

ALGA BIOLOGICS

Category:

Best Startup

Company Name:

ALGA BIOLOGICS

Turnover and/or Funding:

In September 2023, we secured three million euros through business angels, grants from the French government, bank loans, and convertible bonds from VC firms.

In 2024, we have started to implement a two phase go-to-market strategy and are addressing both the diagnostic and pharmaceutical markets. We are offering some BtoB service contract to produce or co-develop antibodies with clients. This strategy already allow us to sign partnership agreements with our 4 first customers to date.

We are currently fundraising to secure ~€12 million for 2026 and beyond. The €12 million (dilutive and non-dilutive) will be used to accelerate business development, acquire more clients, hire more people to successfully run all projects, continue improving our technology, increase production capability, and implement our technology in a GMP-compliant environment to produce clinical batches of antibodies, recombinant peptides, and proteins. Four millions of euros in non-dilutive are already secured and we are currently discussing with different VCs.

Sub-Category:

Biotechnology

Corporate history (creation, key milestones, main funding,...)Information on Condition / Disease and need for solution / product (prevalence, existing treatments / solutions):

Alga Biologics : sustainable antibody production using marine microalgae.

Founded in November 2021, Alga Biologics is a French deeptech and greentech startup.

Professor Muriel Bardor is the CEO and CSO, and Catherine Gallot is the Managing

Director. The company is pioneering an eco-friendly platform for producing antibodies using marine microalgae as natural biofactories.

Inspired by the oceans, Alga Biologics offers an alternative to current antibody production systems. Currently, most therapeutic antibodies are produced using Chinese hamster ovary (CHO) cells, which have been the standard since the 1980s. While effective, this system has several drawbacks, including high production costs, complex and unstable cell lines, potential viral contamination, and a significant environmental impact. These factors contribute to the high cost of antibody-based therapies, limiting access worldwide to just 5% of the population.

Meanwhile, the demand for antibodies continues to increase. In 2022, biotherapies accounted for 40% of global pharmaceutical sales, 81% of which were antibodies. The market is expected to surpass \$700 billion by 2030 due to the growing demand for immunotherapies. Currently, more than 110 therapeutic antibodies are commercialized, and over 500 are in clinical development.

In this context, Alga Biologics introduces a breakthrough innovation: producing functional antibodies in marine microalgae.

Professor Bardor and her previous academic team at the University of Rouen Normandie, in collaboration with the University of Marburg in Germany, were the first to demonstrate that microalgae can be used to produce antibodies on a laboratory scale. Such antibodies were first targeting viral pathogens (Hepatitis B and Marburg viruses). Their work had resulted in several publications and 3 patents, which are now exclusively licensed to Alga Biologics.

Since its founding, the company has increased production yield 80-fold and has successfully produced functional antibodies in 200-liter microalgae-based bioreactors. Its first proprietary product targets pediatric neuroblastoma, a rare and aggressive cancer that affects 25,000 children annually. The survival rate for high-risk forms is below 50%. Alga Biologics has validated that its microalgae-produced antibody targeting Neuroblastoma is functional, safe, and of high-quality, even at this pre-industrial scale. So far, there is two antibodies commercialised worldwide that are produce in mammalian cells. Those antibodies are very costly, not so efficient for high-risk neuroblastoma and induce lots of secondary effects for the patients.

This antibody serves as the company's industrial proof of concept, demonstrating the feasibility and competitive advantages of its platform. The company now aims to expand into other oncology targets, as well as autoimmune and infectious diseases. Its ambition is to democratize access to sustainable biologics. In this regards, the company recently demonstrated the successful production of functional microalgae-based trastuzumab and rituximab.

By reducing production costs and environmental impact, Alga Biologics offers a next-generation solution to one of biomedicine's most pressing challenges: making life-saving antibody treatments more sustainable and accessible to all.

Alga Biologics aims to become the world leader in the sustainable production of antibodies and, later, recombinant proteins using microalgae.

History of the development of the solution/product (Intellectual Property, preclinical and clinical datas, development collaborations):

Scientific Foundations and Intellectual Property Strategy of Alga Biologics

Prior to founding Alga Biologics, Professor Muriel Bardor and her team of researchers at the University of Rouen Normandie in collaboration with researchers from the University of Marburg demonstrated the feasibility of producing antibodies in marine microalgae. These included antibodies that target the hepatitis B virus and the Marburg virus. Remarkably, the produced antibodies naturally bear human-like glycosylation patterns, specifically oligomannosides. This glycosylation enhances the antibodies' affinity for Fcγ receptors, such as FcγRIIIa. This affinity is crucial for antibody-dependent cellular cytotoxicity (ADCC), a mechanism that is essential for eliminating cancer cells. Unlike plant-based systems, microalgae do not generate allergenic glycan structures, ensuring safer therapeutic profiles.

Microalgae produce this advantageous glycosylation without the need for costly inhibitors or post-production modifications, unlike other platforms. This technology has yielded biosimilar versions of rituximab and trastuzumab, which are monoclonal antibodies used to treat non-Hodgkin lymphoma and breast cancer, respectively, as well as a novel antibody that targets GD2. GD2 is a surface antigen that is overexpressed in cancers such as neuroblastoma. All antibodies produced in microalgae demonstrate strong antigen-binding activity and the ability to bind to human FcγRs and FcRn. Pharmacokinetic studies are ongoing.

The unique scientific and technical expertise at Alga Biologics is provided by the team's complementary experience. The team is currently composed of eight people with experience in diagnostics, pharmaceuticals, marine biotechnology, production and characterisation of antibodies.

The company's technology is protected by a robust and growing intellectual property portfolio. The company holds exclusive, worldwide licenses to three granted patents:

- Patent 1 (WO 2009/101160): Granted in Europe, the United States, Canada, Australia, Japan, Denmark, and Israel

- Patent 2 (WO 2012/013337): Granted in Europe, Canada, and the USA
- Patent 3 (EP22305618.5): Under extension in Europe, the United States, and Canada

A fourth patent was filed in France in October 2024.

The company has confirmed its freedom to operate in the production of both antibodies in microalgae and anti-neuroblastoma antibodies specifically.

In parallel, Alga Biologics is executing an evolving and proactive IP strategy.

In September 2022, a Soleau envelope was registered with the French INPI, and the microalgae strain producing the anti-neuroblastoma antibody was deposited with a Spanish reference bank-a critical step prior to patent filing. Patent filing is currently underway based on promising preclinical results.

In the coming months, Alga Biologics plans to file additional patents to protect its recent bioprocess optimization. The goal is to establish a comprehensive patent portfolio to secure its innovations, products, and technological advantages.

The company also emphasizes brand building. Its name, logo, graphic identity, and ten domain names are protected. It has an active presence on LinkedIn and its dedicated website has been launched in 2024.

All experimental work is traceable and recorded in dedicated lab notebooks, and strict attention is given to confidentiality and data protection.

We have recently partnerships with different companies for which we are producing their proprietary antibodies using our innovative bioproduction platform based on marine microalgae.

Why this drug or device is innovative, the broad implications for future research, and/or how it will improve the human condition:

Alga Biologics: A Sustainable, Cost-Effective, and Safer Platform for Antibody Production

Alga Biologics is aiming to revolutionize the production of antibodies through a disruptive biomanufacturing platform that replaces mammalian cells with marine microalgae. This innovative approach meets the growing demand for antibodies in immunotherapy and improves accessibility, safety, and sustainability.

The microalgae used, *Phaeodactylum tricornutum*, a marine diatom, is already well-known in the fields of aquaculture, agri-food, and cosmetics. It is approved by the FDA and Chinese health authorities for food and cosmetic application as well as

nutraceuticals, ensuring strong regulatory compatibility.

Key advantages of microalgae-based antibody production:

- Drastic cost reduction

Alga Biologics' proprietary platform is expected to cut production costs by up to 70%, significantly decreasing the final price of antibody therapies. This cost-efficiency could make life-saving treatments accessible to a much broader global population.

- Enhanced health safety:

Our system eliminates all animal-derived components. Since no animal cells or proteins are used, the risk of viral contamination is virtually zero. Furthermore, viruses capable of infecting mammalian cells cannot survive in the marine, room-temperature environment in which microalgae thrive. This allows Alga Biologics to eliminate viral inactivation steps, reducing complexity and waste in the purification process.

- Superior Therapeutic Efficacy

Antibodies produced in microalgae exhibit a higher biological activity, particularly through enhanced ADCC (antibody-dependent cellular cytotoxicity), a vital mechanism in cancer immunotherapy and greater affinity to FcRn important for the antibody half-life. This translates into potentially higher cure rates for patients.

- Simplified and Consistent Production:

Microalgae grow in a well-defined, chemically simple medium based on seawater, nitrogen, and phosphate that complies with pharmaceutical standards. They naturally secrete very few proteins, so the target antibody becomes the dominant protein in the culture medium. This simplifies downstream purification, offering a cheaper, more efficient process.

A Greener Biomanufacturing Solution:

Alga Biologics' technology provides a sustainable and carbon-negative alternative to existing bioproduction platforms. Microalgae use photosynthesis as their sole energy source and fix atmospheric CO₂ during growth. One kilogram of microalgae sequesters approximately two kilograms of CO₂. Producing one kilogram of antibodies using Alga Biologics' process captures around seven thousand kilograms of CO₂, equivalent to the emissions from seven round-trip flights between New York and Paris.

Microalgae also require less energy to grow. They thrive at room temperature (19-20°C), whereas mammalian cells require 37°C. This further reduces energy consumption and operational costs.

In conclusion,

Alga Biologics' platform delivers a high-impact solution that combines medical innovation with environmental and social responsibility. The company directly addresses six of the United Nations Sustainable Development Goals by supporting

equitable healthcare access, clean energy use, responsible production, and climate action.

By transforming the way antibodies are produced, Alga Biologics is helping create a more affordable, safer, and sustainable future for global healthcare.

Please provide appropriate references (PubMed, Abstract, Website):

Patents protected the innovation that are currently exploited by Alga Biologics

1. CADORET, J.-P., Carlier, A., Lerouge P., Bardor M., Burel, C., Maury, F. (2009) Production of glycosylated polypeptides in microalga. WO 2009/101160, Université de Rouen, IFREMER, CNRS.
2. Bardor M., Louvet, R., Saint-Jean, B., Burel, C., Baïet, B., Carlier, A., Michel, R., Cadoret, J.C., Lerouge, P. (2012) N-glycosylation in transformed *Phaeodactylum tricornutum*. WO/2012/013337, Université de Rouen, IFREMER.
3. Toustou, C., Mekhalfi, M., Kiefer-Meyer, M.C., Bardor, M. (2022) Production of therapeutic antibodies by the microalgae *Phaeodactylum tricornutum*. European patent n° 22305618.5-1111 - Université de Rouen Normandie.

Main related publications out of 106 publications

- Leprovoist, S., Plasson, C., Balieu, J., Walet-Balieu, M.-L., Lerouge, P., Bardor, M. and Mathieu-Rivet, E. (2024), Fine-tuning the N-glycosylation of recombinant human erythropoietin using *Chlamydomonas reinhardtii* mutants. *Plant Biotechnol. J.* <https://doi.org/10.1111/pbi.14424>
- Dehghani, J., Movafeghi, A., Mathieu-Rivet, E., Mati-Baouche, N., Sébastien Calbo, S., Lerouge, P., Bardor, M. (2022) Microalgae as an Efficient Vehicle for the Production and Targeted Delivery of Therapeutic Glycoproteins against SARS-CoV-2 Variants. *Marine drugs*, 2022, 10.3390/md20110657. <https://hal-normandie-univ.archives-ouvertes.fr/GLYCOMEVI/hal-03826579v1>

- Chuberre C., Chan P., Walet-Balieu M.-L., Thiébert F., Burel C., Hardouin J., Gügi B. and Bardor M. (2022) Comparative Proteomic Analysis of the Diatom *Phaeodactylum tricornutum* Reveals New Insights Into Intra- and Extra-Cellular Protein Contents of Its Oval, Fusiform, and Triradiate Morphotypes. *Front. Plant Sci.* 13:673113. doi: 10.3389/fpls.2022.673113. <https://hal-normandie-univ.archives-ouvertes.fr/GLYCOMEVI/hal-03665489v1>.

- Toustou C. #, Walet-Balieu M.-L.#, Kiefer-Meyer M.-C., Houdou M., Lerouge P., Foulquier F.* and Bardor M.* (2022) Towards understanding the extensive diversity of protein N-glycan structures in Eukaryotes. *Biological reviews*, 97, pp. 732-748. doi:

10.1111/brv.12820. # Equal contribution of the two first authors; *co-corresponding authors.

<https://hal-normandie-univ.archives-ouvertes.fr/GLYCOME/03468527v1>.

Dumontier R.*, Loutelier-Bourhis C.*, Walet-Balieu M.L.*, Burel C., Mareck A., Afonso C., Lerouge P.* and Bardor M.* (2021) Identification of N-glycan oligomannoside isomers in the diatom *Phaeodactylum tricornutum*. Carbohydrate Polymers, 259:117660. doi: 10.1016/j.carbpol.2021.117660. * Equal contribution of the authors.

Stelter S., Paul M.J., Teh A.Y., Grandits M., Altmann F., Vanier J., Bardor M., Castilho A., Allen R.L. and Ma J.K. (2020) Engineering the interactions between a plant-produced HIV antibody and human Fc receptors. Plant Biotechnology Journal. doi: 10.1111/pbi.13207.

Vanier G.*, Stelter S.*, Vanier J., Hempel F., Maier U.G., Lerouge P., Ma J. and Bardor M. (2018) Alga-made anti-Hepatitis B antibody binds to human Fcγ receptors. Biotechnology Journal, 13(4): e1700496. doi: 10.1002/biot.201700496. *Equal contribution of the authors.

Vanier G., Hempel F., Chan P., Rodamer M., Vaudry D., Maier U., Lerouge P. and Bardor M. (2015) Biochemical characterization of human anti-Hepatitis B monoclonal antibody produced in the microalgae *Phaeodactylum tricornutum*. Plos ONE, DOI:10.1371/journal.pone.0139282.

Main oral presentations to international meetings in the recent years

Presentation to ALGA EUROPE 2024 that was held in Athens, 11-13 December 2024

Comparative RNA-Seq transcriptomic analyses of ten ecotypes of *Phaeodactylum tricornutum*: toward identifying the best cell biofactory for the production of biologics
Charlotte Toustou , Isabelle Boulogne , Muriel Bardor
AlgaEurope 2023, Dec 2023, Prague (Czech Republic), Czech Republic

Muriel Bardor (2022) Towards understanding why N-glycosylation pathways evolved differently in microalgae
22th Annual Meeting of the American Society for Glycobiology, Nov 2022, Online meeting.

Muriel Bardor (2022) Microalgae as alternative cell factory for the production of monoclonal antibodies Cell Factories for Industrial Bioproduction (CFIB) - Selecting and enhancing expression systems for biomolecules production, Mar 2022, Romainville, France

All the abstract of publications, oral communication and posters are available on the HAL link below:

<https://normandie-univ.hal.science/GLYCOME/search/index?q=Muriel+Bardor>

References File Document upload:

[Alga Biologics Poster IFOBS juin2025.pdf](#)

[Alga_Biologics_Vanier et al 2015.pdf](#)

[Alga_Biologics_Dumontier et al 2021.pdf](#)

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