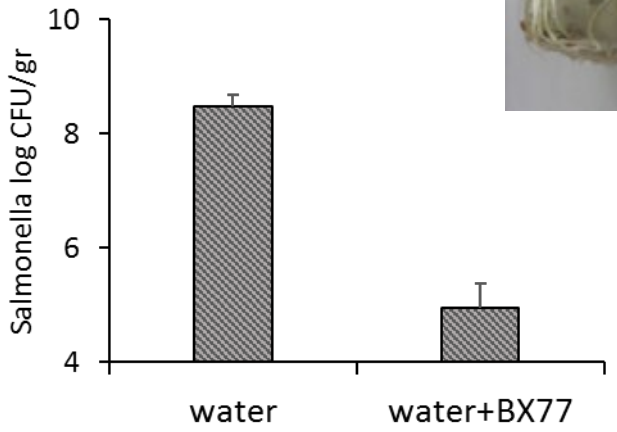
Probiotics for bio-control in poultry





Bio-control in sprouts





Super-hydrophobic anti-bacterial surfaces

Dr. Moshe Shemesh

Journal of Materials Chemistry B

ROYAL SOCIETY OF CHEMISTRY

PAPER View Article Online View Journal

Bioinspired passive anti-biofouling surfaces preventing biofilm formation†

Sasha Pechook,‡[ab] Kobi Sudakov,[c] Iryna Polishchuk,[ab] Ievgeniia Ostrov,[c] Varda Zakin,[c] Boaz Pokroy*[ab] and Moshe Shemesh‡*[c]

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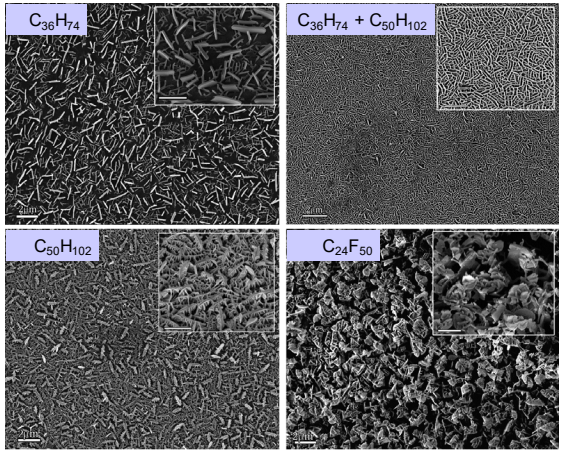
www.rsc.org/MaterialsB

Biofilm formation enables bacteria to grow under unfavorable conditions, provides them with protection, and increases their resistance to antimicrobial agents. Once a biofilm has formed, it is difficult, and in some systems, impossible to treat. Strategies based on the release of biocidal agents have shown only transient efficiency. Herein, we present a novel bioinspired passive approach to the prevention of surface biofilm attachment by exploiting superhydrophobic surfaces formed *via* the self-assembly of paraffin or fluorinated wax crystals. Our surfaces show exceptional ability to inhibit biofilm formation of both Gram-positive *Bacillus cereus* and Gram-negative *Pseudomonas aeruginosa* over a 7 day period (up to 99.9% inhibition).



ACS APPLIED BIO MATERIALS Article

Cite This: *ACS Appl. Bio Mater.* 2019, 2, 4932−4940

www.acsabm.org

Superhydrophobic Wax Coatings for Prevention of Biofilm Establishment in Dairy Food

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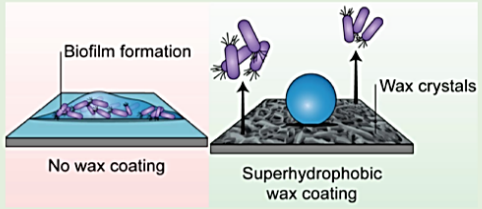
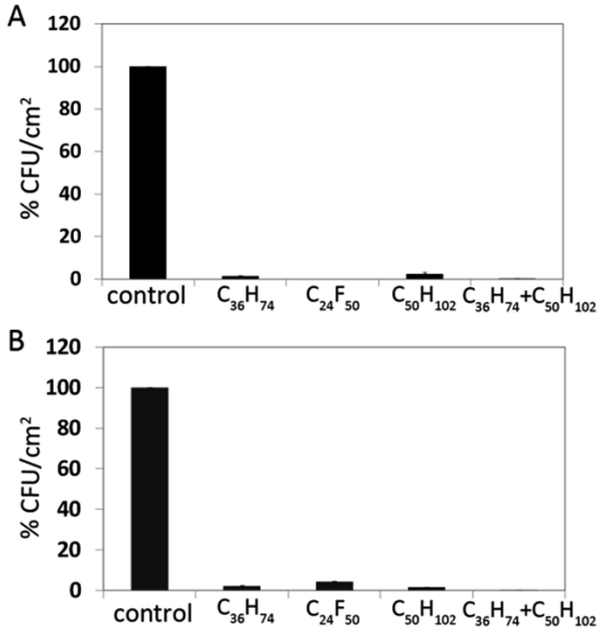
Supporting Information

ABSTRACT: Microbial contamination of dairy products caused by biofilm-forming bacteria is of great concern to the dairy industry, a leading sector impacted by food loss. Previous reports have emphasized that preventing biofilm formation on work surfaces of dairy equipment would be a more desirable option than treating it. However, there is currently no available technology that could completely prevent such biofilm formation without causing detrimental side effects. Here, we demonstrate that a bioinspired approach, exploiting superhydrophobic paraffin/fluorinated wax surfaces, can be efficiently employed to prevent dairy-



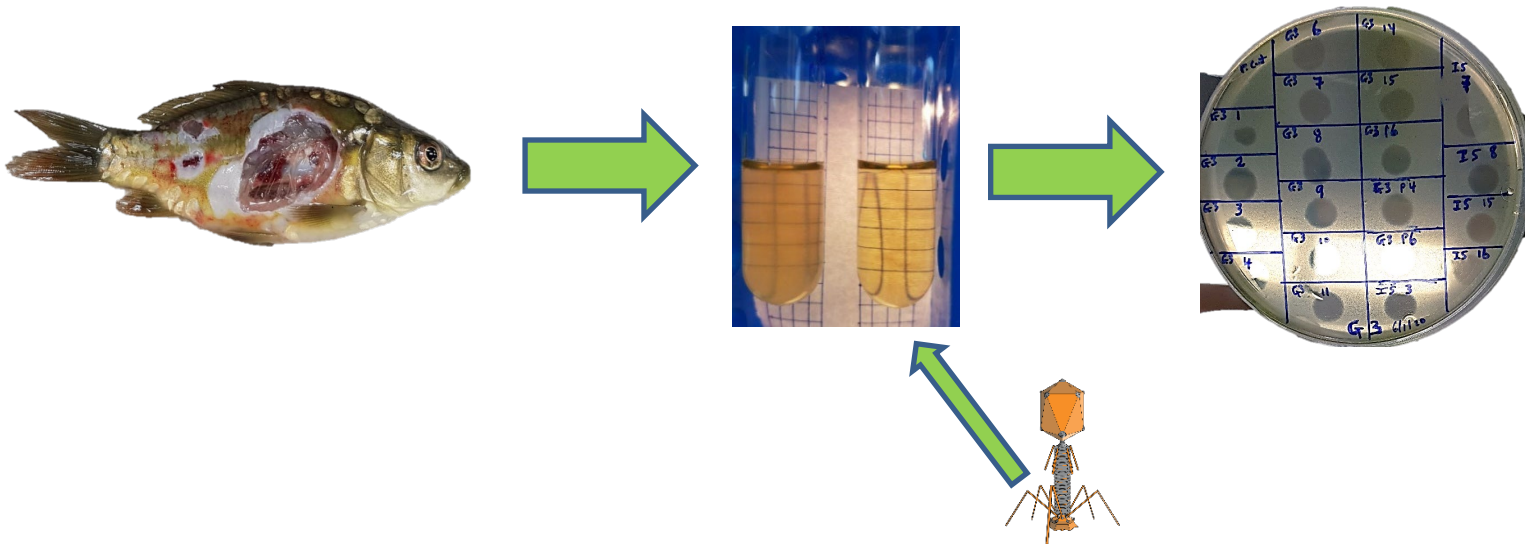


Biocontrol of fish pathogens as alternative to antibiotics

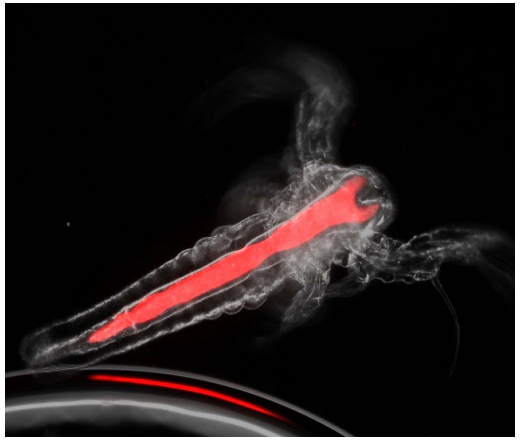
Dr. Orr Shapiro

Research goals:

- Understand disease ecology in aquaculture settings
- Develop relevant disease model systems
- Establish effective protocols for phage-based bio-controls



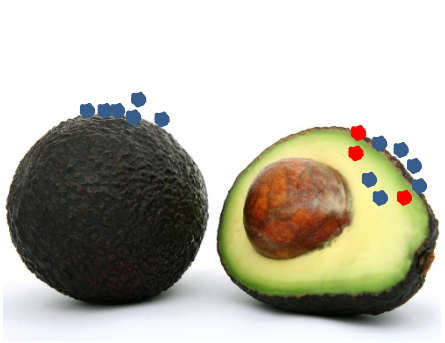
Carpion fish as model for furunculosis disease in freshwater aquaculture

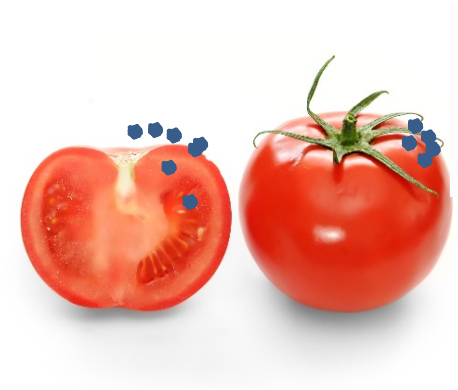


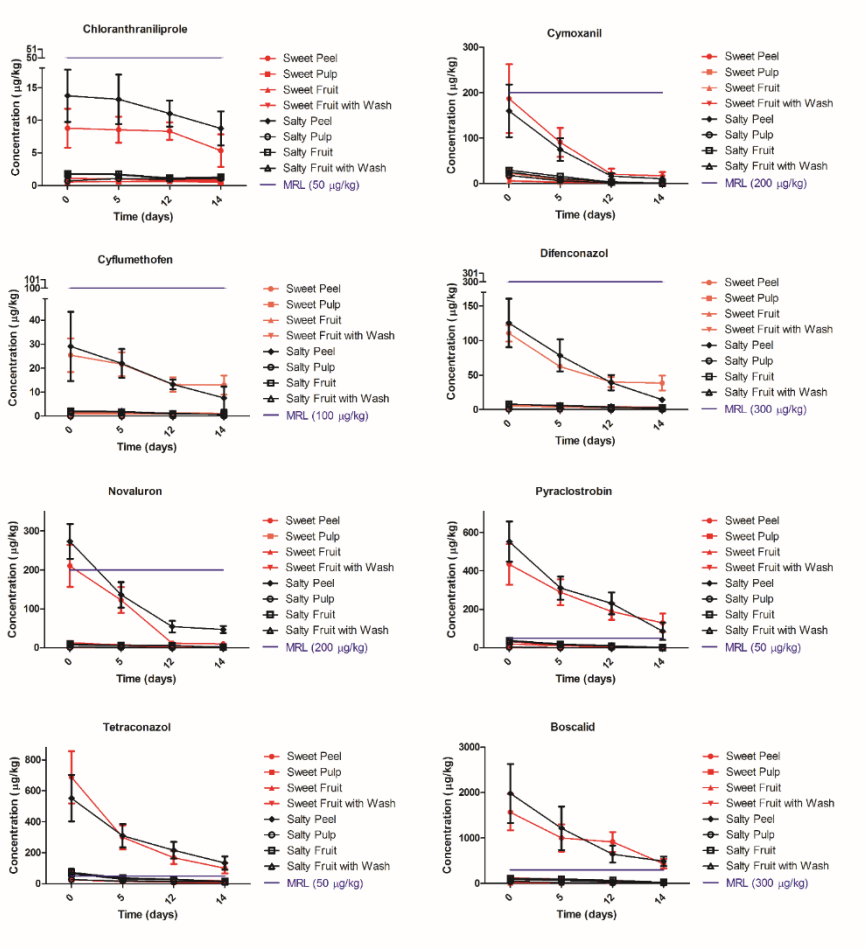
Artemia salina as model for *Vibriosis* in mariculture

Pesticides penetration and dissipation kinetics in fruits and vegetables

Dr. Jacob Shimshoni

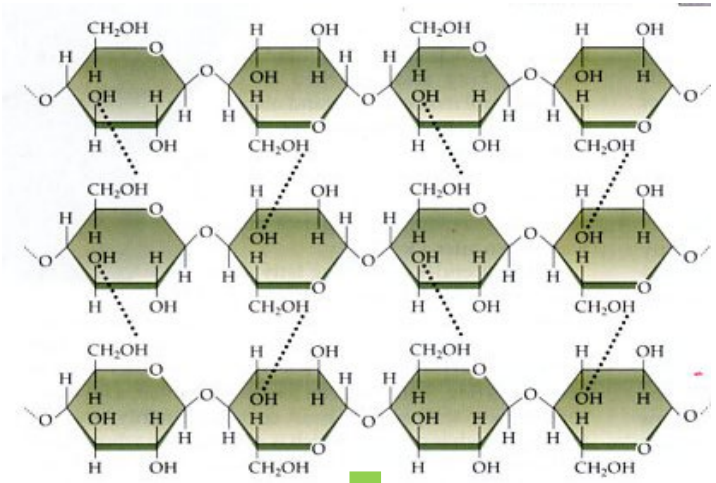


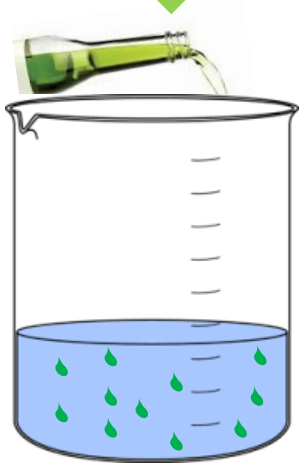




Agro-nanotechnology

Active edible coatings based on natural polymers





Dr. Elena Poverenov

Control **Chitosan 2%**

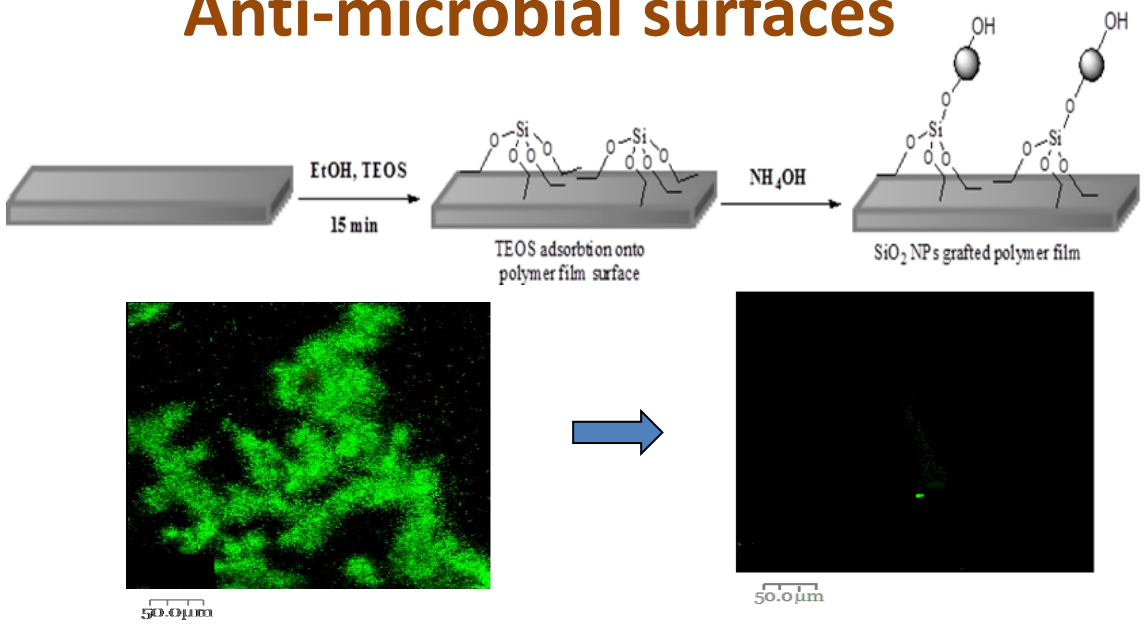
3 weeks at 20°C + 4 days at 20°C

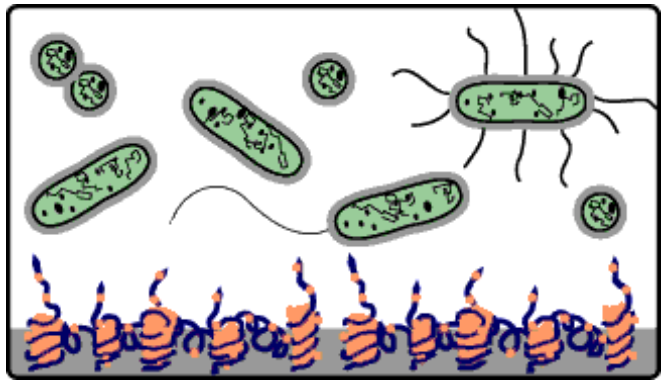
Polysaccharides - natural polymers, biodegradable, non-expensive and safe

Antimicrobial coatings and surfaces

Dr. Elena Poverenov

Anti-microbial surfaces



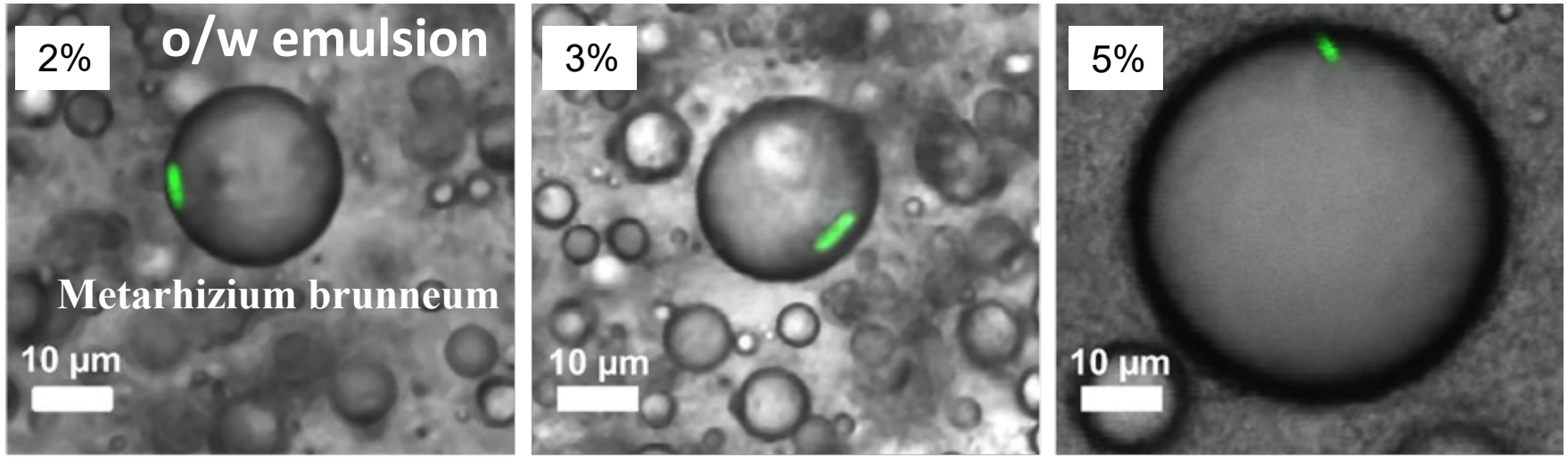


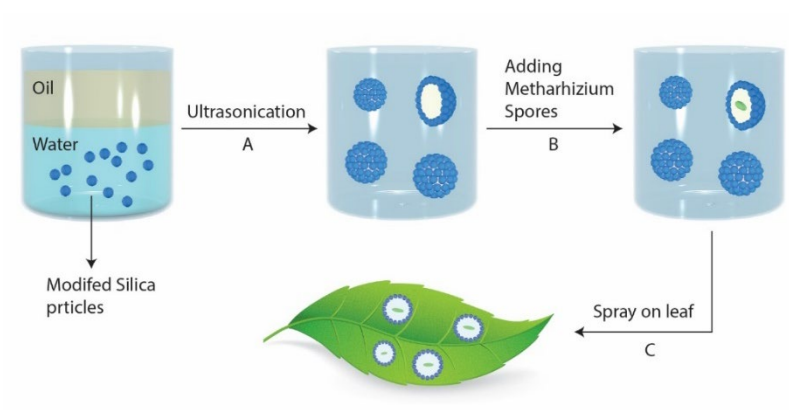
Package boxes

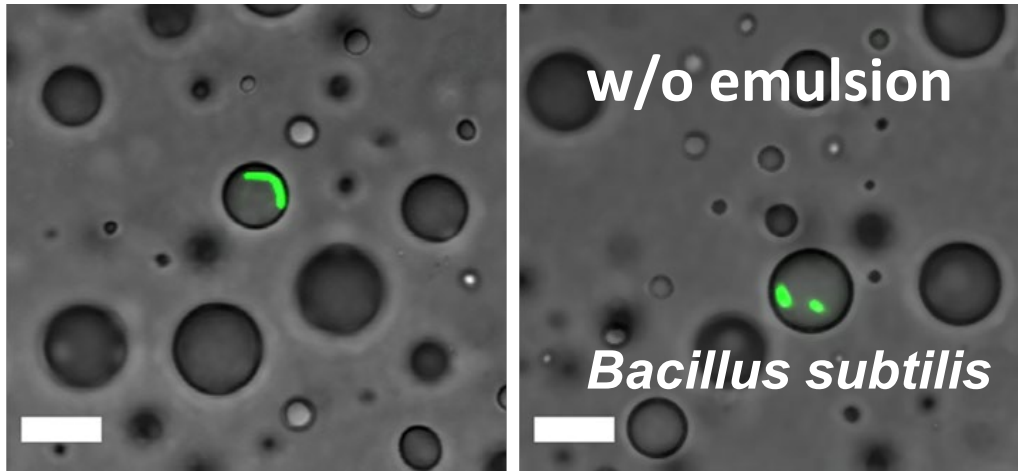
Package films

New formulations for delivery of bio-pesticides based on Pickering emulsions

Dr. Guy Mechrez







Scale bar is 10 microns

Yaakov et al., *ACS Omega 2018, 3(10), 14294-14301.*


Thank you