

## Microalgae as potential source of anticancer drugs

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Microalgae are valuable source of many unique biologically active compounds including anticancer compounds. Micro algae include marine blue green algae (Cyanobacteria). *Stigonema* sp. is a type of cyanobacterium from which a compound "Scytonemin" is isolated. This compound can provide an important agent having anti-proliferative and anti-inflammatory activities. Cell extracts of *Calothrix* isolates are found helpful in inhibiting the growth of human HeLa cancer cells in a dose dependent manner. Calothrixin A (I) and B (II), pentacyclic metabolites are obtained from micro algae, which have growth inhibitory effects. Curacin-A obtained from the organic extracts of Curacao collections of *Lyngbya majuscula* is found to be unusually potent anti-proliferative agent. It shows inhibitory effect against colon, breast and renal cancer cells. Largazole is another compound having anti-proliferative activity was obtained from *Symploca* sp. And Apratoxins, obtained from cyanobacteria, have the ability of inhibiting a variety of cancer cells. An example of apratoxin is apratoxin-A which is obtained from *Lyngbya boulloni* and is found to have cytotoxic effect on adeno-carcinoma. A compound, coidamide-A obtained from *Leptolyngbya* is found to be cytotoxic in mouse models. Other discoveries are compounds cryptophycin 1 and 8, borophycin and cyanovirin. Borophycin is obtained from marine cyanobacterial strains of *Nostoc spongiaeforme* and *Nostoc linckia* var. *tenuis*. It is a boron containing metabolite and is found to have effective cytotoxicity against human epidermoid carcinoma (LoVo) and human colorectal adeno-carcinoma cells. Cryptophycin-I obtained from *Nostoc* sp. GSV 224 have potent cytotoxic activity against human tumor cells especially solid tumors.

Microalgae notably *Dunaliella* and *Spirulina* are also rich source of natural beta carotene (precursor of vitamin A) and have been extensively tested for anticancer effects that are well documented. Besides beta carotene, a blue green algal pigment, cryptophycin demonstrates a powerful anticancer property that is especially useful in the chemotherapy of drug-resistant tumors.

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## Plastid biotechnology for food security and bioeconomy

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The world population is expected to reach 9.2 billion by 2050. Therefore, food production globally has to increase by 70% in order to feed the world, while total arable land, which has reached its maximal utilization, may even decrease. Moreover, climate change adds yet another challenge to global food security. In order to feed the world in 2050, biotechnological advances in modern agriculture are essential. Plant genetic engineering, which has created a new wave of global crop production after the first green revolution, will continue to play an important role in modern agriculture to meet these challenges. Plastid genetic engineering, with several unique advantages including transgene containment, has made significant progress in the last two decades in various biotechnology applications including development of crops with high levels of resistance to insects, bacterial, fungal and viral diseases, different types of herbicides, drought, salt and cold tolerance, cytoplasmic male sterility, metabolic engineering, phytoremediation of toxic metals and production of many vaccine antigens, biopharmaceuticals and biofuels. This talk will give an overview over the current state of the art of plastid engineering in relation to agricultural production, innovation and bioeconomy.

### Biography

Jihong Liu Clarke received her PhD in 2003 and has extensive experience in tissue culture and genetic engineering of various plants including *Brassica napus*, barley, tobacco and poinsettia. Recently, her research group is focusing on genetic engineering of ornamental crops and molecular farming for plant produced human and fish vaccines. She is supervisor/co-supervisor to 6 PhD and 4 master students and has been project manager for 10 projects since 2005. She is serving as an editorial board member for 3 peer-reviewed journals and has published considerably in addition to her role as a coordinator for China relations at her institute.

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