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PHYCOMORPH

Advancing Knowledge Of Seaweed
Growth And Development

COST Action FA1406 (2015-2019)



Utrecht University



university of
 groningen





European Cooperation
in Science and
Technology



COST is supported by the EU Framework Programme
Horizon 2020

Building the next European Research Area

Bottom-up initiative to gather a scattered
community of researchers

Multidisciplinary

Networking of nationally funded research



WHO ARE WE ?



EU participants

- NO: SINTEF, NIBIO, MARFORSK
- DK: DTUniv, Aarhus Univ
- GE: Jena Univ, Marburg Univ
- BE: Ghent Univ
- FR: CNRS-UPMC Roscoff, Museum Paris, CEVA
- UK: Birmingham Univ, Durham Univ, Oxford, Cambridge Univ, IBioIC
- NL: NIOZ, Hortimare
- IE: NUI Galway
- ES: GC Univ, ECOS Marine Park
- PT: CCMAR Porto, CIMAR, Alga+
- IT: Trieste, Universita Politecnica delle Marche
- HR: Ruđer Bošković Institute
- EL: Athens Univ, Fisheries Kavala
- CY: Cyprus Univ Technology
- EE: Univ of Tartu
- LV: Riga Technical Univ
- IS: Icelandic New Energy
- CH: Zürich Univ

Permanently expanding





and.....



Non-COST countries

- Alexandria University **Egypt**
- INSTM - National Institute of Marine Sciences et Technologies **Tunisia**
- CSIR Central Salt and Marine Chemicals Research Institute **India**
- Hokkaido University **Japan**
- Muroran Marine Station **Japan**
- Skidmore College **USA**
- St. Francis Xavier University **Canada**
- University of Massachusetts **USA**
- Cegep de la Gaspésie et des Iles **Canada**
- Cinvestav-Merida **Mexico**

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

➤ **Generate**

Through collaborative publications

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate

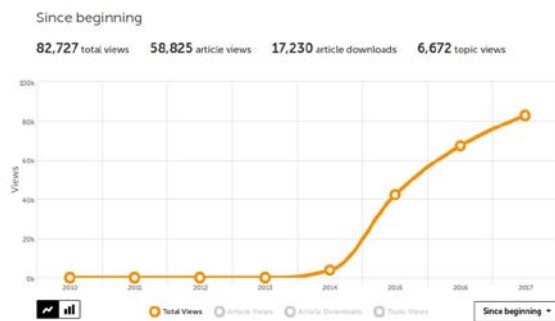
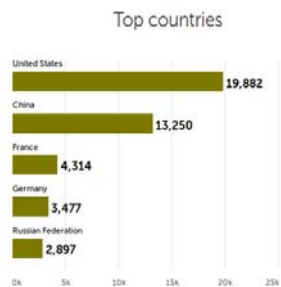
WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate

Open access - Large audience journals



Research Topic
From the emergence of multicellularity to complex

Research Topic

From the emergence of multicellularity to complex body architectures: update and perspectives on the biological mechanisms involved in macroalgal development.

Like Comment

4 0
11 9 1 2 53

Submission closed.

Overview **15** Articles **32** Authors Impact Comments

VIEWS
82,727

Articles

By Views By Type By Date

Exploring bacteria-induced growth and morphogenesis in the green macroalga order Ulvales (Chlorophyta)

Thomas Wichard

Review Green macroalgae, such as Ulvales, lose their typical morphology completely when grown under axenic conditions or in the absence of the appropriate microbiome. As a result, slow growing aberrant phenotypes or even callus-like morphotypes are observed ...

Published on 03 March 2015
Front. Plant Sci. doi: 10.3389/fpls.2015.00086

10,211 total views 21 shares

The green seaweed Ulva: a model system to study morphogenesis

Thomas Wichard, Bénédicte Charrier, Frédéric Mineur, John H. Bothwell, Olivier De Clerck and Juliet C. Coates

Mini Review Green macroalgae, mostly represented by the Ulvophyceae, the main multicellular branch of the Chlorophyceae, constitute important primary producers of marine and brackish coastal ecosystems. Ulva or sea lettuce species are some of the most abundant ...

Published on 19 February 2015

Topic Editors



Bénédicte Charrier
Centre national de la recherche scientifique (CNRS)
Paris, France

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Juliet C. Coates
University of Birmingham
Birmingham, United Kingdom

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Rafael R. Robaina
University of Las Palmas de Gran Canaria
Las Palmas de Gran Canaria, Spain

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2017

Viewpoint

Open access

Furthering knowledge of
seaweed growth and
development to facilitate
sustainable aquaculture

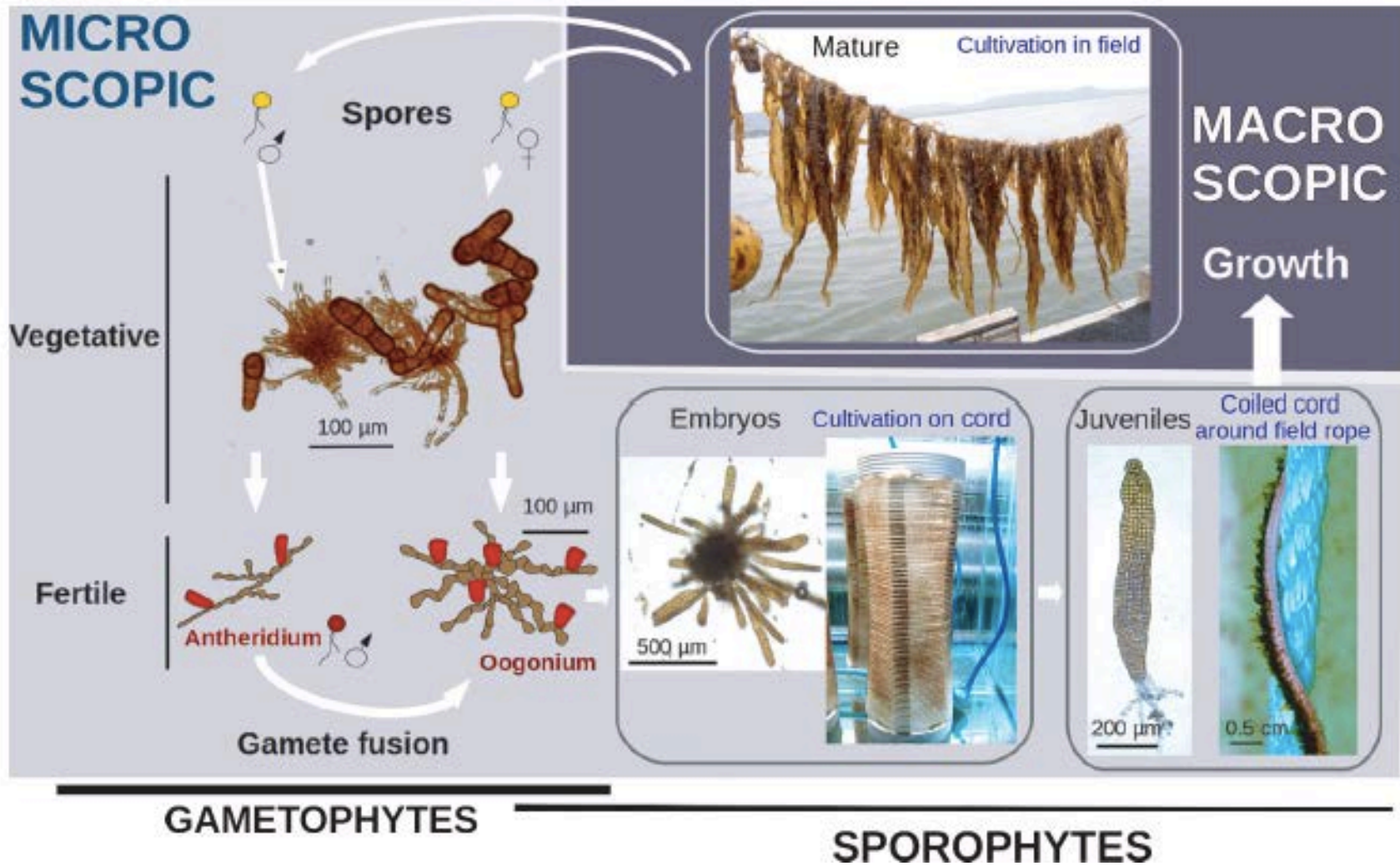
Charrier B, Abreu MH, Araujo R, Bruhn A, Coates JC, De
Clerck O, Katsaros C, Robaina RR, Wichard T.

doi: [10.1111/nph.14728](https://doi.org/10.1111/nph.14728).

Viewpoint

Furthering knowledge of seaweed growth and development to facilitate sustainable aquaculture

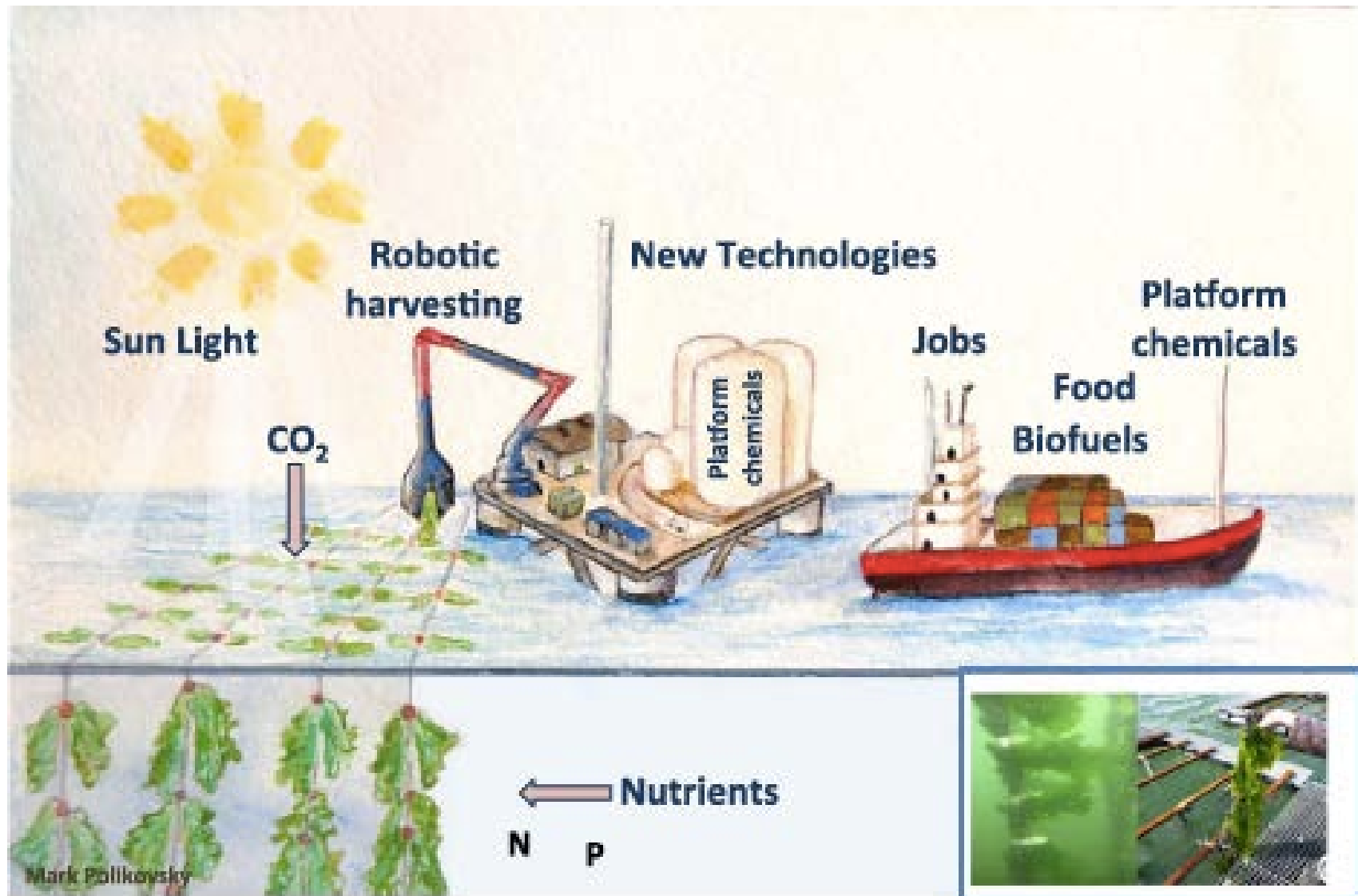
Charrier B, et al. (2017)



But also:

Offshore macroalgae biomass for bioenergy production:

Environmental aspects, technological achievements and challenges (2017). Fernand, Israel, Skjermo, Wichard, Timmermans, Golberg, *Ren. Sust. Energy Rev.*, DOI: 10.1016/j.rser.



WHAT DO WE DO ?



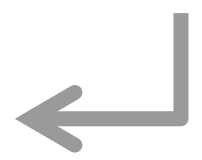
PRODUCER OF KNOWLEDGE

- Generate
- Disseminate

Open access - Large audience journals

Website

Website, Conferences



Search for experts

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate

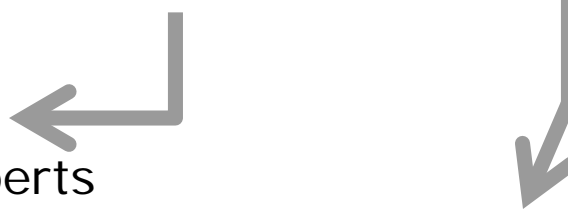
Open access - Large audience journals

Website, Conferences

Website



Search for experts



- 2015: European Phycological Conference
- 2016: International Seaweed Symposium
- 2017: International Phycological Conference
- 2017: International Societies of Applied Phycology

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate



• PRODUCER OF KNOW-HOW

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate



• PRODUCER OF KNOW-HOW

- 31 protocols specific for macroalgae

PROTOCOLS FOR MACROALGAE RESEARCH

(B. Charrier, T. Wichard &
CRK Reddy, Eds)

Hardcover, ~ 400p, release **Feb 2018**



Chemical composition

BIOCHAR

Chapter 10. Biochar production from seaweeds. *L. Contreras-Porcia, M. Araya, E. Garrido-Ramírez, C. Bulboa, J-P. Remonsellez, J. Zapata, C. Espinoza, J. Rivas*

POLYSACCHARIDES

Chapter 11. Identification and quantification of laminarins in brown algae. *A. Graiff, W. Ruth, U. Karsten*

Chapter 12. Determination of carbohydrate composition of macroalgae. *W. J. J. Huijgen, E.M. Cobussen-Pool, B.F. van Egmond, J.W. van Hal*

PROTEINS

Chapter 13. Quantification of proteins in seaweeds. *C. Safi, J. van Leeuwen, Y. Telleman, N. Engelen-Smit, L. van den Broek, P. Harmsen*

PHYTOHORMONES

Chapter 14. Comprehensive phytohormone quantification in the red alga *Pyropia yezoensis* by liquid chromatography-mass spectrometry. *T. Matsuura, I. C. Mori, Y. Ikeda, T. Hirayama and K. Mikami*

PHENOLICS

Chapter 15. Total phenolic content and antioxidant capacity analysis of seaweed biomass. *X. Hou, R. Neerup, A-B. Bjerre*

PIGMENTS

Chapter 16. Extraction of phycocyanin and phycoerythrin pigments from macroalgae and microalgae. *S. W. Beattie, M. Morançais, P. Déléris, J. Fleurence, J. Dumay*

OXYGEN SPECIES

Chapter 17. Quantification and localization of reactive oxygen species in marine macrophytes. *M. Kumar, L. Contreras-Porcia, N. M. Kumar, P. J. Ralph*

METABOLITES

Chapter 18. Metabolomics of intra- and extracellular metabolites from micro- and macroalgae using GC-MS and LC-MS. *C. Kuhlisch, G. Califano, T. Wichard, G. Pohnert*

METABOLITE SURFACE EXTRACTION

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Chapter 3. Derivation of clonal stock cultures and hybridisation of kelps: tool for strain preservation and breeding programs. *I. Bartsch*

Chapter 4. Cryopreservation of Macroalgae. *J. Day*

ENVIRONMENTAL IMPACT

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Chapter 7. A simple protocol for a rapid and consistent production of a large number of viable protoplasts from Ulvophyceae species. *V. Gupta, C.R.K. Reddy*

Chapter 8. Purification of sporulation and swarming inhibitors from *Ulva*: application in algal life cycle controlling. *R. W. Kessler, T. Alsufyani, T. Wichard*

Chapter 9. Preparation of axenic cultures in *Ulva* (Chlorophyta). *G. Califano, T. Wichard*

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Chapter 27. Coralline algae preparation for Scanning Electron Microscopy (SEM) and Optical Microscopy (OM). *S. Kaleb, G. Alongi, A. Falace*

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Chapter 29. Induction of sexual reproduction in *Spirogyra* cultures for laser capture microdissection of gametes and zygotes. *D. Saint-Marcoux, J. Langdale*

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Chapter 30. Cloning and expression strategies for the post-genomic analysis of brown algae. *A. Groisillier*

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate



• PRODUCER OF KNOW-HOW

- 31 protocols specific for macroalgae
- **19 lab-exchanges**

WHAT DO WE DO ?



PRODUCER OF KNOWLEDGE

- Generate
- Disseminate



• PRODUCER OF KNOW-HOW

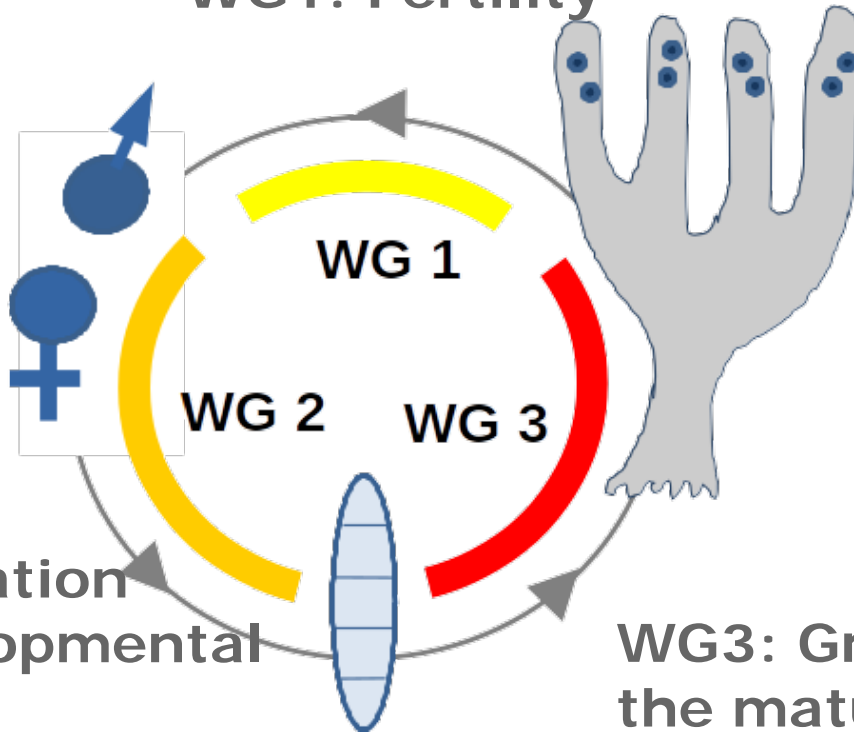
- 31 protocols specific for macroalgae
- 19 lab-exchanges
- 3 workshops, 2 Training Schools

CULTIVATION, METABOLOMICS, GENOMICS, MICROSCOPY

SCIENTIFIC OBJECTIVES

**PHYCOMORPH:
ADVANCING KNOWLEDGE
ON SEAWEED
GROWTH AND
DEVELOPMENT**

WG1: Fertility



**WG2: Fertilisation
& early developmental
stages**

**WG3: Growth towards
the mature stage**

- Environmental factors
- Signaling
- Cell recognition, fusion
- Cell cycle control
- Embryo polarisation
- Cell fate
- Long-distance and cell-cell communication
- Morphogens
- Tissue and body patterning
- Developmental mechanics

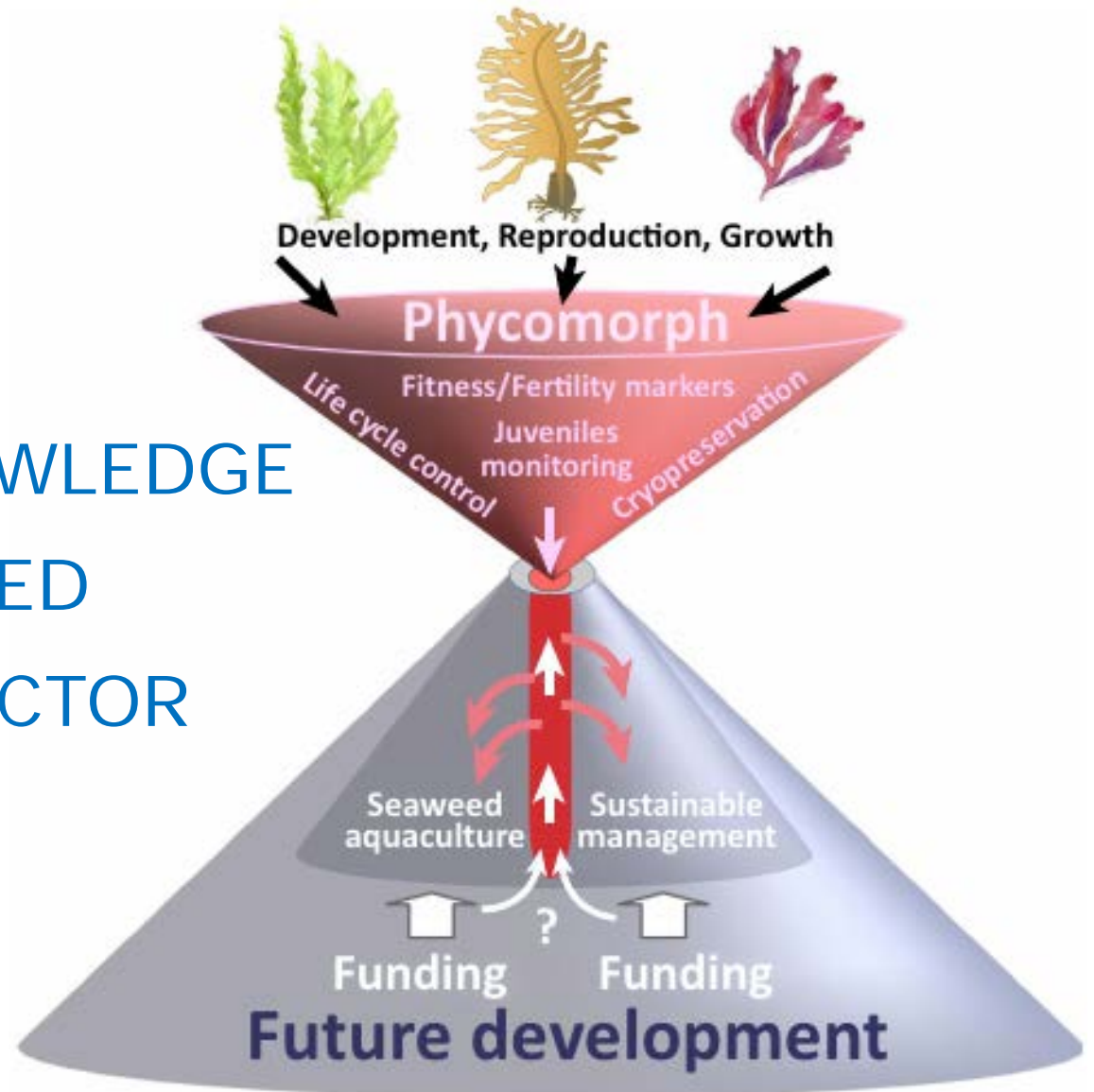


WG4: Technical tools

- Cultivation protocols
- Cell biology/Microscopy
- "-OMICS"
- Bioinformatics
- Modeling

AND NOW ?

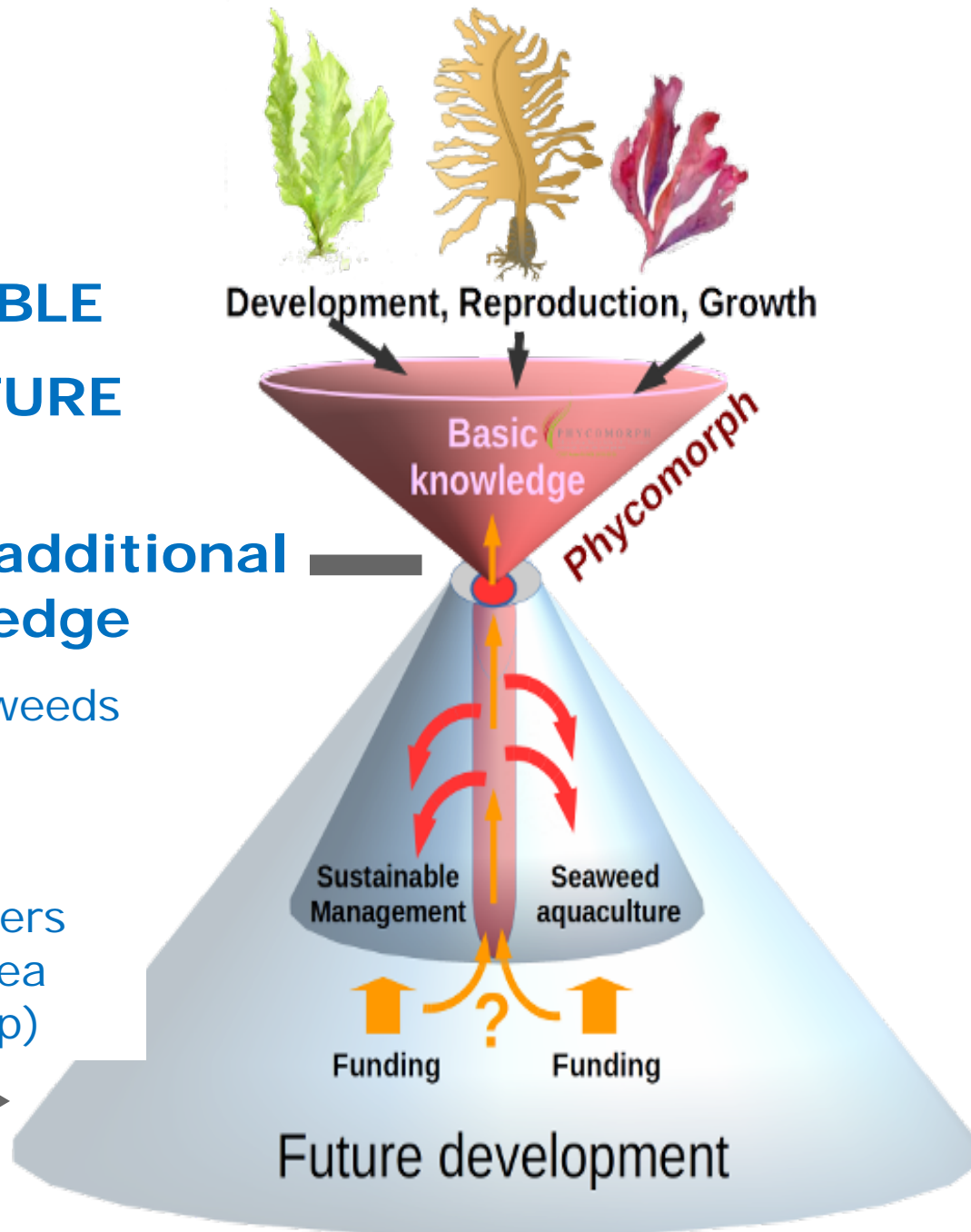
TRANSFERRING KNOWLEDGE
TO THE SEAWEED
AQUACULTURE SECTOR



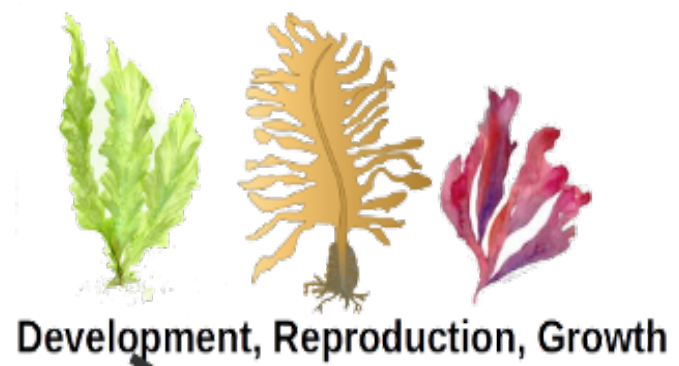
DEVELOP SUSTAINABLE SEAWEED AQUACULTURE

Necessary additional knowledge

- Cultivation of "difficult" seaweeds
- Life cycle control
- Cryopreservation
- Fitness markers
- Developmental stages markers
- Adhesion and resilience in sea
- Juvenile thallus density (kelp)



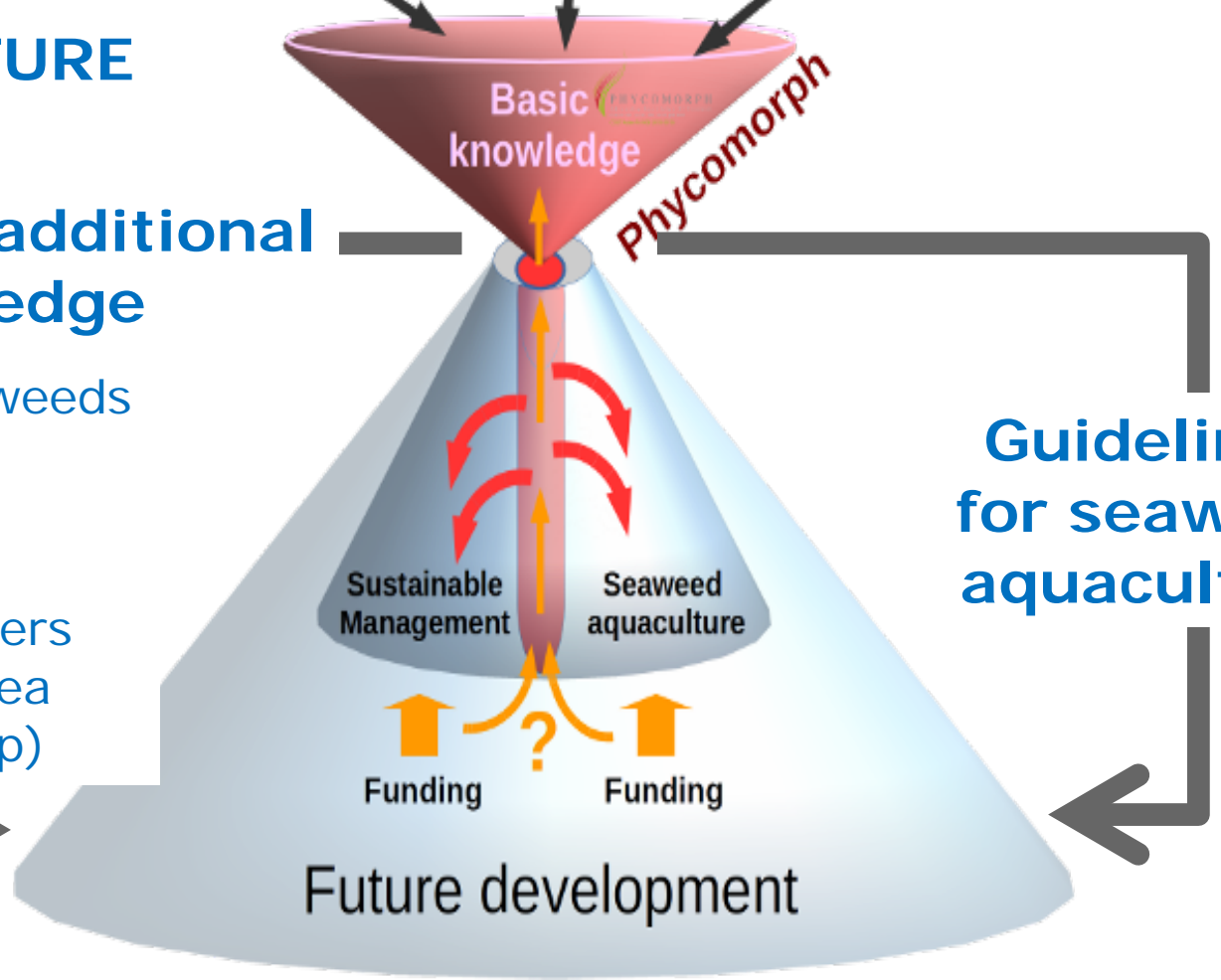
DEVELOP SUSTAINABLE SEAWEED AQUACULTURE



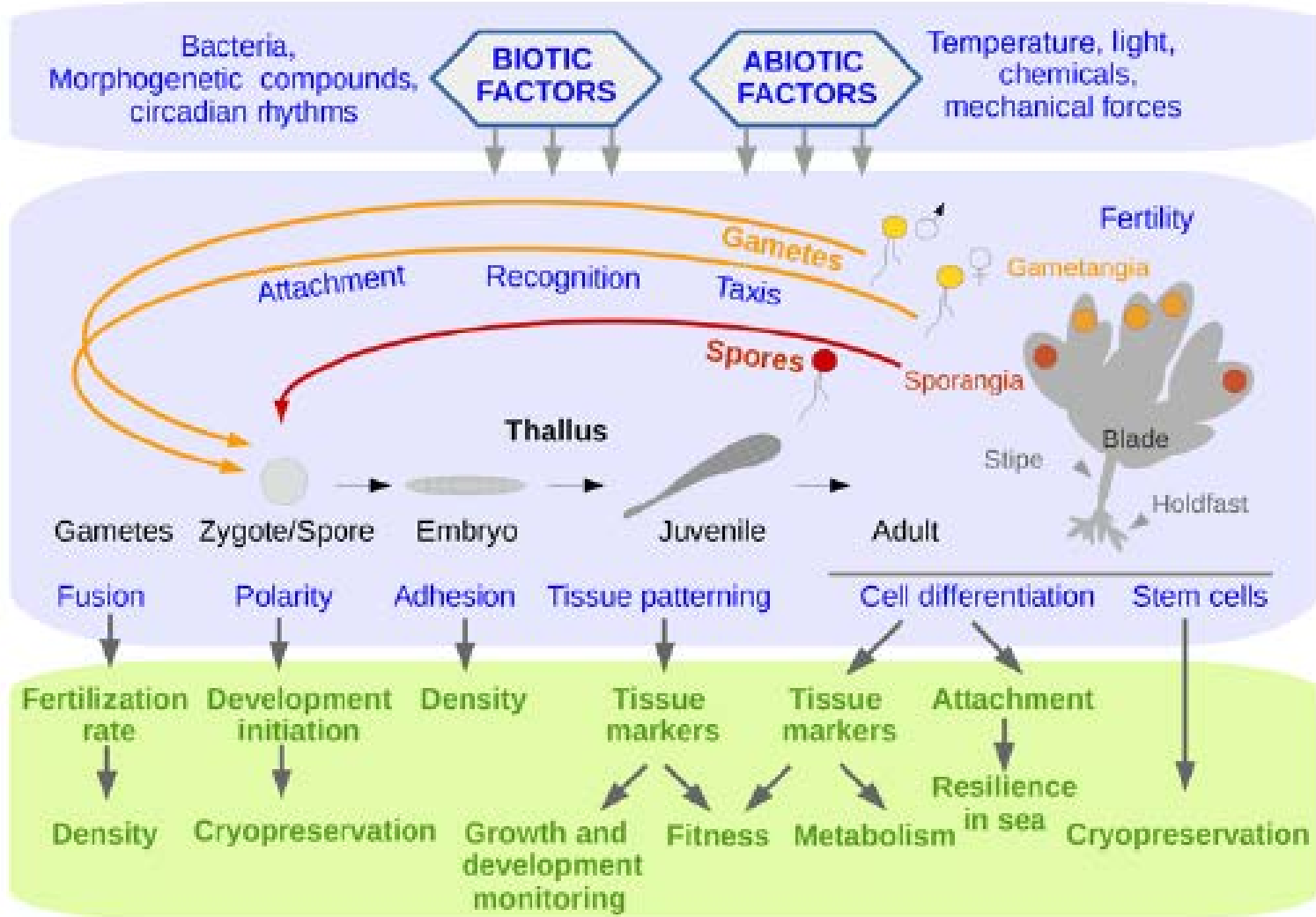
Necessary additional Knowledge

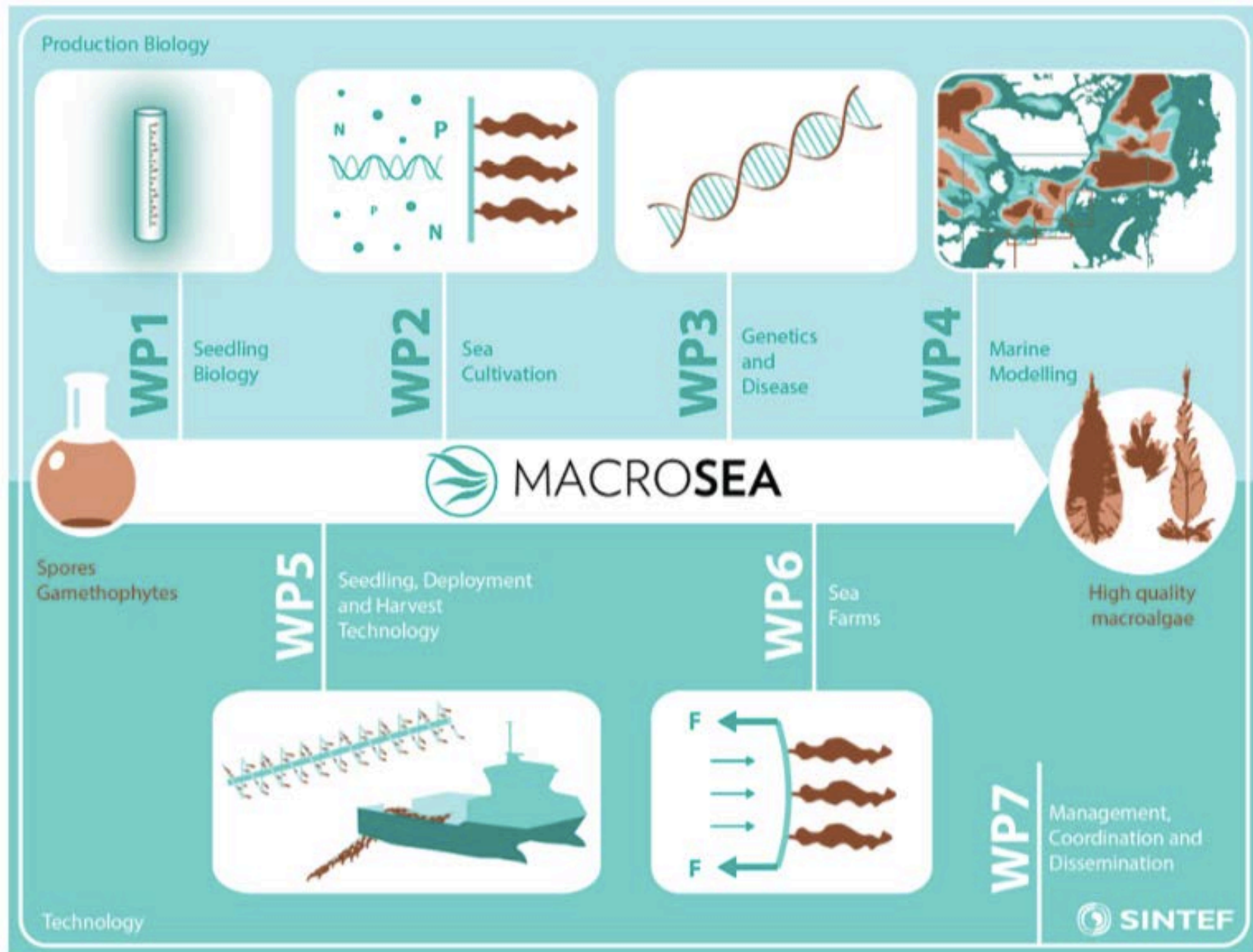
- Cultivation of "difficult" seaweeds
- Life cycle control
- Cryopreservation
- Fitness markers
- Developmental stages markers
- Adhesion and resilience in sea
- Juvenile thallus density (kelp)

Guidelines for seaweed aquaculture



Basic research





Interaction MACROSEA – PHYCOMORPH

Having seen what the objectives and activities of PHYCOMORPH are:

These are relevant for MACROSEA !?

What additions/changes would you like ?

Is there need for more exchange ?

How can we facilitate transfer of knowledge ?

.....?

.....?

Thank you !



P H Y C O M O R P H

**A d v a n c i n g K n o w l e d g e O f S e a w e e d
G r o w t h A n d D e v e l o p m e n t**

COST Action FA1406 (2015-2019)