Plantas Biofactoría: un sector emergente

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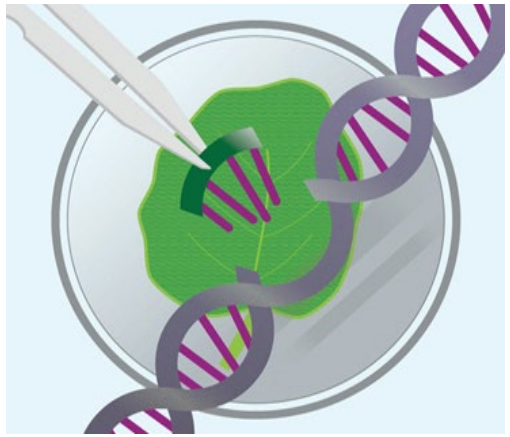
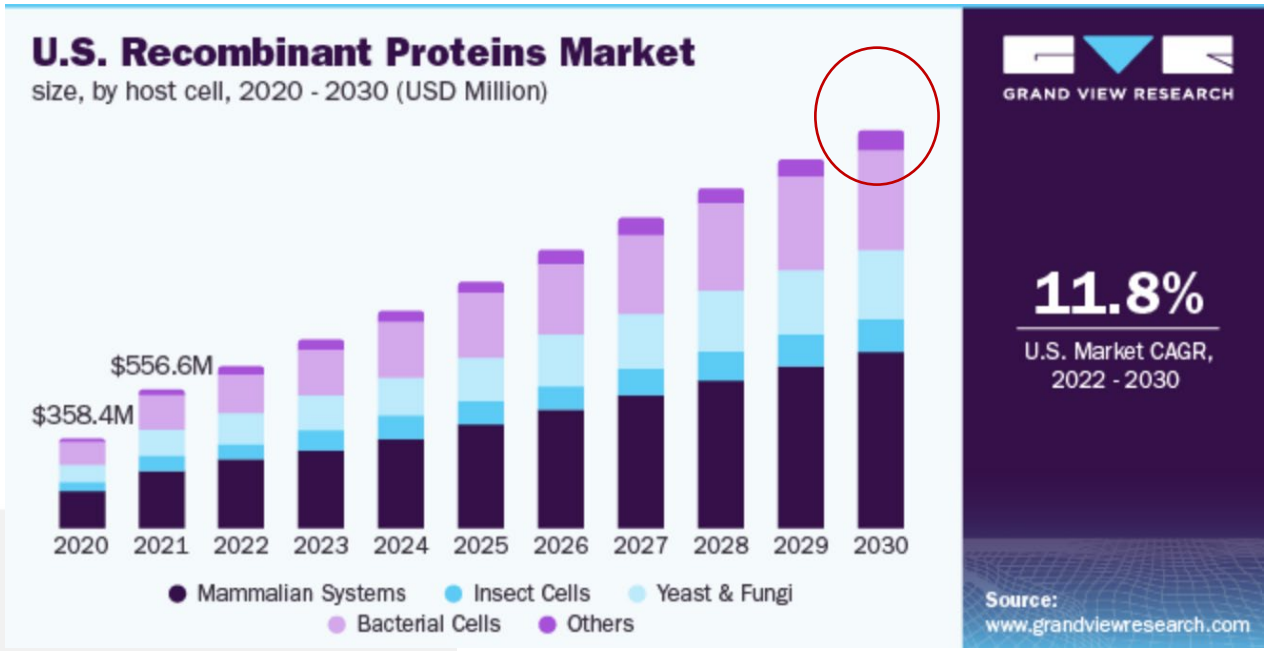
Madrid Oct 2022

THE GROWING GLOBAL DEMAND on (recombinant) BIOPRODUCTS

Large molecules (proteins)

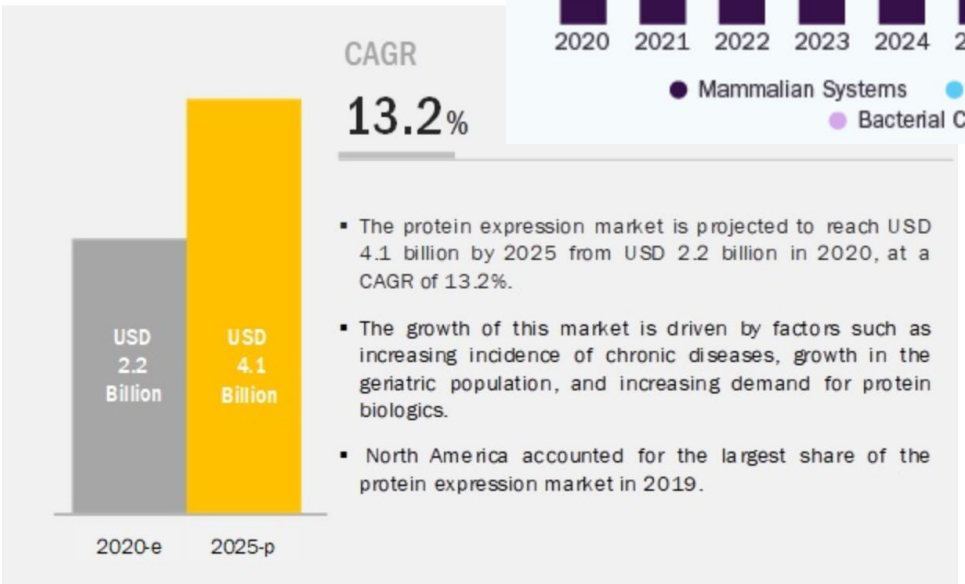
Vaccines
Antibodies
Therapeutic proteins
Growth factors
Food proteins of animal origin
Industrial enzymes





Small molecules (added-value-metabolites):

Anti-cancer drugs
Food suplements
Antimalarials
Cosmetics components
Biological insecticides
Pheromones

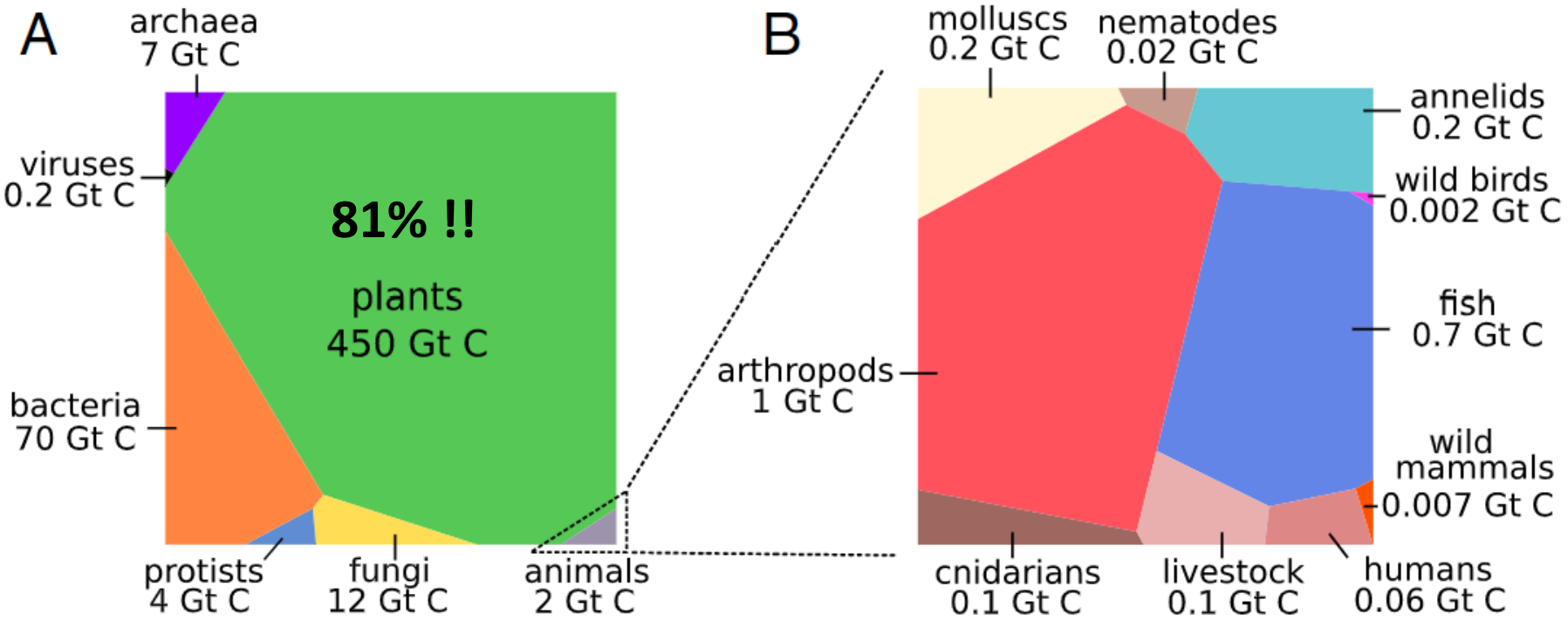


Source: www.grandviewresearch.com

RESPONSES to the GROWING GLOBAL DEMAND on (recombinant) BIOPRODUCTS

The biomass distribution on Earth

Yinon M. Bar-On[a], Rob Phillips[b,c], and Ron Milo[a,1]



RESPONSES to the GROWING GLOBAL DEMAND on (recombinant) BIOPRODUCTS

Traditional bioreactors

Medicago production facilities, Canada

VENTAJAS de la BIOPRODUCCION en PLANTAS

Bajo coste: Menores requerimientos medios de cultivo

Sostenibilidad: Luz como fuente de energía

Animal-free: Segmentos de población con requerimientos éticos

Múltiples productos: Biorefinería

Escalabilidad: Una planta = un bioreactor

ESTRATEGIAS de BIOPRODUCCION en PLANTAS

Very high value products Pharmaceuticals (vaccines, antibodies, etc)	High-value products Food-feed, agro, veterinary, cosmetics	Industrial products Food products/aditives Biorefineries
Medium scale	Large scale	Very Large Scale
CONTAINED- GMP	CONTAINED, GAP/GMP	OPEN FIELD
M	**L**	**XL**

El sector de las Plantas Biofactoría en el panorama internacional

M

FINANCIAL TIMES

US COMPANIES TECH MARKETS CLIMATE OPINION WORK & CAREERS LIFE & ARTS HTSI

Coronavirus treatment + Add to myFT

World's first plant-based Covid vaccine a step closer to launch

Pre-Omicron study shows Medicago jab with GSK adjuvant is up to 88% effective against coronavirus

The Canadian biotech Medicago and GSK are seeking regulatory approval for the vaccine, which uses plants to express the protein needed © Medicago

Medicago: Covifenz

This vaccine may also be referred to as CoVLP, MT-2766, Plant-based VLP

PHASE 1 | PHASE 2 | PHASE 3 | APPROVED

About Trial Phases

2 Trials

NCT04450004
Canada

NCT05065619, jRCT2051210093
Japan

2 Trials

NCT04636697
Argentina, Brazil, Canada, United Kingdom of Great Britain and Northern Ireland, United States of America

NCT05065619, jRCT2051210093
Japan

2 Trials

NCT04636697
Argentina, Brazil, Canada, United Kingdom of Great Britain and Northern Ireland, United States of America

NCT05040789
Canada

Approvals

1 Country
Canada

The industry gold standard: Agroinfiltration of *Nicotiana benthamiana*

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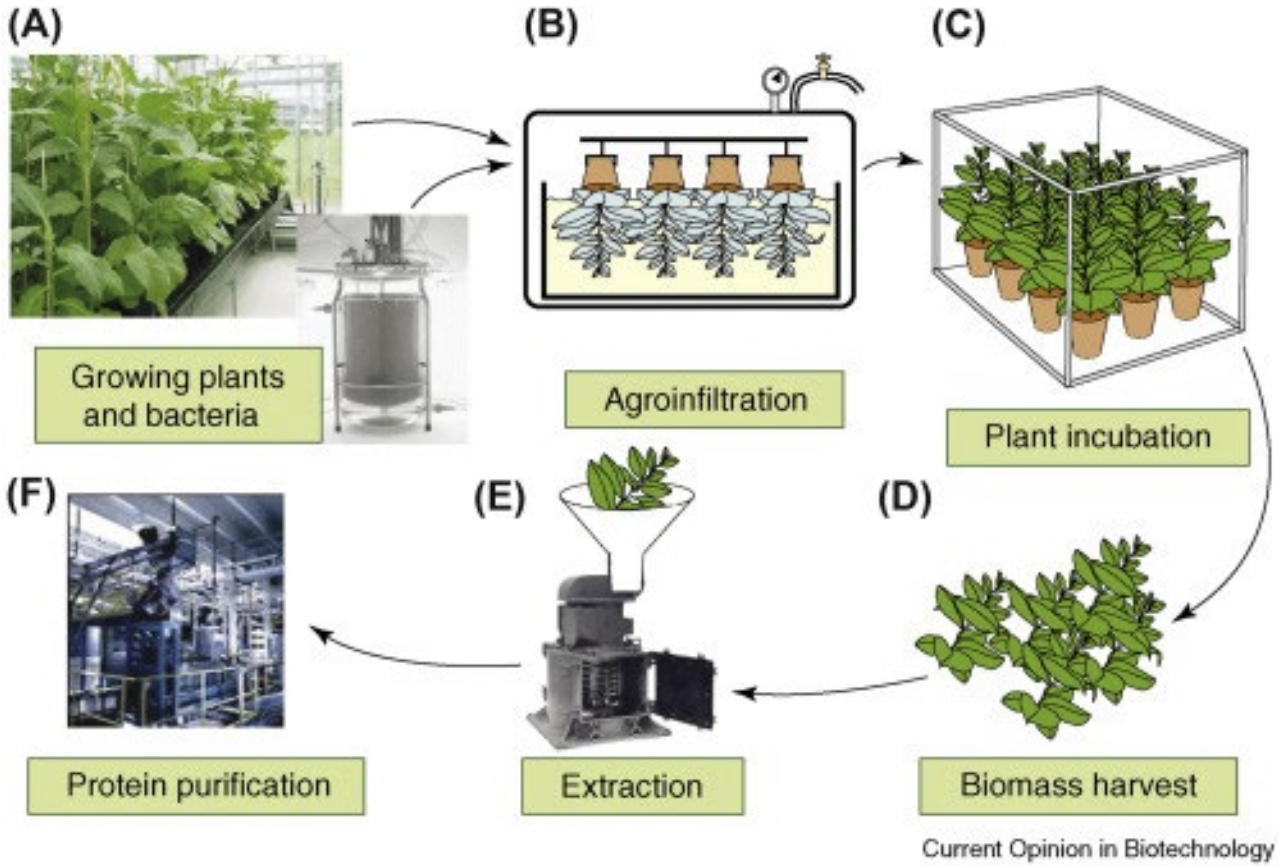


Current Opinion in Biotechnology

Companies world-wide operating at the very high value segment

M

USA

iBio

KBio

British American Tobaco

UK

Leaf Expression Systems

Canada

medicago

Germany

ICON GENETICS

NOMAD

Thailand

BAIYA PHYTOPHARM

China

cc-pharming

High and medium- value segment companies world-wide

L

Island

ORF GENETICS

Growth factors ***Hordeum vulgare***

Germany

NOMAD

Protein sweeteners

Nicotiana tabacum

France

CORE BIOGENESIS

Growth factors

Camelina sativa

XL

Very large scale segment companies world-wide (start ups)

Kyomei
Next Generation Meat Proteins

Kyomei
Next Generation Meat Proteins

Moolec®
SCIENCE IN ALTERNATIVE PROTEINS

NxG

Plant Synthetic Biology (R+D and start-ups)
Highly innovative bioproducts

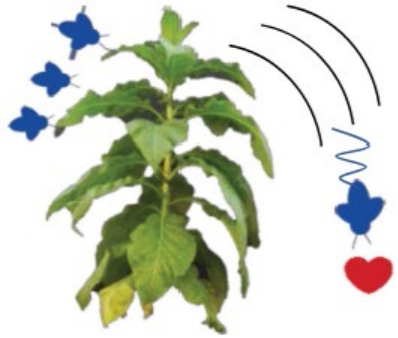
neoplants
BIOENGINEERED PLANTS THAT FIGHT AIR POLLUTION

light bio
biodesigns in living light

Plantas biofactoría de pheromonas sexuales de insectos para protección sostenible de cultivos

SUSPHIRE

PHEROPLUS



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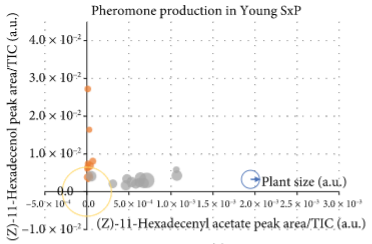
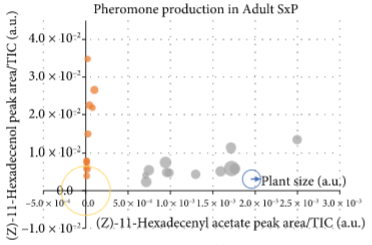
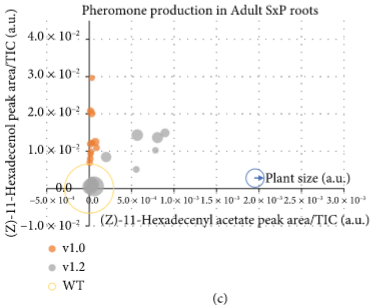
Show citation

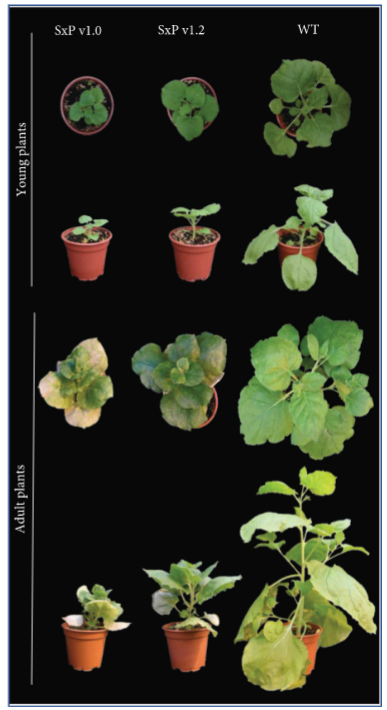
Production of Volatile Moth Sex Pheromones in Transgenic *Nicotiana benthamiana* Plants

Sexy Plant v1.2









(d)

What about Spain?

Leading research position in Plant SynBio and Molecular Farming

upna

Universitat de Lleida

ESPAÑA

IdAB
Instituto de Agrobiotecnología
Agrobioteknologiako Institutua

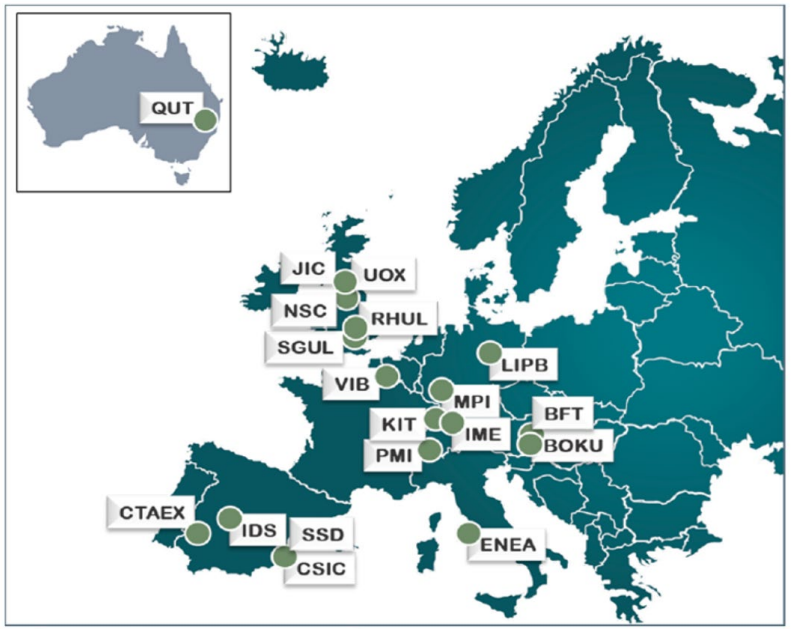
UCLM
UNIVERSIDAD DE CASTILLA-LA MANCHA

agrenvec Pioneer SMEs in the field

Founded in 2002

Newcotiana

Accelerated breeding of Nicotiana biofactories with New Plant Breeding Techniques



NEWCOTIANA

Accelerated breeding of Nicotiana biofactories with New Breeding Techniques

Industrial products
Food products/aditives
Biorefineries

OPEN FIELD

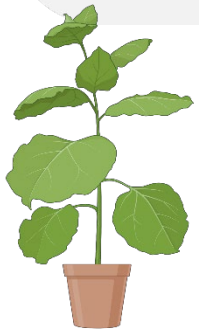
High-value products
Food-feed, agro, veterinary, cosmetics

CONTAINED, GAP/GMP

Very high value products
Pharmaceuticals (vaccines, antibodies, etc),

CONTAINED- GMP

Nicotiana tabacum



Nicotiana benthamiana

NEWCOTIANA Field trials 2020-2021-2022

newcotiana

ctaex centro tecnológico nacional agroalimentario

idoasis

ENEA

CSIC Consejo Superior de Investigaciones Científicas

ibmcp

VIB Plant Science

Royal Holloway University of London

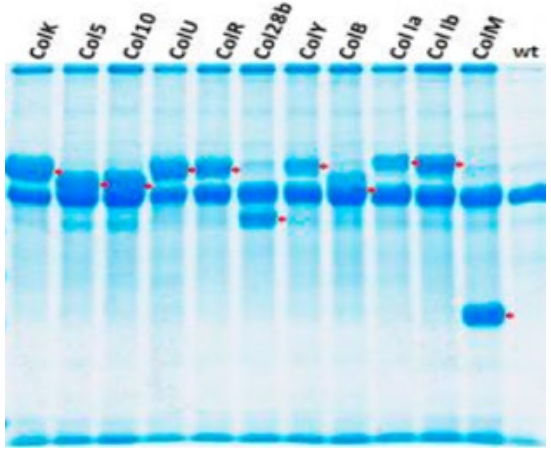
Nomad NOMAD Bioscience GmbH activities in Spain CTAEX

Thaumatin II produced in tobacco

- Natural non-caloric sweetener/flavor modifier produced in plants
- Sweetest known natural substance: 11.000 times sweeter than sugar (w/w)
- Can replace: ≥35% of sugar without taste changes; 50% - with light lingering aftertaste; similar when replacing corn syrup

Salmocin E1b in tobacco

- Salmocin for control of *Salmonella* in processing of poultry, swine, fish meat and eggs as **food processing aid**
- Natural protein, non-antibiotic, the most potent known bacteriocin, active at nanomolar concentrations
- Broadly active against **all** *Salmonella* pathovars



The start-up ecosystem in Spain

Madeinplant

Synthetic Biology meets Plant Biofactories

Customized bioproducts for cosmetics, pharma, and food industries.
Disruptive technologies for next generation plant-made products

Pluribodies: recombinant polyclonal antibodies

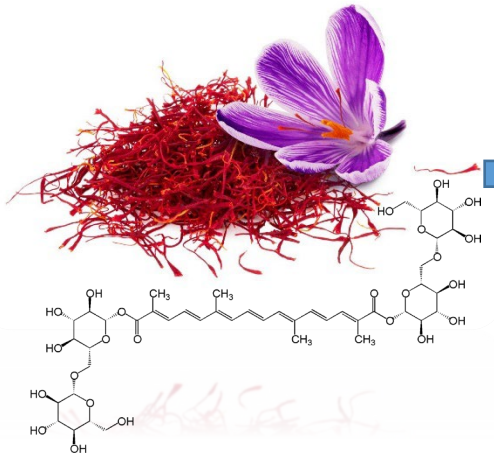
SPIN-OFF upv

agrotecUV agroalimentación + tecnología

The start-up ecosystem in Spain

NAPLATEC
Biotechnology & Nanotechnology

Saffron-made crocins



Tomato-made crocins

Metabolic engineering
meets
Plant Biopharming

Affordable Crocins
Sustainable, secured production
Anti-oxidant, anti-inflamatory activities
Potential aplications in anti-aging, neurodegenerative diseases

UCLM UNIVERSIDAD DE CASTILLA-LA MANCHA

CSIC Consejo Superior de Investigaciones Científicas

… and hopefully many more

Plant Biofactories

@dorzaez
@NewcotianaP

Gracias por su atención