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Editorial: The world of seaweeds

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Editorial on the Research Topic
The world of seaweeds

Nowadays, we use hundreds of algal species worldwide, which are destined for human or animal consumption and the production of hydrocolloids and other chemicals. Despite their importance and the increasing interest in seaweeds, our knowledge is still insufficient to sustain industrial and governmental expectations compared to land plants and agricultural practices. This Research Topic aimed to contribute to filling the gaps of knowledge of the basic and applied aspects that support and may improve future advances toward a sustainable seaweed industry.

The quality of the cultivated product could be determined in an efficient and non-invasive way

The availability of techniques that allow us to efficiently and cost-effectively assess production quality could be one of the most awaited practical advances for seaweed growers. Aware of this, Stedt et al. presents in their work a non-invasive technique, accessible via web and based on color, to determine the amount of nitrogen accumulated inside the green alga *Ulva fenestrata*, cultivated under different conditions. It is well known that nitrogen content is directly related to protein content and, therefore, to the nutritional quality of the produced seaweed.

Moreover, Derksen et al. has worked for similar purposes, using the very sensitive spectroscopic approach of ATR-FTIR duly combined with multivariate data analysis. In this way, they have been able to detect variations in metabolites (carbohydrates or nitrogen, for example) in the green alga *Ulva laetevirens*, also cultivated under different experimental conditions.

Cultivation conditions and the life-cycle stage can alter the contents of the metabolites of interest

The research groups of Concha Obando et al. and Pasqualetti et al. have focused their attention on the ability to cultivate species of interest for their metabolites, with the aim of eventually abandoning the use of natural populations, given the enormous amount of algal

biomass needed to exploit a species for industrial pharmacological purposes, for example. Thus, Concha Obando et al. focuses on the production of terpenoids by species of the Dyctiotaceae family and on the effects of cultivation conditions. On the other hand, Pasqualetti et al. has focused on primary metabolites and their modifications depending on the stage of the seaweed life cycle. The variation in the type and amount of compounds of industrial interest, such as carrageenan, depending on the phase of the life cycle, is well known in certain species. According to the results of these authors, this also seems to occur with the basic levels of metabolism in the Chilean and Antarctic *Sarcopeltis* species.

In vitro growth regulation may provide us with tools to improve propagation

Despite the relevance that growth regulation may have for developing more efficient cultivation practices, one of the least understood aspects of algae is the effect of growth- and development-regulating substances in algae. In this Research Topic, Luo et al. presents a new example of the effect of plant growth regulators such as gibberellic acid (GA3), naphthaleneacetic acid (NAA), or 6-benzylaminopurine (BAP) on regeneration in thalli of the brown alga *Sargassum fusiforme*, whose holdfast regenerated new juveniles induced by these hormones.

The group of Del Rosario Santana et al. adds a new case to the regulation of carposporogenesis in red seaweed. In this novel scenario, their results show that methyl jasmonate (MEJA) suppresses carrageenan synthesis (i.e., hydrocolloid of sulfated galactans) by disrupting most of the genes encoding precursors or those in charge of transformation into sulfated hexoses for galactan backbone synthesis. This dysregulation of galactan synthesis was illustrated by carrageenan vanishing in MEJA-treated fertile thalli of *Grateloupia imbricata* as MEJA disrupted the functional groups of carrageenan and flattened the spectral peaks in the FTIR spectrum of carrageenan. The celerity of these events is connected with the reduction in the maturation time of cystocarps and further alterations in the ploidy of the carpospores. The ploidy of thalli and spores of *G. imbricata* seems to confirm the induction of the mitotic production of haploid spores by MEJA, thus revealing MEJA as a plant regulator affecting the cell cycle, apart from its demonstrated effect on the life cycle.

Molecular tools are available to track the possible genetic interaction of the cultivar and natural populations

Concerns regarding potential interactions between the cultivar-defined population and the natural population always accompany intensive algal cultivation practices. Hence, demonstrating the convenience of molecular tools to monitor these undesirable interactions, Xu et al. shows us effective molecular markers able to track the gene interaction between the cultivar and natural population of *Neopyropia yezoensis* in China. Their results reveal possible genetic introgression over time.

Author contributions

PG: Writing – review & editing. RR: Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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