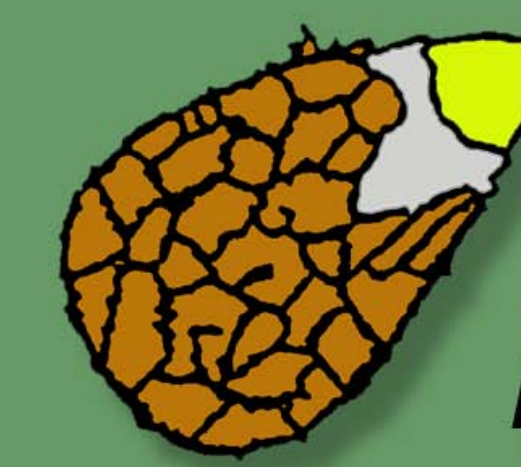




**ROYAL
HOLLOWAY
UNIVERSITY
OF LONDON**

Novel biomaterial engineering technologies, molecular and hormone analyses to improve vegetable seed priming and production in stressful environments

Gerhard Leubner & Tina Steinbrecher
Chair of Plant Biochemistry Seed Biomaterial Engineer



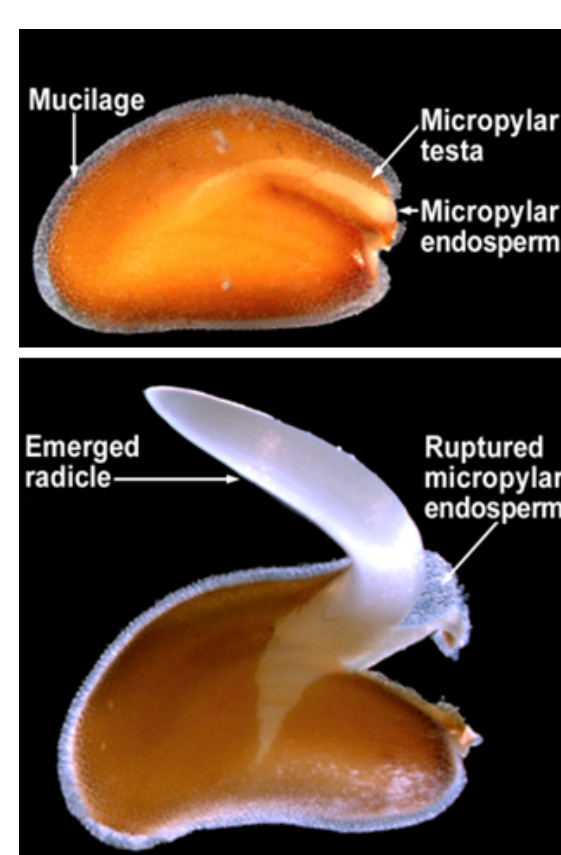
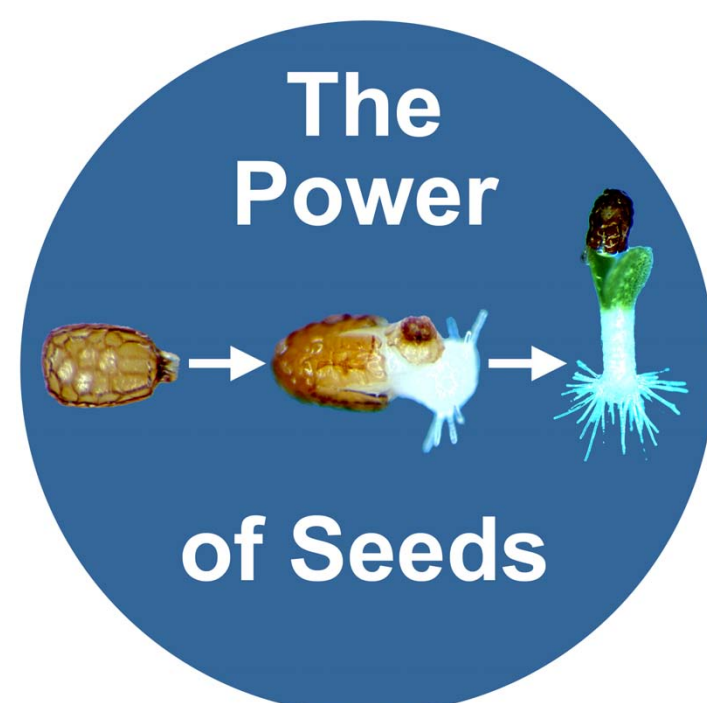
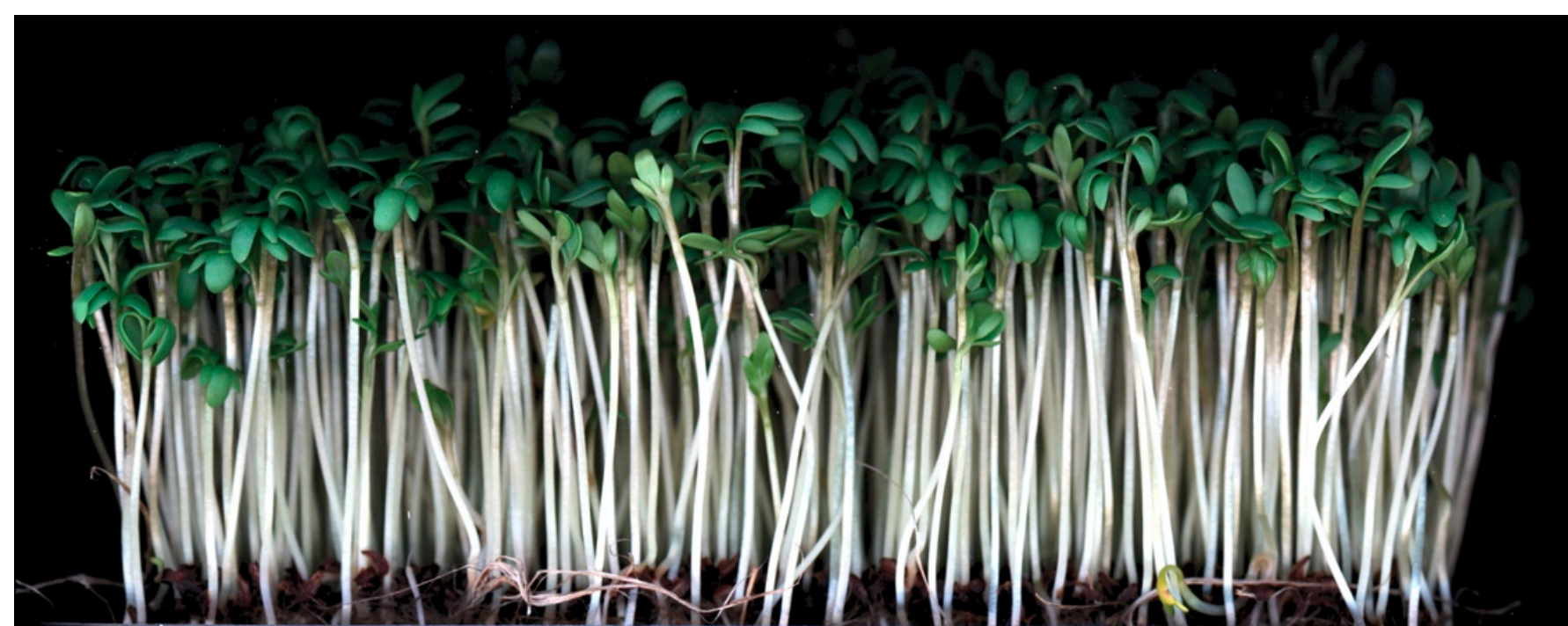
**The Seed
Biology Place**

Agri-Tech Catalyst collaboration with Adrian Dunford & Sue Kennedy, Elsoms Seeds Ltd, Spalding

www.seedbiology.eu

Interdisciplinary and integrated research approaches

- Plant seeds, fruits and tubers are at the beginning and the end of all important supply chains for food, feed, sprout and tuber vegetables, garden flowers and other horticultural products. **Seed and bud dormancy, germination and sprouting** properties are key quality traits for **secure, sustained and resilient horticulture**.
- The long term goal of our research group '**The Seed Biology Place**' – www.seedbiology.eu at Royal Holloway University of London (RHUL) is to understand the molecular mechanisms underlying these quality traits in order to **control dormancy and storage**, to **improve seed quality and seedling performance** of horticultural and agricultural crops, and to **develop improved weed management tools and strategies**. This knowledge is key for high quality and yield even in stressful production environments and adaptation to a changing climate.



Horticultural research expertise and example seed project funding

BBSRC project 'Roles of Proanthocyanidins in Seed Dormancy'

Wheat and Brassicaceae (garden cress) seeds
2015-2017, Leubner lead PI, Steinbrecher Co-I



SeedAdapt – ERA-CAPS European Consortium

Dimorphic fruits/seeds as stress adaptation mechanisms in unpredictable environments - www.seedadapt.eu
2014-2017, Leubner lead PI, 7 European partner labs



AgriTech Catalyst Early Stage feasibility study with Elsoms Seeds

Vegetable seed priming: novel technologies including biomechanics
2014-2016, Leubner lead PI, Steinbrecher Project Manager



Sugar Beet Seed Quality Projects with KWS Saat AG

1) Seed technologies and aging during storage, 2) Biomechanics
2013-2015, two projects with either Leubner or Steinbrecher PI



Begonia Seedling Uniformity & Flower Seed Dormancy with Benary

2005-2006, earlier horticultural research by Leubner, unpublished

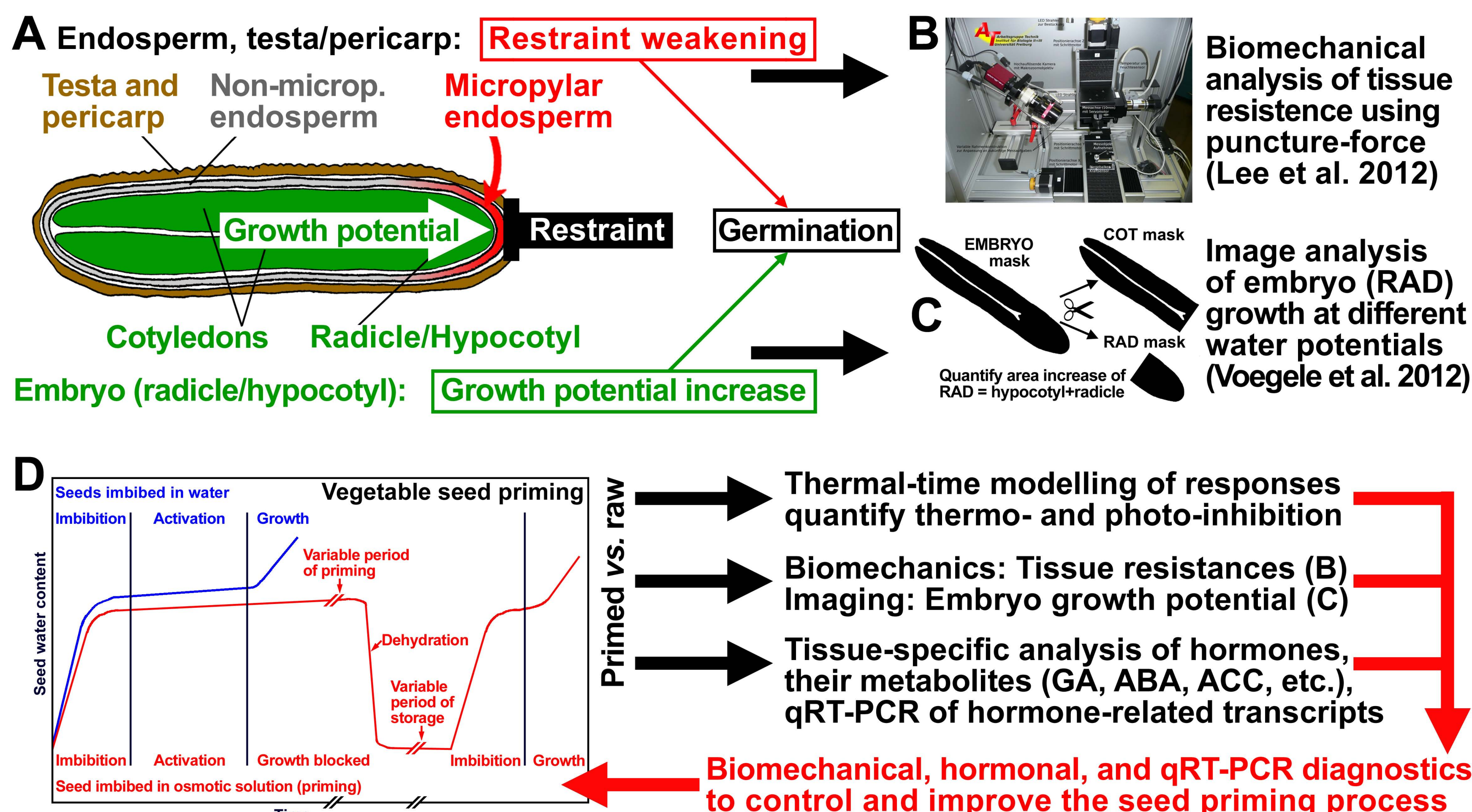


Potato Tuber Dormancy and Bud Sprouting during Storage

Earlier work by Leubner, publication Rentzsch et al (2012) in Planta 235:137-151

Project outline and novel innovative technologies

- In our **Agri-Tech Catalyst collaboration project** with the seed technology and vegetable breeding company **Elsoms Seeds (Spalding, www.elsoms.com)** we utilise an interdisciplinary and integrated approach with **novel technologies** to provide innovative diagnostic tools to further improve **vegetable seed priming** and production. This includes **biomechanical tissue analysis (Dr-Ing. Tina Steinbrecher, plant biomaterial engineer RHUL)**, advanced **hormone and transcript (qRT-PCR) analytics**, and physiological temperature stress modelling of germination.

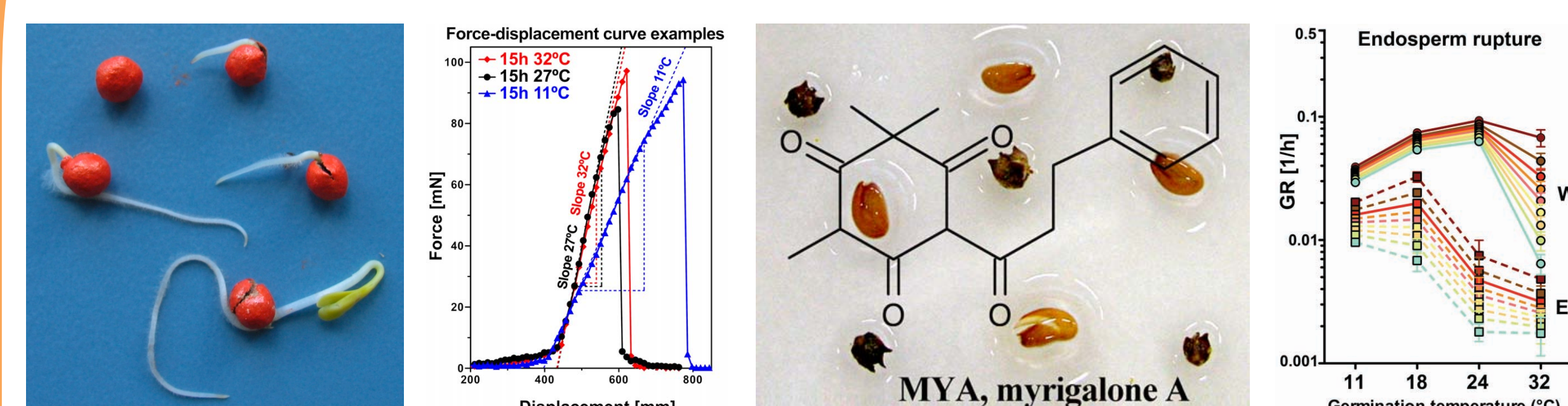


- Seed technologies including priming, pelleting, and beneficial additives** (hormones, allelochemicals, microorganisms) are a major focus of our research. We combine abiotic stress modelling, especially of ambient temperature and water availability, with novel biomaterial engineering techniques and advanced imaging, tissue-specific hormone and transcriptome (next-generation sequencing) in integrated projects to address fundamental and applied questions.

Impact for industry and the horticulture sector

- Novel technologies for improving seed, fruit, bulb and tuber quality
- Improved uniformity and sturdiness of vegetable & flower seedlings
- Enhanced seed and seedling performance in stressful environments
- Novel seed treatments to increase stress tolerance and resilience, e.g. heat or cold stress during leafy salad seedling raising
- Reduction of post-harvest storage losses in quality and yield
- Reliable material properties of vegetable and flower seed pellets
- Reduced vegetable and flower seed and bud dormancy issues
- New technologies and compounds to manage weed seed banks
- Healthy harvest and novel nutritional flavour & storage compounds

Potential research challenges in horticulture



- Adaptation of seeds, fruits, bulbs and tubers to climate change
- Mechanisms of seed & seedling vigour in stressful environments
- Improving harvest quality of seeds, fruits, bulbs and tubers
- Understanding the mechanisms underlying post-harvest quality
- Molecular mechanisms of seed longevity & aging during storage
- Understanding the mechanisms of weed and flower seed dormancy
- Developing novel treatments to improve vegetable seed quality
- Improving biomaterial properties of seed/fruit coats and pellets
- Allelochemicals and microbes as seed enhancement technologies
- Biochemistry of novel crop seed/fruit flavour & storage compounds

The Seed Biology Group of Professor Gerhard Leubner at RHUL:

Dr-Ing Tina Steinbrecher (Research Fellow, Biomechanical Engineer, BBSRC)
Dr Marta Perez (BBSRC Proanthocyanidins)

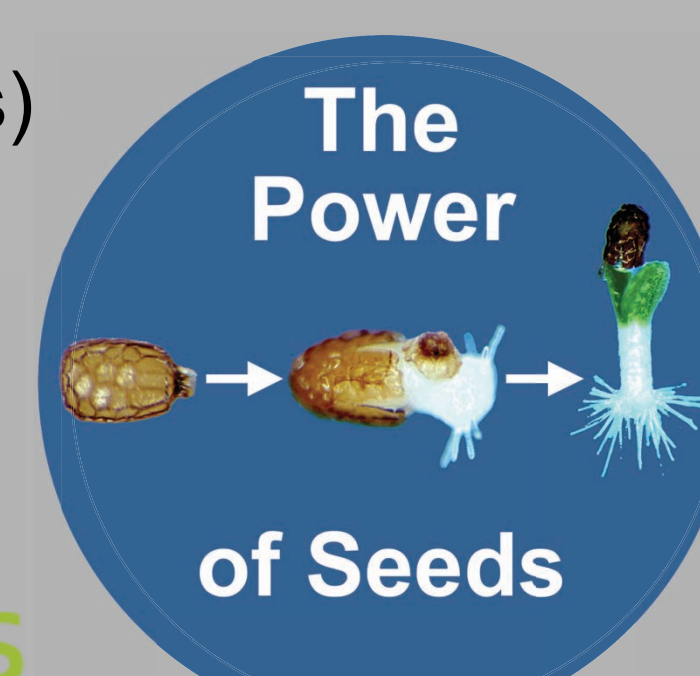
Dr Kazumi Nakabayashi (Agri-Tech Catalyst with Elsoms Seeds)
Christina Schulze (Agri-Tech Catalyst with Elsoms Seeds)
Giles Grainge (iCASE PhD student with Elsoms Seeds)

Dr Michael Ignatz (KWS Saat AG Sugarbeet)

Dr Kai Graeber (ERA-CAPS SeedAdapt)

Dr Safina Khan (Technician, SeedAdapt)

Dr Lorna Ravenhill (Consortium Manager, SeedAdapt)



www.seedbiology.eu

Agri-Tech Catalyst
Helping to commercialise
UK agricultural innovation



Elsoms
The Seed Specialists

