

Was genau kauft man, wenn man *Chlorella* kauft?



What exactly do you get when you buy *Chlorella*?

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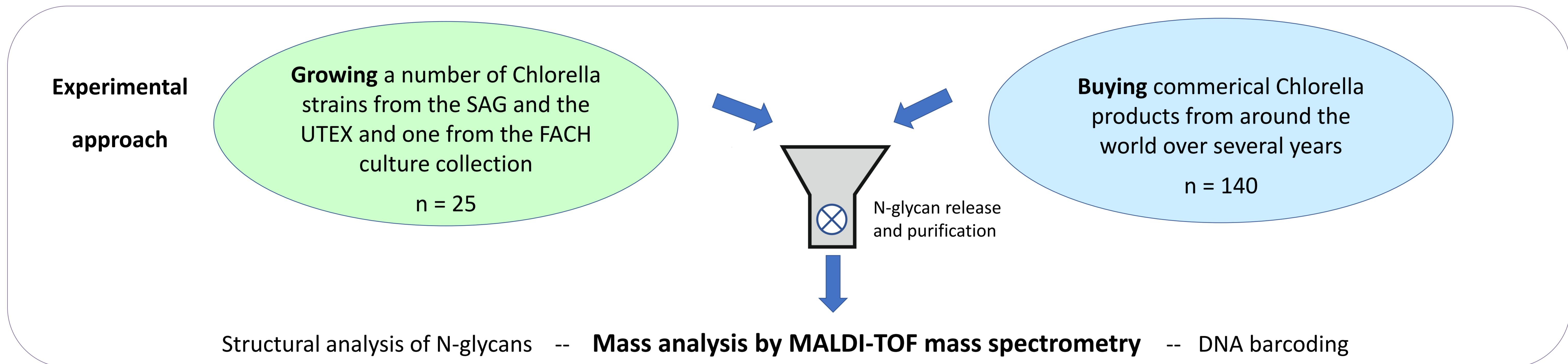
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Health benefits from consuming certain amounts of the green algae *Chlorella* are advertised in the most dazzling colors. In addition to the high protein content, their ability to bind and excrete heavy metals, their content of natural vitamin B12 (cobalamin) and sometimes also mysterious vital substances are promised. A recent study found large differences in the content of cobalamin vs. the inactive pseudo-cobalamin in large survey of different brands [1]. Side note: Many *Chlorella* products did in fact contain cobalamin whereas *Spirulina* products essentially contained pseudo-cobalamin [2].

Recent studies revealed striking differences in the patterns of protein-linked oligosaccharides (N-glycans) of *Chlorella* specimens [3-6].

► Different *Chlorella* strains have very different N-glycans with no resemblance to plant N-glycans

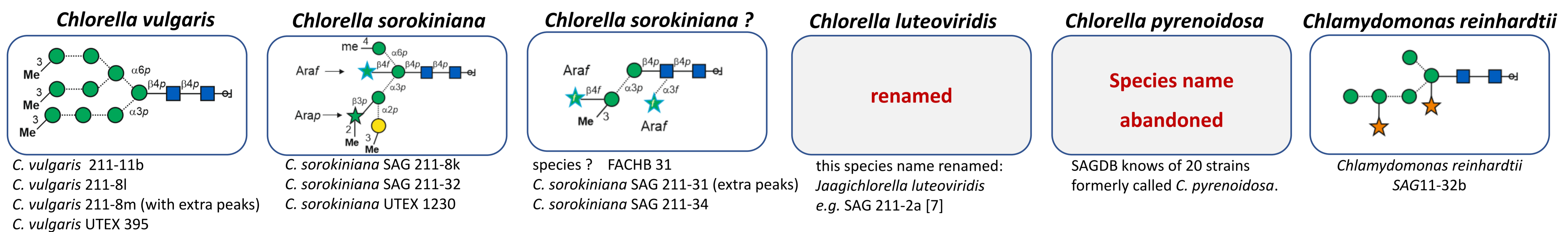
Given that N-glycan patterns for all plants are essentially identical and that all mammals exhibit the same structural elements, we surmise that the genesis of several unique glycosyl-transferases for each glyco-type is a large evolutionary lap that precludes to list different glyco-types under the same species or even genus name.



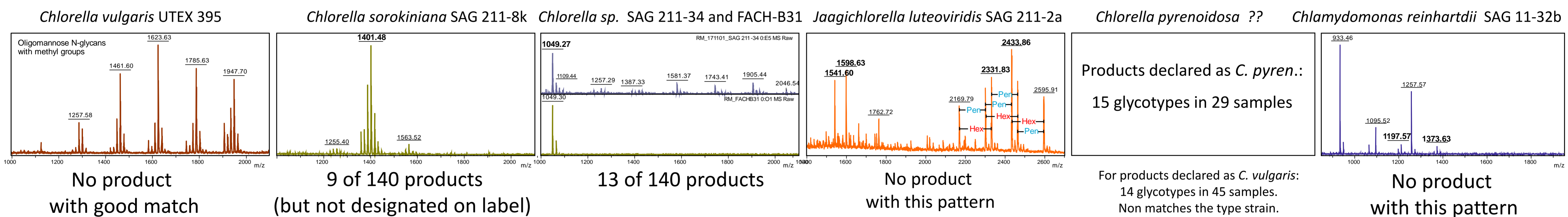
The European Novel food catalogue lists five *Chlorella* species (and also *Chlamydomonas*):

Chlorella vulgaris, *Chlorella sorokiniana*, *Chlorella luteoviridis*, *Chlorella pyrenoidosa*, *Chlamydomonas reinhardtii*.

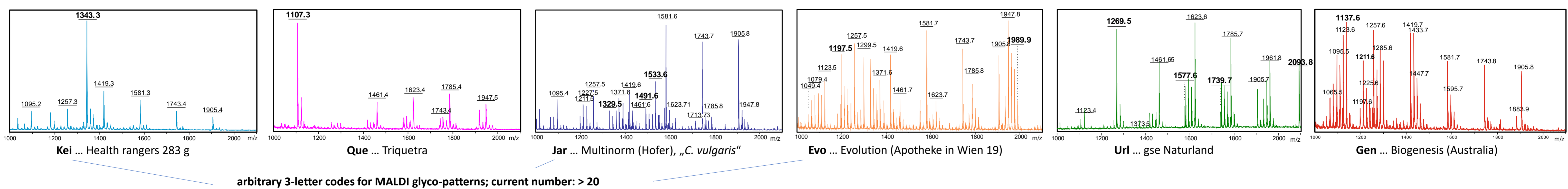
Structures of N-glycans of microalgae strains from type culture collections



MALDI-TOF mass spectrometry patterns typical for the above cultured algae strains



Examples of the other about 20 glycan patterns found among 140 commercial products



► Consistency: 16 products were re-purchased after 1–3 years and re-analyzed: 11 of 16 had a clearly different pattern

The different products may all have their benefits, but more clarity would be desirable.

► N-glycan structures / patterns could be a perfect tool for strain characterization

Currently, strain designations on neither products nor type collection strains have an accountable meaning.

[1] Potential of *Chlorella* as a Dietary Supplement to Promote Human Health. Bito T, Okumura E, Fujishima M, Watanabe F (2020) *Nutrients*. 12, 2524
 [2] Biologically active or just “pseudo”-vitamin B12 as predominant form in algae-based nutritional supplements? van den Oever SP & Mayer HK (2022) *Journal of Food Composition and Analysis* 109, 104464
 [3] A first view on the unsuspected intra-genus diversity of N-glycans in *Chlorella* microalgae. Mócsai R, Figl R, Sützl L, Fluch S, Altmann F. (2020) *Plant J.* 103, 184-196.
 [4] The Structural Difference of Isobaric N-Glycans of Two Microalgae Samples Reveals Taxonomic Distance. Mócsai R, Kaehlig H, Blaukopf M, Stadlmann J, Kosma P, Altmann F. (2021) *Front Plant Sci.* 12:643249.
 [5] The N-glycans of *Chlorella sorokiniana* and a related strain contain arabinose but have strikingly different structures. Mócsai R, Blaukopf M, Svehla E, Kosma P, Altmann F. (2020) *Glycobiology* 30, 663-676
 [6] N-glycans of the microalga *Chlorella vulgaris* are of the oligomannosidic type but highly methylated. Mócsai R, Figl R, Troschl C, Strasser S, Svehla E, Windwarder M, Thader A, Altmann F. (2018) *Sci Rep.* 9, 331
 [7] The genus *Jaagichlorella* Reising (Trebouxiophyceae, Chlorophyta) and its close relatives: an evolutionary puzzle. Darienko T, Pröschold T. (2019) *Phytotaxa* 388, 047-068.