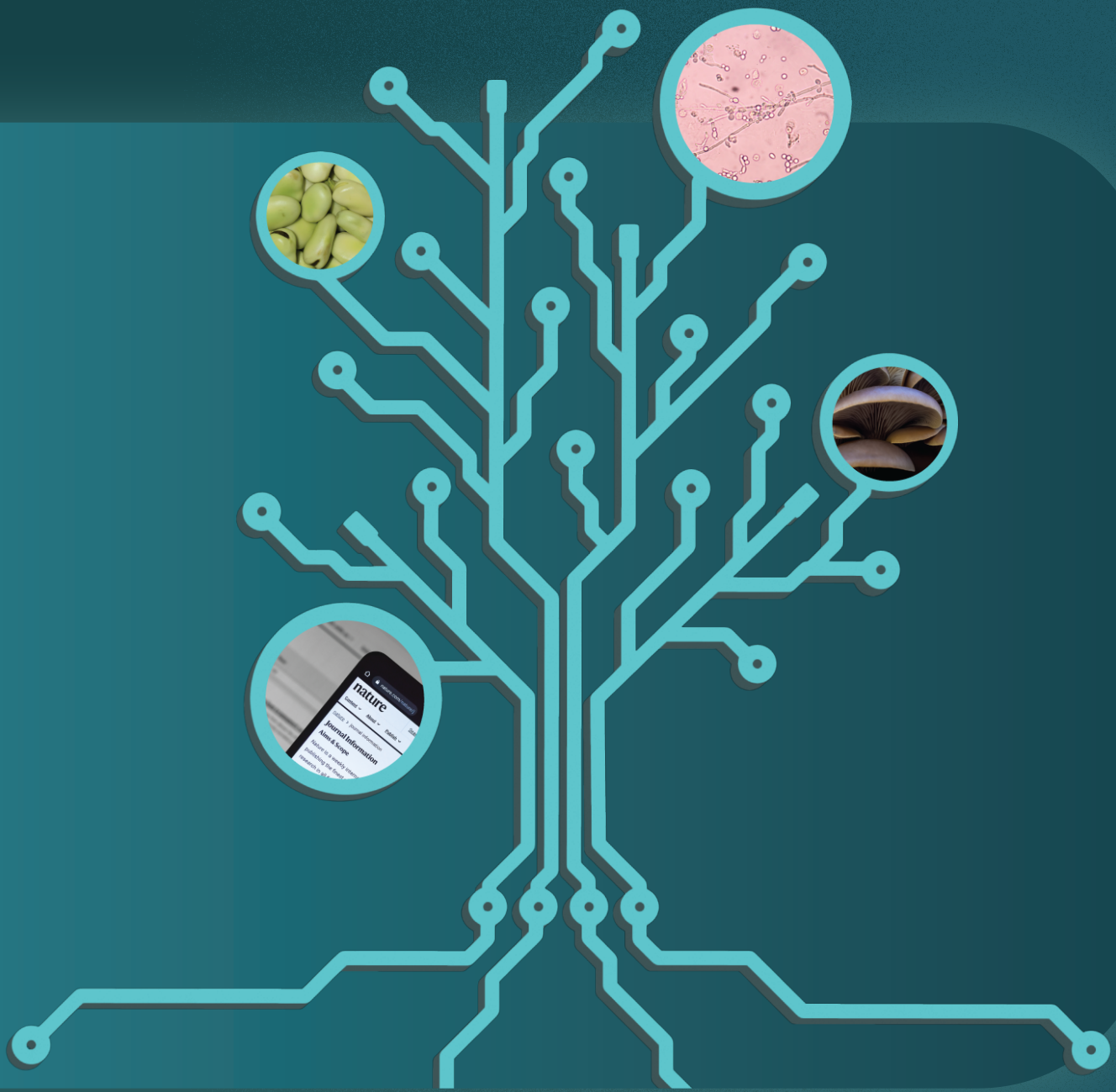
Alternative protein: all pillars | Region: Europe | September 2025

2020 to 2024

Alternative protein publication landscape analysis

State of the European Alternative Protein Research Ecosystem



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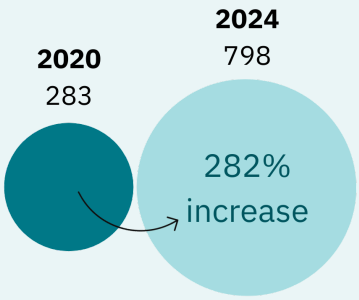
Headline statistics



Alternative protein research is undergoing sustained growth in Europe, with an **average year-on-year growth in publications of 30%.**

Since 2020, when 283 research outputs on alternative proteins were published, the field has seen rapid expansion, with 798 papers published in 2024, a **282% increase.**

Germany leads the way in Europe with 368 publications since 2020, followed by the Netherlands and the UK.

Considerable differences in output can be observed between countries, especially on a per capita basis, with some smaller countries performing strongly while their larger neighbours have the capacity to expand their activity in this field.

7,784 researchers have contributed to this output, **representing 1,519 organisations from 89 countries**, including all 30 countries analysed in this report and collaborators from 59 additional countries.

Alternative protein researchers show a **lower degree of international collaboration than the European average** and the research ecosystem needs support to become more cohesive and integrated.

Plant-based protein research has been the dominant alternative protein pillar in this timeframe, contributing 66% of total publications.

Large differences are observed in research activity across technology areas, particularly within cultivated meat and precision fermentation, which remain highly neglected.

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01 Mapping the European alternative protein research ecosystem

Why a thriving open-access research ecosystem is important in Europe

Alternative proteins offer a promising solution to meet the projected growth in the global demand for meat, seafood, eggs, and dairy, while building a more sustainable food system. However, European consumers report taste and price as the main barriers to trying and continuing to purchase these foods. In order to achieve widespread uptake, alternative proteins must compete on taste and price, as well as being nutritious and widely available to purchase, but addressing these challenges means key technological hurdles must be overcome.

Given that many of these technological challenges are of a fundamental, pre-competitive nature, publicly funded, open-access research[1] can play a critical role in tackling the kinds of questions that industry isn't necessarily incentivised or well-placed to address. It is much more efficient for scientists to publish their research for the benefit of the wider ecosystem, rather than having private companies address these challenges in silos. This kind of research reduces duplication of effort, promotes interdisciplinary collaboration, and can ultimately provide a more solid foundation on which to build private sector innovation.

As a global research and innovation powerhouse accounting for over 20% of global R&I investment, Europe has the potential to be home to a world-leading alternative protein research ecosystem. The EU is second only to China in terms of scientific output and is responsible for 18% of global scientific publications, while 76 of the world's top 200 universities are located in the European Union and United Kingdom, more than any other region. However, we have only recently begun to appreciate the full breadth and depth of alternative protein research activity in Europe, and key questions about the health and future trajectory of this ecosystem remain unanswered.

[1] Unless otherwise specified, GFI Europe uses the term 'open-access research' to refer to all results that are published in an academic journal. We use this term independently of the open-access status of the journal in which the research is published.

What we hope to achieve with this analysis

This report builds upon and supersedes a previous GFI Europe analysis published in 2024. Using an improved, more exhaustive methodology, it provides a comprehensive analysis of publications on topics related to alternative proteins published by authors working in European[2] research organisations during the years 2020-2024 inclusive. A full description of the methodology used, including caveats, limitations and improvements made since the previous version of this report was published, can be found in the methodology section.

On the basis of this analysis, this report aims to:

1. Present a thorough overview of the European alternative protein research landscape, including overall growth, leading countries and institutions, trends in collaboration, and specific research categories.
2. Help current and future scientists understand how they can best contribute to the development of this field.
3. Provide recommendations for how other stakeholders, including public research funders, can best support the further development and growth of the sector.

Dive into the alternative protein research ecosystem

This report is part of our *State of the European Alternative Protein Research Ecosystem* series, which explores the current research and innovation landscape for alternative proteins in Europe and features in-depth analyses of public and nonprofit funding, academic publications, and patents.

Read the funding report

Read the patent report

[2] Defined herein as the 27 EU member states, plus Norway, Switzerland, and the United Kingdom.

What we mean when we talk about alternative proteins

The Good Food Institute defines alternative proteins according to three pillars:

Plant-based
Produced directly from plants but look, taste, and cook like conventional animal products. For the purpose of this report, *traditional fermentation* techniques which use yeast or other microorganisms to modify the flavour, texture, or other characteristics of plant proteins will be considered within the plant-based pillar.

Fermentation
Used in two primary ways: *Biomass fermentation* leverages the fast growth and high-protein content of microorganisms to produce large quantities of protein. *Precision fermentation* uses microbial hosts to produce specific functional ingredients which are important for the manufacture of alternative protein end products.

Cultivated meat
Foods like chicken, pork, beef, and fish that are produced by cultivating animal cells directly, thus replicating the sensory and nutritional profiles of conventional meat and seafood.

Cross-cutting
Research that applies to more than one production pillar. A common example of a cross-cutting research area is cellular agriculture, which often refers to the combined approaches of precision fermentation and cultivated meat development, sometimes in mutually supportive ways. Research which seeks to understand an aspect of the entirety of the alternative protein field, such as a social science question, is also included here.

Image credit (top to bottom): Juicy Marbles, Planted, Onego Bio, Ivy Farm.

02 Trends and dynamics 2020-2024

Overall growth trends

This analysis shows that open-access alternative protein research is undergoing rapid growth in Europe and is moving quickly to fill fundamental knowledge gaps across numerous research areas. The period 2020-2024 has seen European institutions contribute to 2,695 unique publications on topics related to alternative proteins. The volume of publications has increased each year since 2020 at an average rate of 30%. It peaked at 798 in 2024, up from 283 in 2020 – a 282% increase. A total of 7,831 researchers have contributed to this output, representing 1,561 organisations from 89 countries, including all of the 30 European countries analysed in this report and collaborators from an additional 59 countries.

It is important to note that the majority of the funding for alternative protein research in Europe has come in the last three years, with 2024 seeing a record €300 million total investment by European public and nonprofit research funders into the space. As this report does not capture research activity that is currently ongoing, we can therefore expect this growth in research output to continue in the near future as this increased funding starts to bear fruit.

Figure 1. Summary data outlining the key community health indicators of the European alternative protein research ecosystem in the years 2020-2024 inclusive.

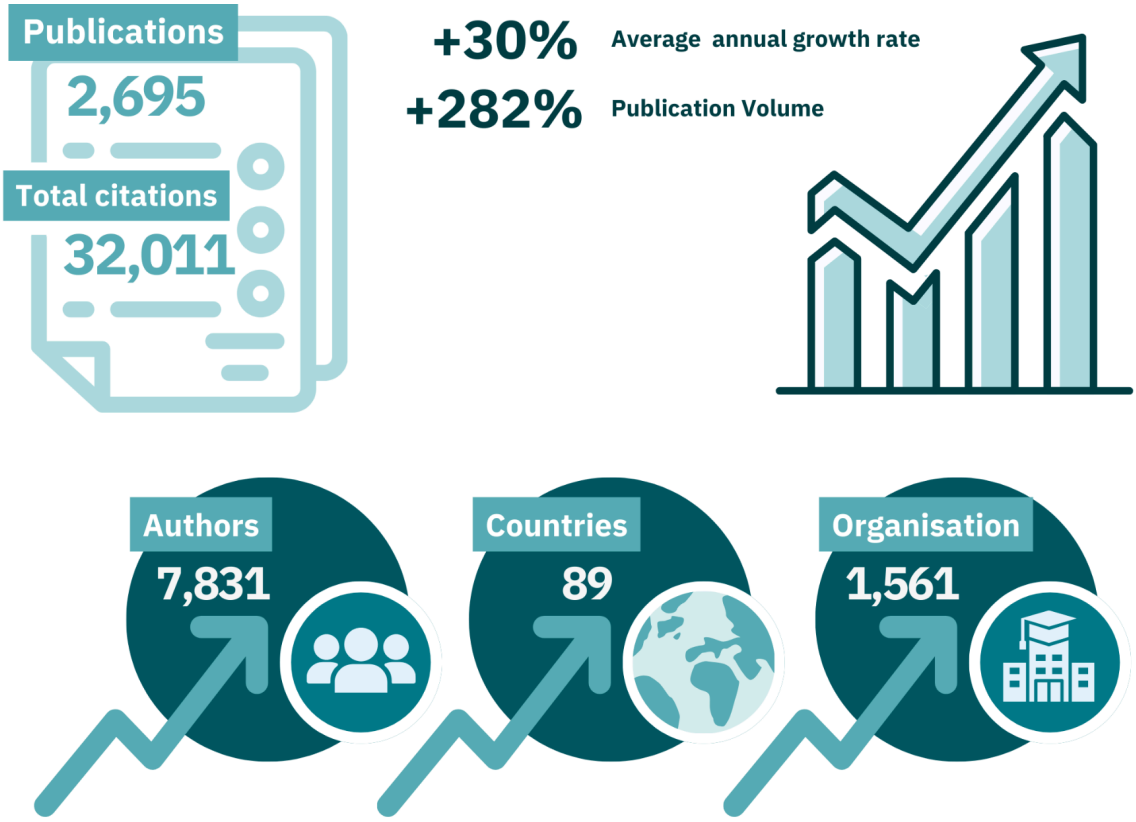
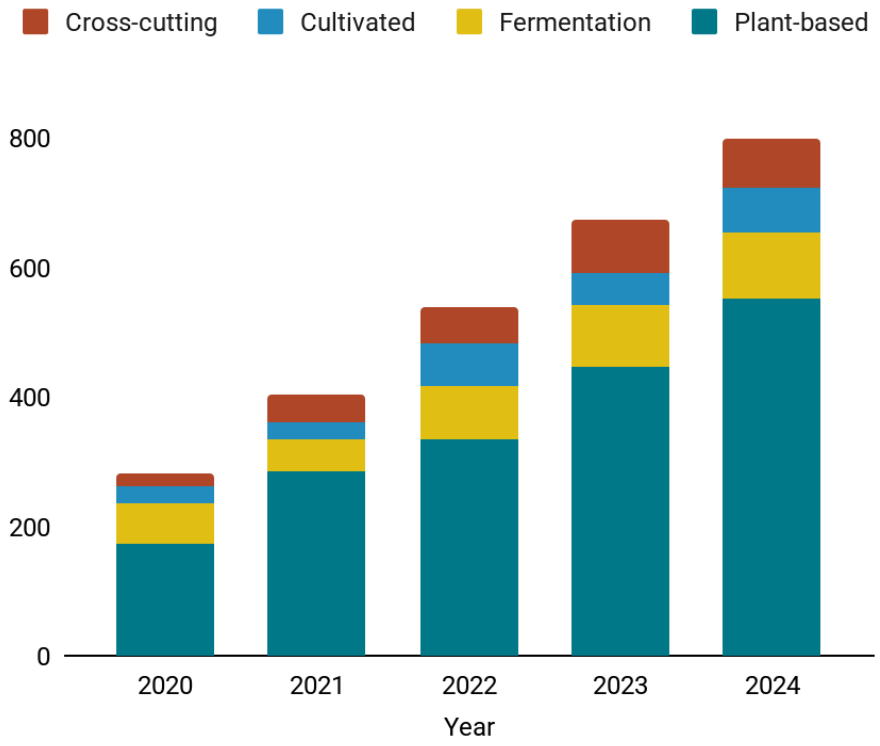


Figure 2. Number of alternative protein publications per year from European institutions in the years 2020-2024 inclusive, stratified by alternative protein pillar.



Geographic breakdown

Germany has been the most productive European country since 2020, with a contribution to 13.7% of all publications, followed closely by the Netherlands (13.5%) and the UK (12.9%). Italy has the largest number of researchers working on alternative proteins (633), followed by Germany (590) and the UK (571).

Considerable differences in output can be observed between countries on a per capita basis, with some smaller countries performing strongly while their larger neighbours have the capacity to expand their activity in this field. Measured in this way, Denmark has been most productive with 43 publications per million inhabitants, followed by Ireland (29) and Finland (26), showing that some smaller countries are punching above their weight.

Conversely, larger countries have the capacity to contribute more to this research field. For example, the four largest countries in the European Union by population (Germany, France, Italy and Spain) collectively contributed 56% of overall EU research output in 2022 across all scientific disciplines. In comparison, this analysis indicates that their contribution to the overall EU output in alternative protein research stands at 36% for the years 2020-2024.

Figure 3. Heat map of the most productive European countries in alternative protein research in the years 2020-2024 inclusive, as measured by total unique publications.

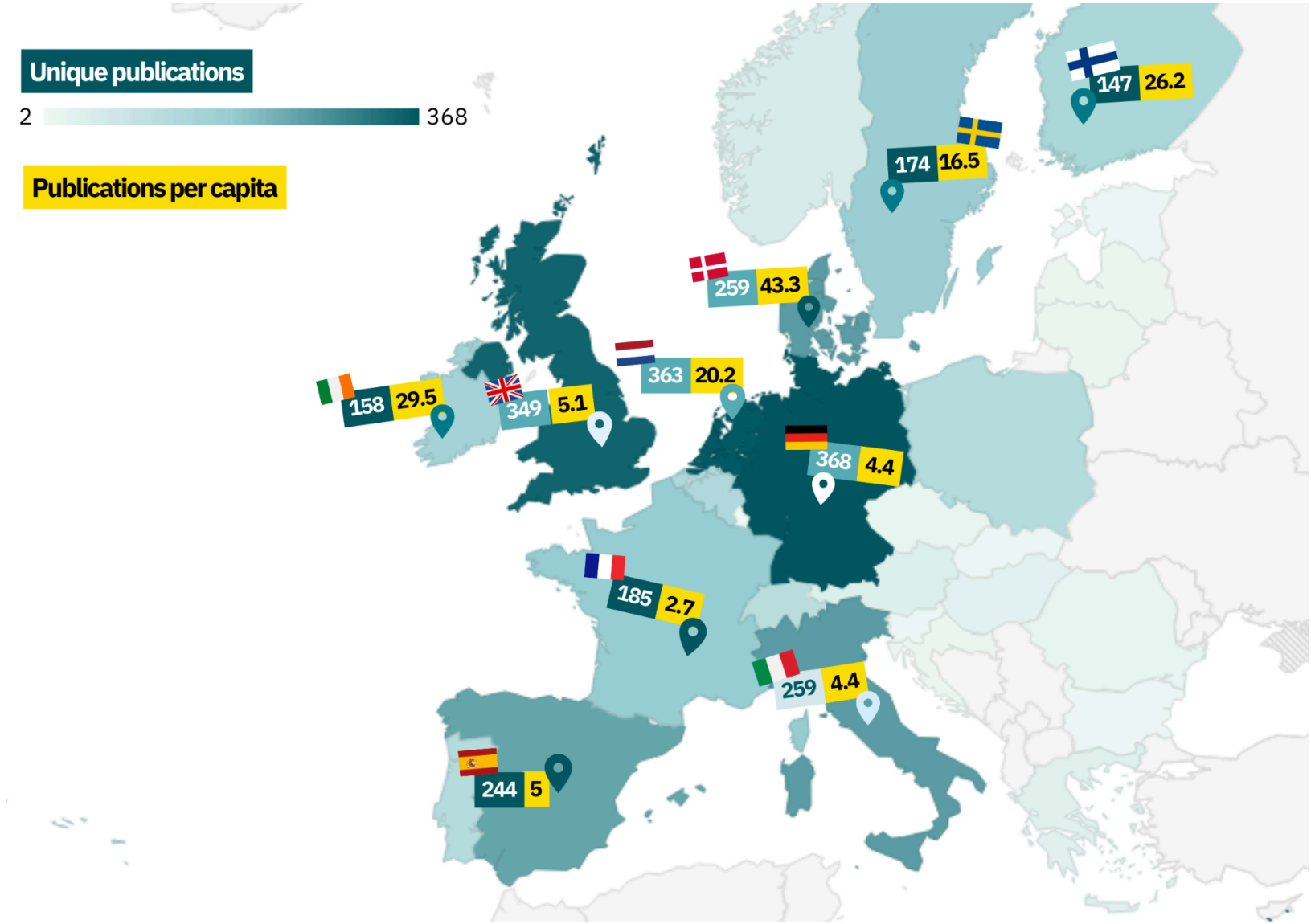


Table 1. Ranking of countries in Europe on the basis of total unique publications in the years 2020-2024 inclusive.

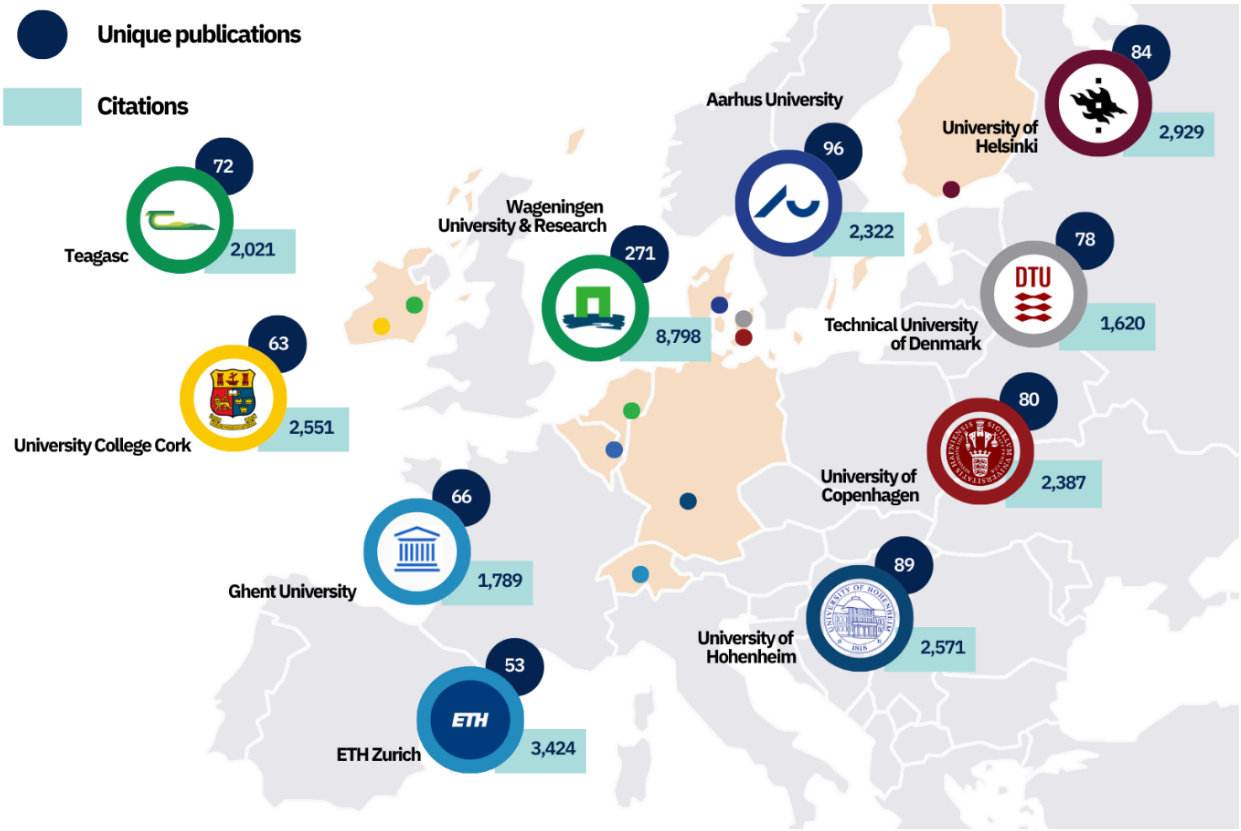
Country	Total unique publications	Contribution to total output	Publications per million inhabitants	Publications/ $1k GDP (PPP) per capita	Total researchers	Researchers per million inhabitants
Germany	368	13.7%	4.4	5.3	590	7.1
Netherlands	363	13.5%	20.2	4.6	504	28.1
United Kingdom	349	12.9%	5.1	6.0	571	8.4
Denmark	259	9.6%	43.3	3.5	386	64.8
Italy	259	9.6%	4.4	4.5	633	10.7
Spain	244	9.1%	5.0	4.6	483	9.9
France	185	6.9%	2.7	3.2	363	5.3
Sweden	174	6.5%	16.5	2.6	248	23.5
Ireland	158	5.9%	29.52	1.3	185	34.6
Finland	147	5.5%	26.2	2.4	243	43.4
Belgium	134	5.0%	11.3	1.9	240	20.3
Poland	127	4.7%	3.5	2.7	299	8.2
Portugal	121	4.5%	11.4	2.6	292	27.4
Switzerland	112	4.2%	12.5	1.3	178	19.9
Norway	51	1.9%	9.2	0.5	95	17.1
Austria	44	1.6%	4.8	0.6	69	7.5
Greece	36	1.3%	3.5	0.9	103	9.9
Hungary	29	1.1%	3.0	0.6	79	8.2
Romania	23	0.9%	1.2	0.5	85	4.5
Czechia	20	0.7%	1.8	0.4	49	4.5
Latvia	13	0.5%	6.9	0.3	41	21.9
Lithuania	13	0.5%	4.5	0.3	37	12.8
Croatia	10	0.4%	2.6	0.2	26	6.7
Bulgaria	9	0.3%	1.4	0.2	18	6.5
Slovakia	9	0.3%	1.7	0.2	12	2.2
Estonia	9	0.3%	6.5	0.2	9	2.8
Slovenia	8	0.3%	3.8	0.1	22	10.4
Malta	4	0.1%	7.1	0.1	5	8.9
Luxembourg	3	0.1%	4.5	0.02	12	17.9
Cyprus	2	0.1%	2.1	0.03	2	2.1

Most prolific institutions

Wageningen University & Research (WUR) is the dominant institution for alternative protein research in Europe, both in terms of unique publications and accumulated citations. Denmark has three institutions in the top 10, Ireland has two, and the Netherlands, Germany, Finland, Belgium and Switzerland all have one each. In some countries, there is one clear leading institution that is contributing a disproportionate amount of the national output, such as WUR or ETH Zurich, which have contributed to 75% of the total Dutch outputs and 47% of the total Swiss outputs, respectively.

Likewise, in small countries such as Belgium and Switzerland, where research is concentrated in a small number of institutions, these institutions perform strongly in the rankings, despite the fact that neither country is in the top 10 overall. While research *output* cannot be equated to research *quality* or *impact*, these findings indicate that individual institutions can make an outsized contribution to the field, independent of the overall research activity of their home country. In contrast, large countries such as the UK, Italy, Spain, and France rank highly in Europe on the basis of total publication output but do not have any research organisations in the top 10, suggesting there is significant research activity happening in these countries but that it is relatively thinly spread out.

Figure 4. Top 10 most productive European research institutions in the years 2020-2024 inclusive.



04 Alternative protein pillar deep-dives

Overview

This section examines research activity across the three alternative protein pillars in Europe to assess their relative stage of maturity and identify areas where greater research efforts are needed. Plant-based protein research has been the dominant pillar in this timeframe, contributing 66% of all publications. 14% of all publications focused on fermentation-made proteins and ingredients, 9% on cultivated meat and seafood, and 10% on cross-cutting topics.

While the overall volume of publications has increased steadily, there are differences in growth rate across the alternative protein pillars (Table 2). Plant-based research output has shown strong growth over the period 2020-2024 and accounts for the majority of the overall growth in research output, with an increase of 317% when comparing the 2024 output to the 2020 baseline. While research on both fermentation-made and cultivated proteins has increased, these increases have been from a considerably lower baseline and are more variable year-on-year.

Table 2. Summary data outlining the key community health indicators of the European alternative protein research ecosystem in the years 2020-2024 inclusive, stratified by alternative protein pillar.

Metric	Plant-based	Fermentation	Cultivated
Publications	1,790	386	242
Average growth rate %	35%	18%	38%
2020-2024 % change	317%	168%	250%
Authors	5,436	1,465	755
Organisations	1,169	413	286

Key countries and institutions

Plant-based meat, dairy, eggs, and seafood

Figure 5. The most productive European research institutions in plant-based research in the years 2020-2024 inclusive.

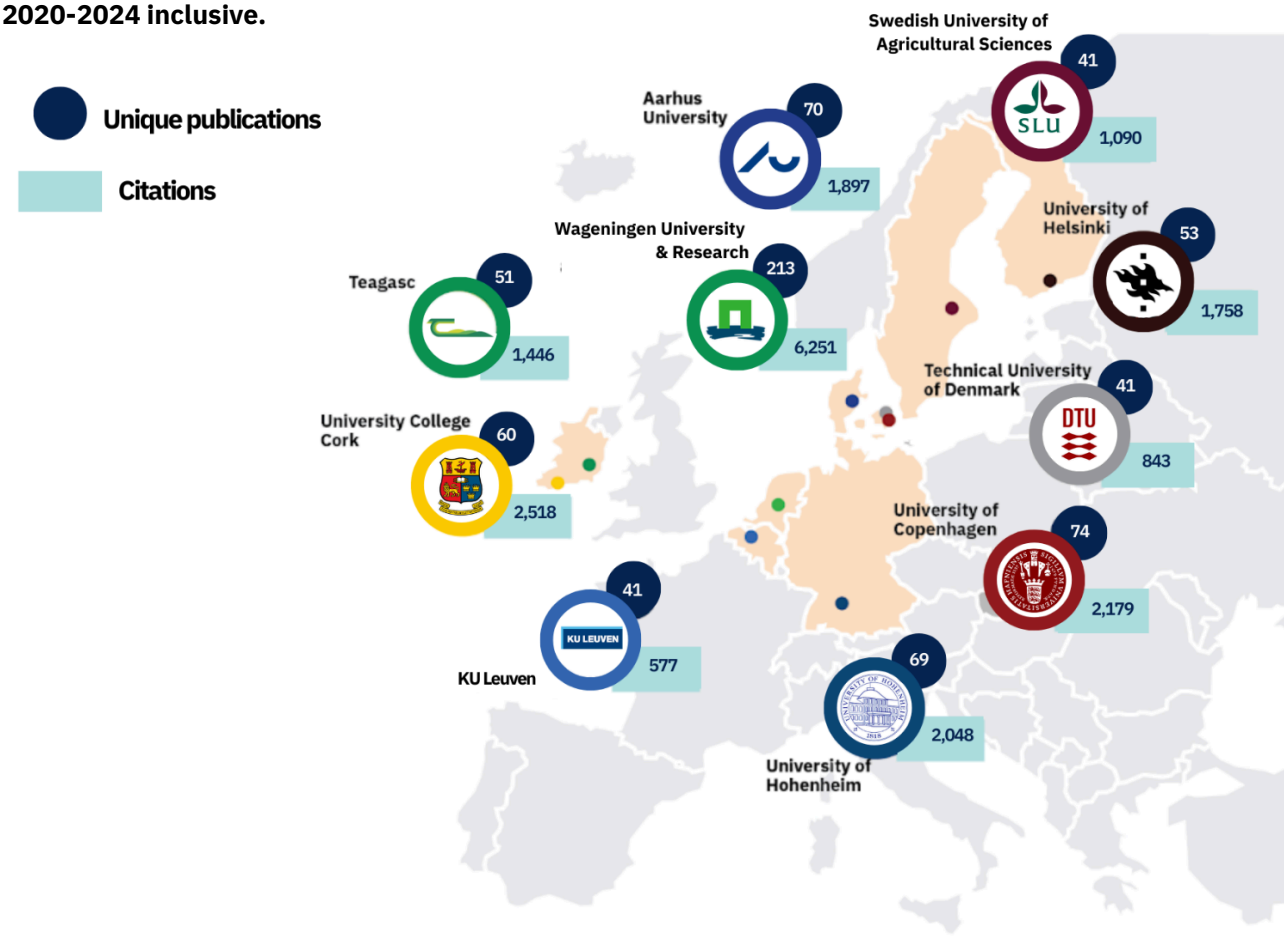


Table 3. The most productive European countries in plant-based protein research in the years 2020-2024 inclusive.

Country	Publications	Researchers	Publications per capita
Netherlands	253	353	14.1
Germany	246	387	2.9
Spain	187	375	3.8
United Kingdom	186	331	2.7
Denmark	186	294	31.2
Italy	163	410	2.8
France	127	302	1.9
Ireland	126	157	23.5
Sweden	113	190	10.7
Finland	96	161	17.1

Figure 6. The most productive European institutions in fermentation research in the years 2020-2024 inclusive.

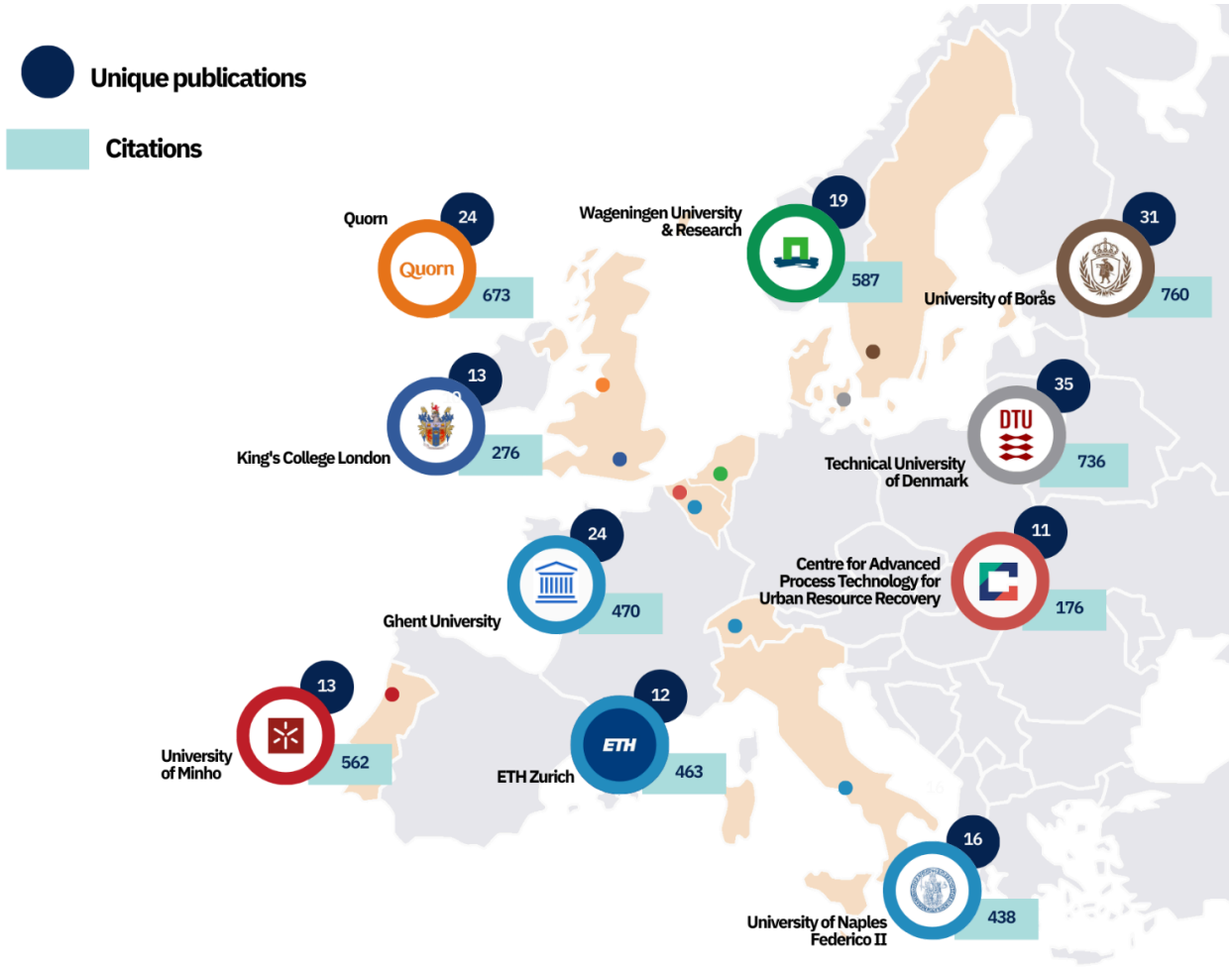


Table 4. The most productive European countries in fermentation research in the years 2020-2024 inclusive.

Country	Publications	Researchers	Publications per capita
United Kingdom	60	137	0.9
Germany	50	147	0.6
Denmark	46	91	7.7
Sweden	44	56	4.2
Italy	39	105	0.7
Belgium	33	59	2.8
Spain	30	76	0.6
Netherlands	30	63	1.7
Portugal	25	86	2.3
Switzerland	16	45	1.8

Figure 7. The most productive European institutions in cultivated meat and seafood research in the years 2020-2024 inclusive.

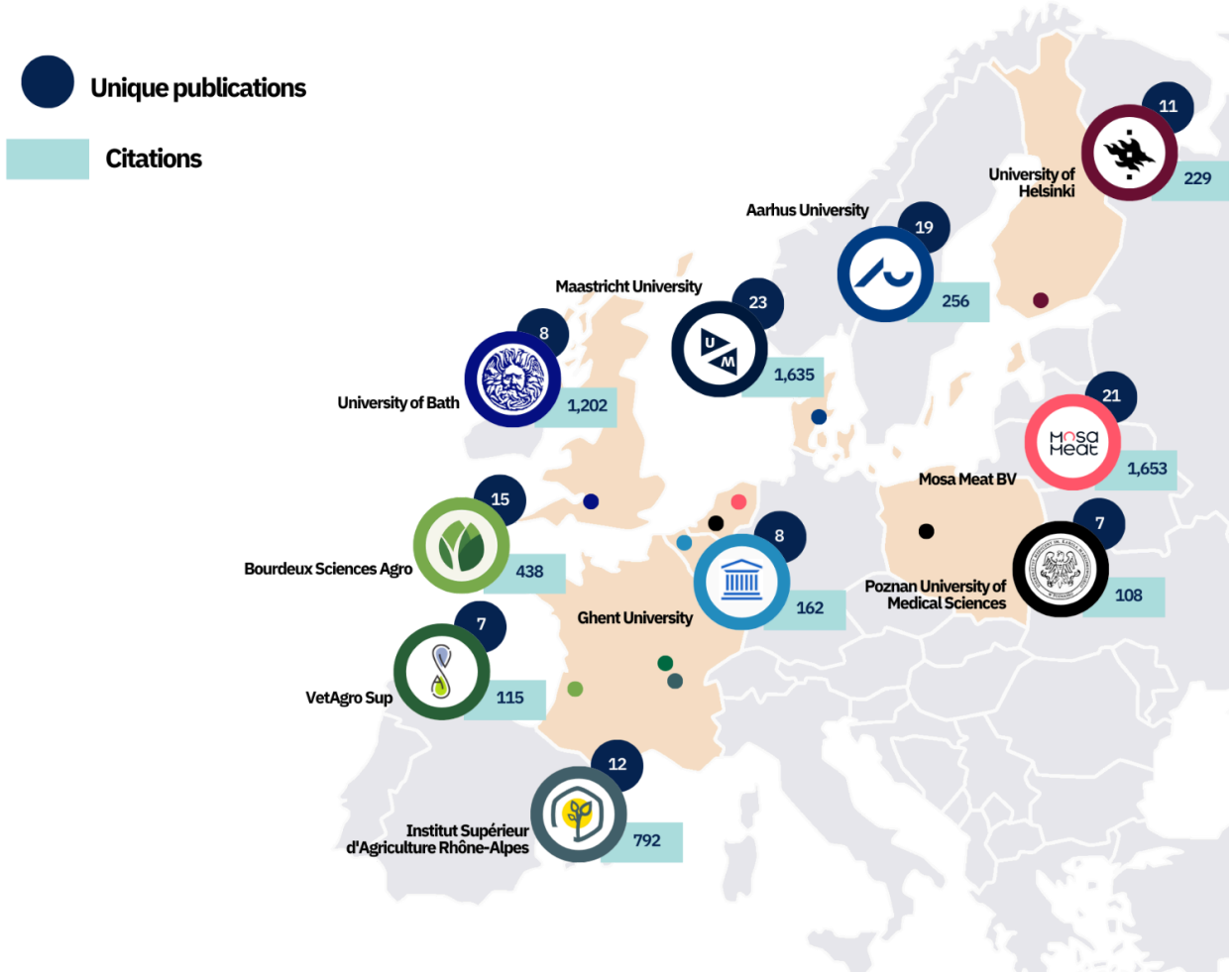


Table 5. The most productive European countries in cultivated meat and seafood research in the years 2020-2024 inclusive.

Country	Publications	Researchers	Publications per capita
United Kingdom	45	97	0.7
Netherlands	39	73	2.2
Germany	36	62	0.4
France	28	21	0.4
Italy	26	84	0.4
Denmark	22	27	3.7
Poland	17	46	0.5
Finland	13	10	2.3
Belgium	11	26	0.9
Norway	10	23	1.8

Research categories

To allow a more thorough investigation of the breadth and depth of research topics covered within each alternative protein pillar by European researchers, the publications analysed in this report have been assigned to one of the research categories described in Table 6. These categories have been updated and clarified from last year's report, and now include downstream sectors such as impact assessments and non-technical categories such as consumer and market research. For details on the most pressing research priorities across these categories, please consult our alternative protein R&D priorities resource.

Table 6. Alternative protein research categories.

Research category	Description	Relevant pillar(s)
Strain development	Screening and optimisation of novel strains to identify the most efficient pathways for producing targets or modifying substrates.	**Fermentation** **Plant-based**[3]
Cell line development	Sourcing, optimising, and banking new and existing cell lines to achieve faster cell growth, greater stability and stress tolerance, improved cell line performance (such as adherence and differentiation), and higher cell density in terrestrial and aquatic cell lines.	**Cultivated**
Target molecule selection	Target identification and validation to broaden the scope of food ingredients produced by precision fermentation.	**Fermentation**
Cell culture media	Reducing cell culture media costs and increasing their availability by characterising and validating novel sources of growth factors, amino acids, and other media components.	**Cultivated**
Feedstocks	Innovations in media, including new components and feedstock utilisation strategies (including the use of alternative feedstocks) to achieve higher efficiency, greater scale, and reduced costs.	**Fermentation**
Bioprocess design	Innovations in bioreactor design including improved efficiency, monitoring and control, and both upstream and downstream process innovations.	**Fermentation** **Cultivated** **Plant-based**[3]
Crop development	Breeding of crops and increased use of underutilised protein crops for higher protein yields and functionality.	**Plant-based**

[3] Refers to the use of traditional fermentation techniques to modulate or enhance the characteristics of plant proteins.

Ingredient optimisation	Improved protein fractionation and functionalisation to achieve higher-quality ingredients with less processing. Also covers the development of novel ingredients to augment nutritional profiles and enhance the sensory experience of alternative protein products.	**Plant-based** **Fermentation**
Scaffolding	Improved scaffolding biomaterials that support cell adherence and differentiation to allow the replication of complex animal meat structures.	**Cultivated**
Texturisation methods	Process innovations, including (but not limited to) novel texturisation methods such as extrusion, electrospinning, 3D printing, and enzymatic processing to match the texture of animal protein.	**Plant-based** **Fermentation** **Cultivated**
End product formulation	Formulation and product design and testing including fat integration, shelf life and stability testing, evaluations of sensory quality, and nutritional assessment and fortification.	**Plant-based** **Fermentation** **Cultivated**
Health & nutrition	Dietary impacts of alternative proteins including population-wide studies, systematic reviews, and *in vitro* studies on health impacts, for example, bioavailability.	**Plant-based** **Fermentation** **Cultivated**
Food safety & quality	Toxicological and safety assessments, regulatory improvements, such as assay development or validation.	**Plant-based** **Fermentation** **Cultivated**
Consumer & market research	Consumer behaviour research including nomenclature studies, purchasing intent (including retail and food environments), and market scoping and brand development.	**Plant-based** **Fermentation** **Cultivated**
Impact assessments	Impact assessments including life cycle or techno-economic analyses, economic and other broader environmental impact assessments, and social/geopolitical impacts including policy interventions.	**Plant-based** **Fermentation** **Cultivated**
No category assigned	Publications on topics not covered by the other research categories described here. This can include discussions on the political, ethical, or philosophical implications of alternative protein or the protein transition. Broad-scope review articles covering numerous aspects of alternative proteins are also assigned to this category.	**Plant-based** **Fermentation** **Cultivated**

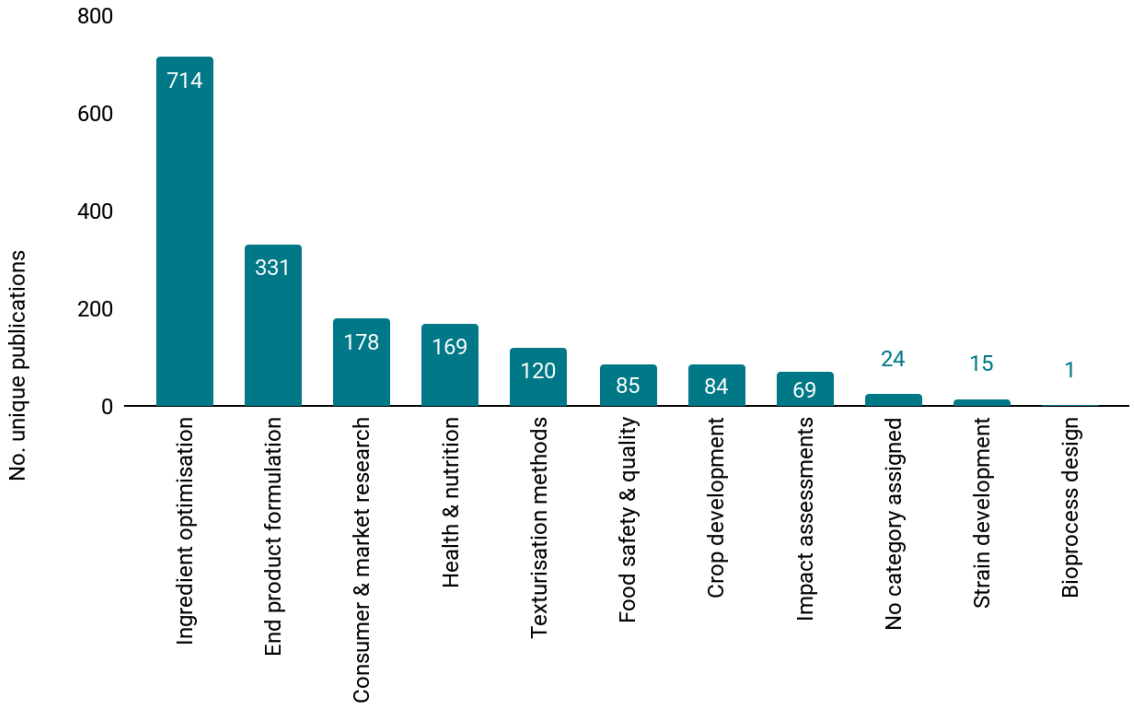
Plant-based

Publications in the plant-based dataset cover 11 separate research categories, with ingredient optimisation and end product formulation and manufacturing being the most common categories, accounting for 40% and 19% of publications, respectively. This aligns with trends in the funding data, which show that funding for ingredient optimisation far exceeds the other research categories.

Crop development is the third best-funded category over the period 2020-2024, but only accounts for around 5% of publications in the plant-based pillar. This may reflect the difficulty and longer timelines associated with developing plant varieties with improved traits. But when considered alongside the observation that no patents on crop breeding were identified in our recent alternative protein patent report, it suggests that recent funding for crop development has not yet realised the desired impact.

Strain development for traditional fermentation represents only a tiny fraction of the total, but this category received increased funding in 2024 and can therefore expect to see a boost in research activity in the coming years. Conversely, texturisation methods is a neglected category that has not received recent funding and is at risk of dropping further behind.

Figure 8. Research categories covered within the European plant-based literature in the years 2020-2024 inclusive.

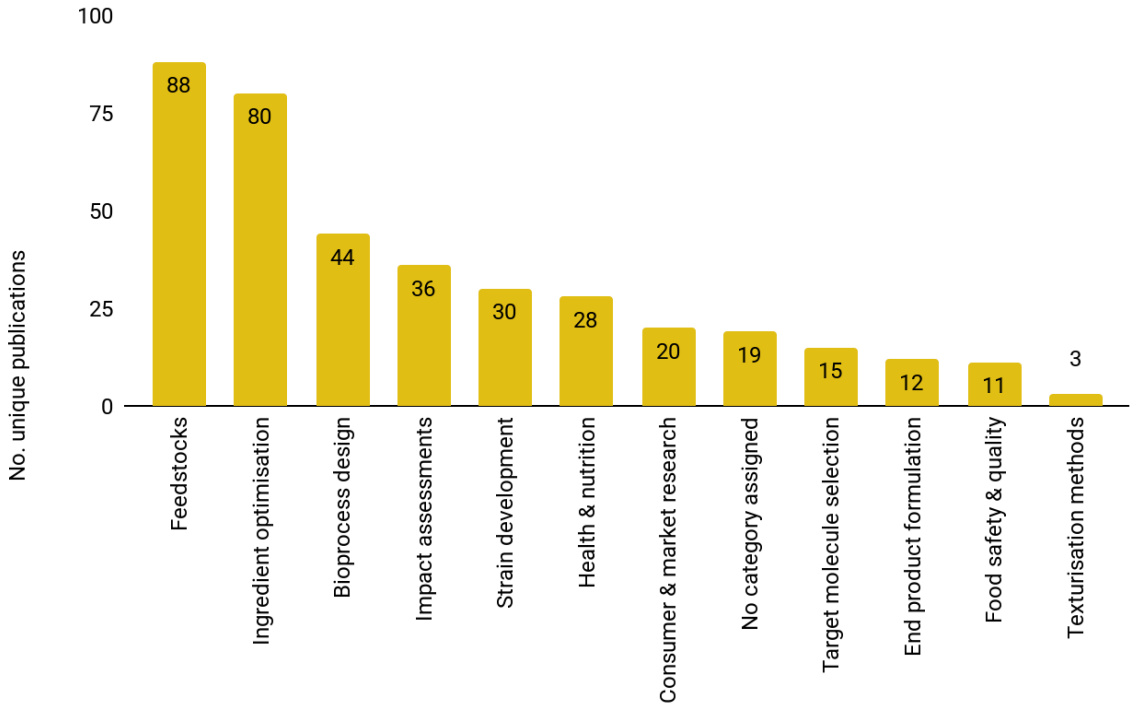


Fermentation-made proteins and ingredients

Publications in the fermentation dataset cover 12 separate research categories, with feedstocks, ingredient optimisation, and bioprocess design being the most common categories, on 23%, 21%, and 11% of publications, respectively. The validation of novel feedstocks has seen increased funding in recent years and may be emerging as a relative area of strength for the European research ecosystem.

It is concerning to find only a small number of publications dedicated specifically to strain development and target molecule selection, demonstrating that there are still significant knowledge gaps in this research area. While the former has begun to see increased funding support in recent years, the latter remains almost entirely neglected, suggesting that Europe will play a limited role in the identification and validation of novel targets in the coming years.

Figure 9. Research categories covered within the European fermentation literature in the years 2020-2024 inclusive.

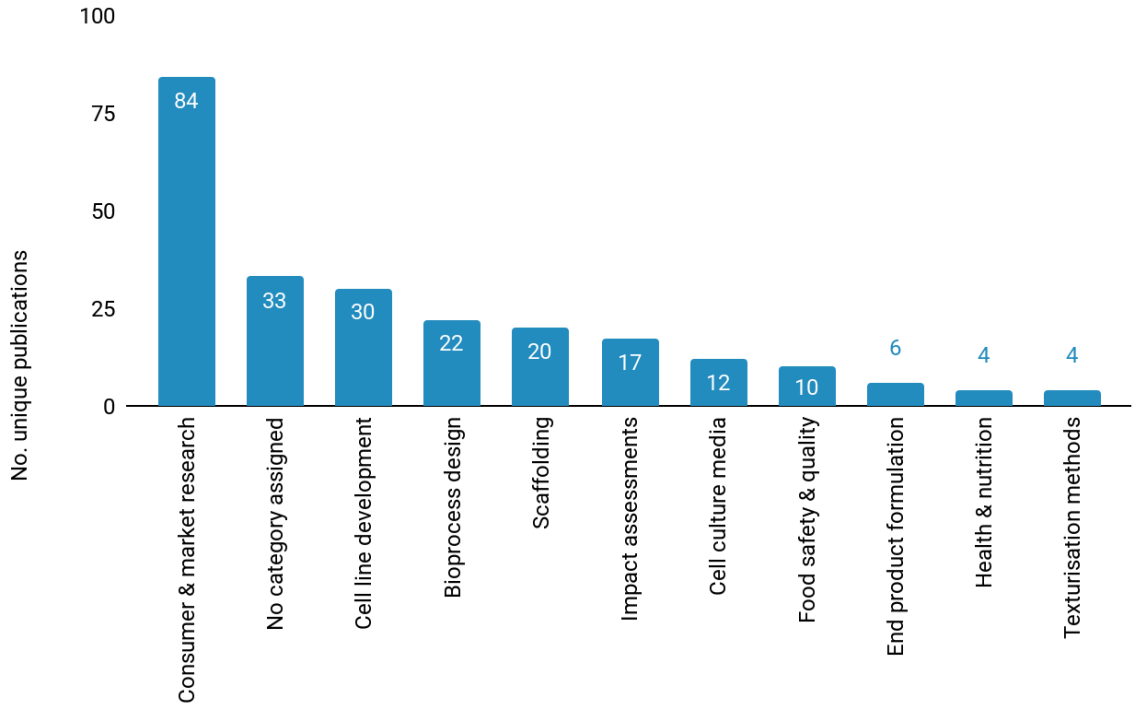


Cultivated meat and seafood

Publications in the cultivated dataset cover 11 separate research categories. In stark contrast to the other pillars, 35% of cultivated meat and seafood publications were assigned to the consumer & market research category, while a further 14% were not assigned to any category. This is because a significant number of publications focus on concepts such as food law, policy, philosophy, and broad-scope discussions about the feasibility of the technology rather than on technical aspects that can contribute to moving cultivated meat and seafood towards taste and price parity with conventional products.

For those publications that did focus on technical research categories, cell line development and bioprocess design were the most common, but only accounted for 12% and 9% of all publications, respectively. Most of the recent European funding has gone into either cell line or cell culture media development, and an increase in publications on these topics may be expected in the coming years. However, as noted previously, overall funding for this pillar lags significantly behind that for plant-based or fermentation.

Figure 10. Research categories covered within the European cultivated meat and seafood literature in the years 2020-2024 inclusive.



Citations & impact

At the time of writing, publications involving European researchers had accumulated 32,011 citations from 7,609 citing organisations in 156 countries. The country that has cited European research more than any other is China (7,220), followed by the United States (3,004) and India (2,304). Chinese researchers have cited European plant-based and fermentation research more than those from any other country, while publications on cultivated meat and seafood have been cited most by researchers in the United States, with China in a close second place.

For all three pillars, more than 90% of publications in the dataset have been cited at least once. This complements the observation that more than 75% of publications have some form of open-access[4] publishing status, which, while encouraging, is slightly lower than the 2020 EU average of 80%.

However, in line with the relative differences in size between these respective research communities, clear differences can be observed between the pillars when examining publication output and citation impact on a per researcher basis, reinforcing the impression that the fermentation and cultivated communities in particular are still in their infancy in Europe (Table 7).

Table 7. Summary data outlining the key citation and impact indicators of the European alternative protein research ecosystem in the years 2020-2024 inclusive, stratified by alternative protein pillar.

Metric	Plant-based	Fermentation	Cultivated
Total citations accumulated	22,103	6,191	3,065
Number of citing countries	149	119	101
% of publications cited	95%	95%	91%
Researchers with five or more publications	245	38	19
Researchers with 10 or more citations	3,328	968	454

[4] Contrary to other sections of this report where the term 'open-access' is used to refer to all results which are published in an academic journal and therefore accessible to the wider scientific community, in this instance 'open-access' refers specifically to publications which are delivered to readers free of access charges or other barriers.

Figure 11. Heat map of countries where European alternative protein researchers were cited in the academic literature in the years 2020-2024 inclusive, as measured by unique citing publications.

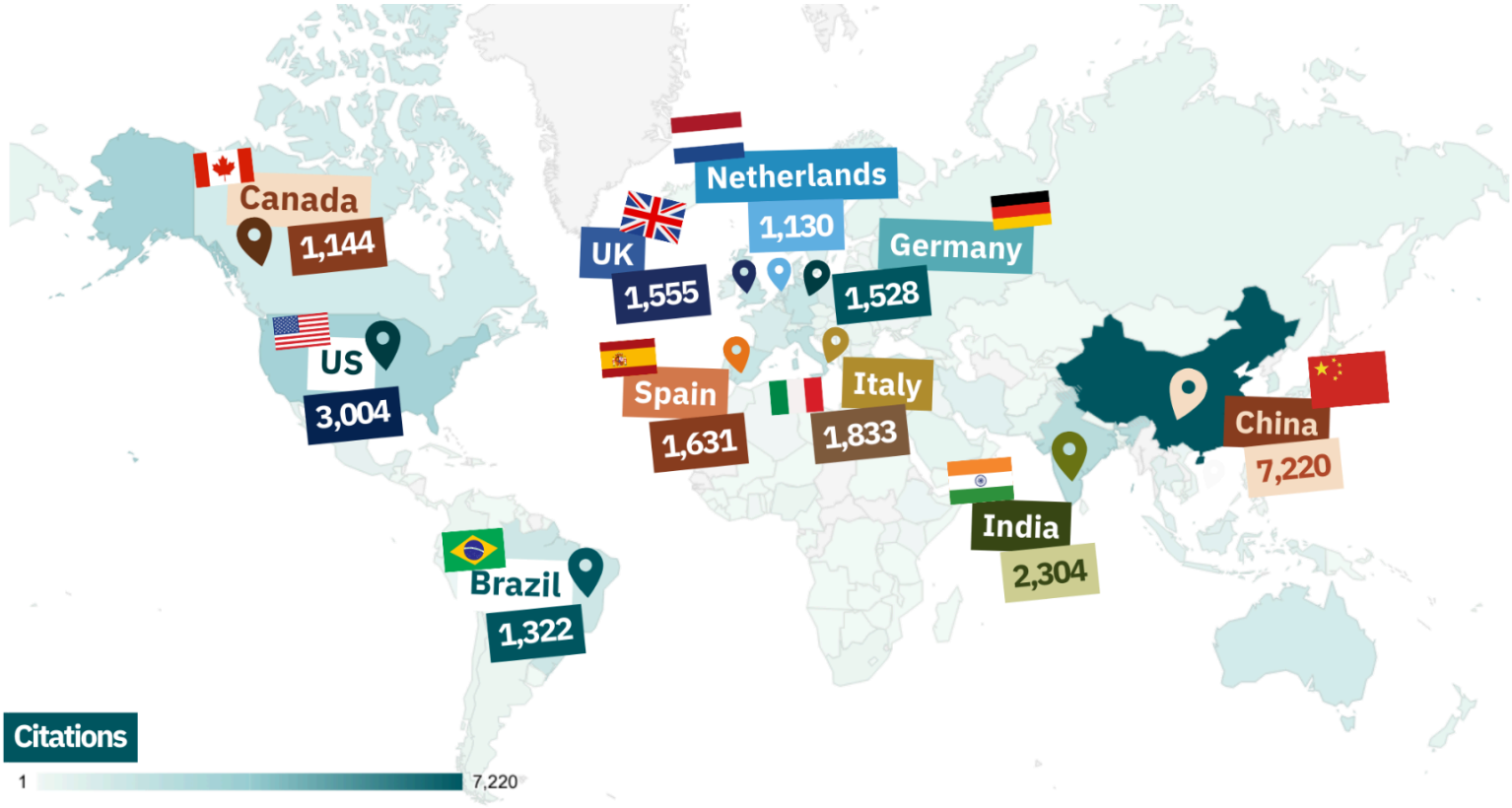


Table 8. Countries where European alternative protein researchers were cited in the academic literature in the years 2020-2024 inclusive, stratified by alternative protein pillar.

Plant-based		Fermentation		Cultivated	
Country	Citing publications	Country	Citing publications	Country	Citing publications
China	5,636	China	1,215	United States	507
United States	2,051	India	661	China	437
India	1,504	United States	560	United Kingdom	258
Italy	1,202	Italy	394	South Korea	197
Spain	1,193	United Kingdom	331	Italy	194
Germany	1,048	Germany	330	Germany	177
United Kingdom	978	Spain	314	India	152
Brazil	922	Brazil	281	Brazil	145
Canada	889	Portugal	238	Netherlands	143
Australia	815	Denmark	211	Australia	132

We can also analyse the number of publications that have been cited in a patent filing. While this does not mean the invention disclosed in the patent has been developed from or even directly inspired by the findings of the research publication, it can give some insight into the degree of knowledge flow from academia to industry. A breakdown of the organisations that have most often cited European alternative protein researchers in patent filings in the years 2020-2024 inclusive is presented in Table 9.

In total, 228 patents from 93 assignees in 24 countries cite a publication from the dataset. However, this amounts to just 5.5% of publications in the dataset being cited in a patent filing. Stratified by pillar, 144 patents cite a publication in the plant-based dataset, compared to 47 citing patents for fermentation and 35 citing patents for cultivated meat and seafood. Overall, 50% of citing patents are from an assignee outside Europe.

Table 9. Organisations that cited European alternative protein research in patent filings in the years 2020-2024 inclusive, ranked by unique citing patents.

Plant-based			
Organisation	Country	Citing patents	Cited publications
Nestlé	Switzerland	12	13
Cargill	United States	7	7
Roquette Frères	France	7	4
Chr Hansen	Denmark	6	10
dsm-firmenich[5]	Switzerland, Netherlands	4	4
Unilever[6]	Netherlands, United States	4	4
L'Oréal	France	4	1
Plantible Foods	United States	3	3
Northeast Agricultural University	China	3	3
Nomad Foods Europe	United Kingdom	3	1
Fermentation			
Organisation	Country	Citing patents	Cited publications
dsm-firmenich[5]	Switzerland, Netherlands	7	2
Unibio	Denmark	3	3
Unilever[6]	Netherlands, UNited States	3	3
Mycorena[7]	Sweden	3	2
Nestlé	Switzerland	2	1
Xinjiang Academy of Animal Science	China	2	1
Every	United States	2	1
Biotechnology Research Institute	China	2	1
Solar Foods	Finland	1	1
Capra Biosciences	United States	1	1
Cultivated			
Organisation	Country	Citing patents	Cited publications
Mosa Meat	Netherlands	10	6
Upside Foods	United States	5	2
Jiangnan University	China	2	2
Bühler	Switzerland	2	1
Cellular Agriculture Ltd	United Kingdom	1	2
Kindai University	Japan	1	1
Tokyo Women's Medical University	Japan	1	1
Cellcraft Ltd	United Kingdom	1	1
Nanjing Agricultural University	China	1	1
University of California, Berkeley	United States	1	1

[5] Data for DSM and Firmenich are combined as these companies merged in 2023.
[6] Data for Unilever and Conopco Inc are combined as these companies are part of the same parent company.
[7] Mycorena now operates under the name Promyc.

Collaboration

Reflecting its relative degree of immaturity, the European alternative protein research community displays a lower-than-average degree of collaboration, with international co-authorships[8] accounting for 40% of the total. This figure is equal to the 40% international average for all scientific disciplines calculated in 2022, but significantly lower than the corresponding figure of 56% in the EU and 64% in the UK.

Despite this, European alternative protein researchers have published in collaboration with more than 1,700 researchers from a total of 59 external countries[9]. European alternative protein researchers have co-authored most frequently with collaborators from the United States across all three pillars. For both plant-based and fermentation, China is the second most common country where European researchers have formed collaborations. However, for cultivated meat and seafood, China is only in sixth place.

Only marginal differences can be observed in the relative rates of multi-organisation and international co-authorships between alternative protein pillars (Table 10). However, it must be remembered that these data describe academic communities of considerably different sizes, with the European plant-based research community approximately seven times larger than that of cultivated meat and seafood.

As a result, while all three pillars show similar *relative* rates of collaboration, the *absolute* number of connections between researchers within each pillar varies greatly. This is highlighted by examining the number of external countries where European researchers have established collaborations. For plant-based, this number stands at 56 external countries, while for fermentation and cultivated it stands at 29 and 24 external countries, respectively.

Table 10. Summary data outlining the key collaboration indicators of the European alternative protein research ecosystem in the years 2020-2024 inclusive, stratified by alternative protein pillar.

Metric	Plant-based	Fermentation	Cultivated
Multi-organisation collaborations (% of total)	60%	66%	66%
International collaborations (% of total)	40%	42%	39%
Total contributing authors	5,436	1,465	755
Collaborating external countries	56	29	24

[8] International co-authorships includes publications which have two or more authors and at least two of those authors come from different countries. This includes both collaborations between the European countries within the scope of this report and those including at least one European and one external country.

[9] Defined here as those outside the 27 EU member states, along with Norway, Switzerland, and the United Kingdom.

Figure 12. Heat map indicating countries with which European alternative protein researchers have collaborated on research publications in the years 2020-2024 inclusive.

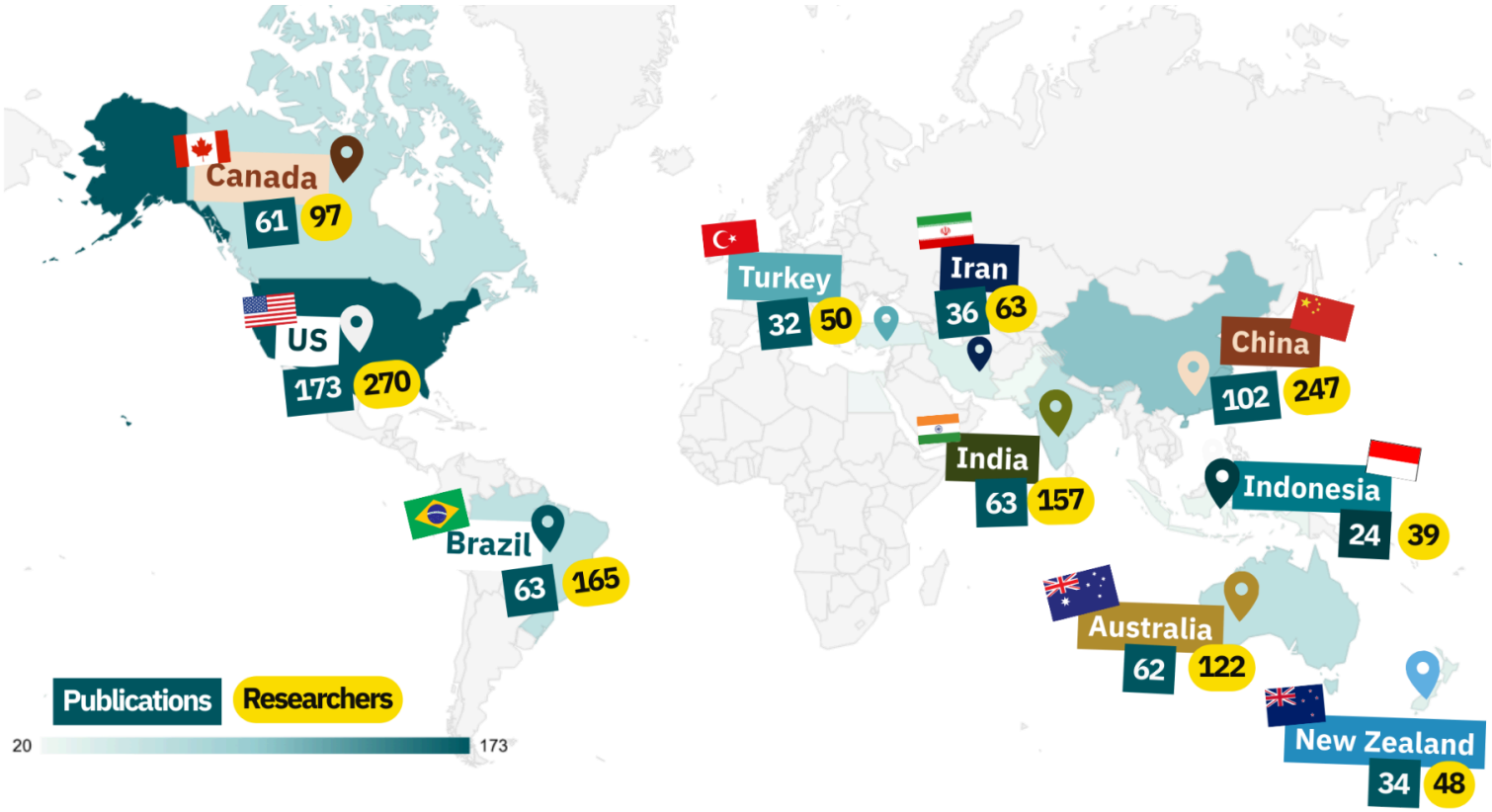


Table 11. Countries with which European alternative protein researchers have collaborated on research publications in the years 2020-2024 inclusive, stratified by alternative protein pillar.

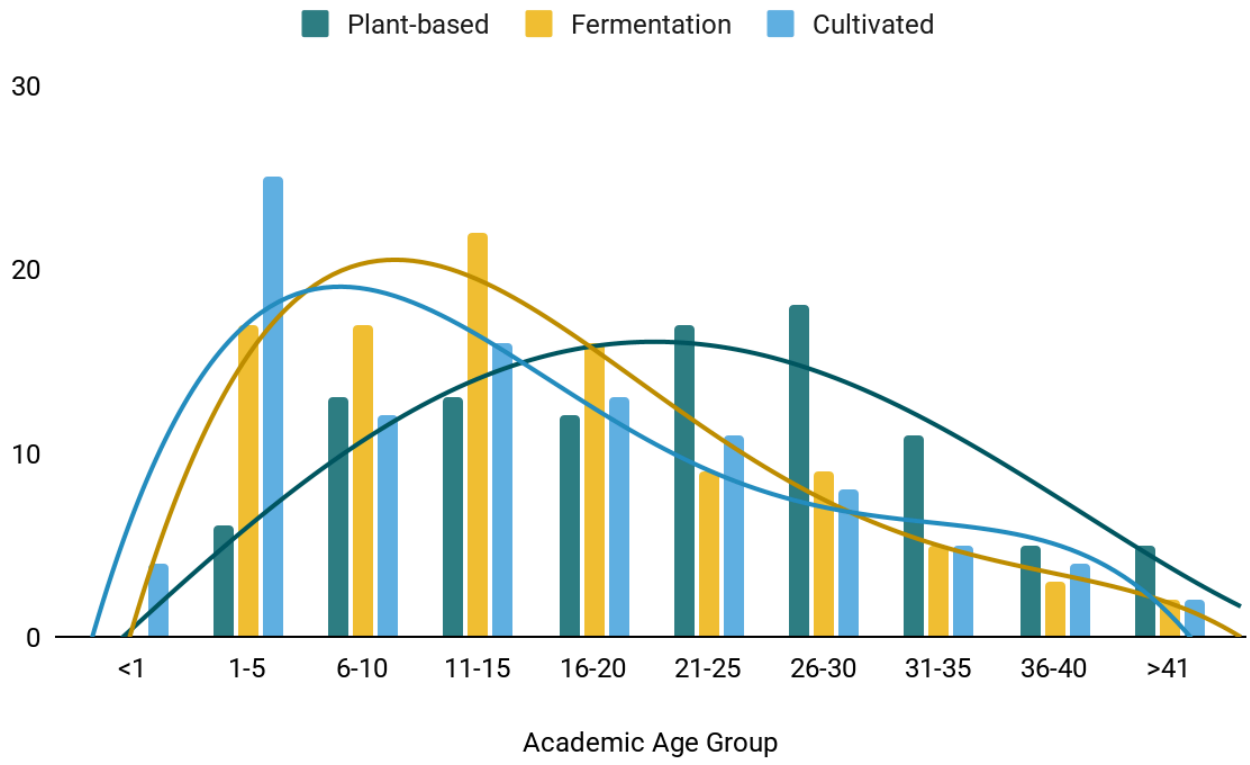
Plant-based			Fermentation			Cultivated		
Country	Unique publications	Collaborating researchers	Country	Unique publications	Collaborating researchers	Country	Unique publications	Collaborating researchers
United States	95	142	United States	26	49	United States	27	58
China	67	191	China	21	42	Brazil	10	37
Canada	45	78	Australia	11	25	India	6	7
Brazil	44	112	Indonesia	11	17	Australia	6	7
India	39	121	Mexico	9	22	New Zealand	5	9
Australia	36	83	India	7	11	China	5	10
Iran	24	51	Brazil	5	14	Iran	4	3
Turkey	24	35	Canada	5	12	Canada	3	6
New Zealand	19	28	Israel	5	6	South Korea	3	10
Egypt	17	18	New Zealand	5	14	Singapore	3	6

Academic community maturity

The academic age[10] of the 100 most productive researchers in the plant-based dataset broadly follows a normal distribution. The median age range of 26-30 years is significantly higher than that of the top 100 researchers in the fermentation or cultivated meat and seafood datasets, which, in contrast, are both skewed towards less established researchers (11-15 years and 1-5 years, respectively).

This further reinforces the observation that there is a significant difference in relative maturity between the pillars. A striking example of this can be seen in the data for cultivated meat and seafood publications, wherein four of the 100 most productive researchers have an academic age of less than one year.

Figure 13. Comparison of the academic age[10] of the 100 most productive researchers in the years 2020-2024 for each of the alternative protein pillars.



[10] Academic age is calculated using the difference between the first and last publication years for any given author and gives an indication of the stage of the researchers' academic career.

05 Conclusions

Alternative protein research is on the rise in Europe

Alternative protein research is undergoing tremendous growth in Europe. Since 2020, when 283 research outputs were published on alternative proteins, the field has seen rapid expansion, with 798 papers published in 2024 – a 282% increase. This aligns with trends in the data we have collated on R&I funding and patents in Europe and contributes to an impression of a field that is rapidly on the rise.

Encouragingly, most of the funding for alternative protein research in Europe has been awarded in the last three years, with 2024 seeing a record €300 million total investment by public and nonprofit research funders. We can therefore expect this growth in research output to continue in the coming years as the increased funding begins to bear fruit.

Sustained investment is reaping rewards in the leading countries

Germany, the Netherlands, the UK, Denmark and Italy lead Europe in terms of publication volume, with a combined contribution to 46% of the overall European output. This is broadly consistent with trends in R&I funding, and we should expect to see these countries continue to dominate the alternative protein research space in Europe. The Nordic countries have all spent above average both in terms of funding per capita and by GDP, resulting in Denmark, Sweden, and Finland all making the top 10 for overall publication output and publications per capita.

Some of these countries are notable for the coordinated, high-value investments they have made in the growth of their alternative protein communities. Examples include a 2021 announcement by the Danish government of over 1.25 billion kroner (€168 million) to advance plant-based foods, or the €60 million investment by the Dutch government in 2022 to support the formation of a precision fermentation and cultivated meat ecosystem. Likewise, the United Kingdom has established the £15 million National Alternative Protein Innovation Centre, the latest in a string of UK alternative protein research centres.

This contrasts with other European countries, which are home to vibrant communities of researchers despite little to no funding data being available from national funders. One possible explanation for this is that these communities are being supported primarily by European Commission funds via high-profile Horizon Europe projects such as Smart Protein, FEASTS, VALPROPath, and GIANT LEAPS. While the European Commission continues to be the single largest funder of alternative protein research in Europe, targeted investment by national funders is critical to the sustained success of local ecosystems. Accordingly, national funders across Europe should develop strategies to ensure long-term R&I success in the space.

Key technology areas remain neglected

Large differences in research activity can be seen across technology areas that will be key to moving alternative proteins towards taste and price parity with conventional foods. The plant-based research field is developing rapidly, with numerous new areas of research being explored. This is encouraging to see and it is important that this pillar receives continued support to capitalise on these advances.

However, several technical research areas within cultivated meat and precision fermentation, such as cell culture media, scaffolding, or host strain development, remain highly neglected, and funders should prioritise increased support for these technology areas.

Looking forward, it is likely that we may see the balance in research output shift between the alternative protein pillars. Plant-based protein research has received the most funding over the last five years, but fermentation research was the best-funded pillar in 2024, with over €100 million awarded in that year alone. In contrast, cultivated meat and seafood has received just €92 million in total funding from 2020-2024. We might therefore expect to see an increase in the volume of fermentation research publications over the coming years, while cultivated meat and seafood research will likely continue to lag behind.

Tailored funding mechanisms are needed to support the sector

This report identifies important differences in the relative maturity and degree of cohesion and interconnectedness between the alternative protein pillars. In particular, the fermentation and cultivated research communities are notable for their high proportion of early-career researchers. This points to a need for tailored approaches to meet the needs of these different research communities. While a traditional mix of funding mechanisms may be sufficient to support the continued expansion of the plant-based research community, a greater focus on promoting career progression for early-career researchers may reap better results for consolidating the nascent growth of the fermentation and cultivated communities.

Across the three pillars, the European alternative protein research community displays a lower-than-average degree of collaboration and a considerable amount of regional disparity. To begin to bridge the gap, researchers should explore mechanisms such as COST Actions (which has specific inclusiveness targets for underrepresented countries) as well as Twinning projects (which bring together institutions from EU member states and external beneficiary countries to build up capacity in the latter by tapping into the expertise of the former). Alternative proteins are largely neglected in the COST ecosystem and there is a real need for COST Actions and other networking mechanisms focused on alternative protein science to help grow the research ecosystem.

This report also finds a low level of information flow from academic publications to patent filings. The citing of a publication in a patent filing does not necessarily indicate a direct transfer of new knowledge from the academic to the commercial sphere. However, when considered in the context of the findings of our companion report on European alternative protein patents, which found that only 7% of patent families published in the years 2015-2024 have a public or nonprofit research organisation listed as a sole or co-assignee, these data strengthen the impression of a research field that requires greater support to realise the commercial potential of its work. It is well documented that Europe struggles to convert its scientific excellence into successful innovations in the market – the so-called 'European paradox'. European public funders should strive to adopt flexible, open-innovation structures for generating and exploiting new knowledge about alternative proteins to shorten the innovation cycle, reap the economic benefits of innovation, and positively impact the food system.

Author: **Dr David Hunt**

Senior Research Community Manager

The Good Food Institute Europe

europe-scitech@gfi.org Linkedin

About the Good Food Institute Europe

The Good Food Institute Europe is a nonprofit and think tank helping to build a more sustainable, secure and just food system by diversifying protein production.

We champion the science, policies and investment needed to make alternative proteins delicious, affordable and accessible across Europe.

Our SciTech team develop open-access research and resources, educate and connect the next generation of scientists and entrepreneurs, and fund open-access research across the field.

By advancing plant-based foods, cultivating meat from cells and producing ingredients through fermentation, we can boost food security, meet our climate targets and support nature-friendly farming. GFI Europe is powered by philanthropy.

06 Methodology

Search criteria

Data was sourced from Dimensions, an interlinked research information system provided by Digital Science (https://www.dimensions.ai). Given the interdisciplinary nature of alternative protein research and the wide range of potentially relevant publications that could fall under that definition, complex search terms were devised that allowed us to trigger numerous publications that may be relevant to our analysis. These search teams were:

1. ("alternative protein" or "meat substitutes" or "slaughter-free meat" or "animal-free meat" or "vegan meat" or "meat alternative" or "animal-free" or "animal substitute" or "meat substitute" or "meat analogue" or "meat analog" or "seafood substitutes" or "plant-based seafood" or "fake fish" or "fish substitutes" or "plant-based fish" or "smart protein" or "clean meat" or "future food" or "sustainable protein" or "protein production")
2. "food" AND ("protein") AND ("plant" OR "plant based" OR "plant based meat" OR "vegetable" OR "vegetarian" OR "vegan" OR "plant based seafood" OR "plant based fish" OR "algae" OR "algal" OR "macroalgae" OR "kelp" OR "microalgae" OR "seaweed" OR "crop")
3. ("plant based milk" OR "non dairy milk" OR "oat milk" OR "soy milk" OR "rice milk" OR "plant based cheese" OR "plant based dairy" OR "vegan dairy" OR "vegan cheese" OR "vegan milk" OR "dairy substitute" OR "milk substitute" OR "dairy alternative" OR "milk alternative" OR "dairy replacement" OR "milk replacement" OR "cashew cheese" OR "plant based egg" OR "egg substitute" OR "egg replacement" OR "egg alternative" OR "vegan egg")
4. "food" AND ("protein") AND ("precision fermentation" OR "fermentation derived" OR "fermentation made" OR "biomass fermentation" OR "fermentation" OR "mycoprotein" OR "single cell" OR "microbial" OR "fusarium" OR "quorn" OR "fusarium venenatum" OR "fungus" OR "fungi" OR “fungal” OR "mycelium" OR "mycelial" OR “recombinant protein” OR “microbial cell factories” OR “recombinant expression” OR "microalgae" OR "microalgal" OR "yeast" OR "cellular agriculture" OR "synthetic biology" OR "edible filamentous fungi" OR "fungal hyphae" OR "bacteria" OR "bacterial" OR "engineering biology" OR "hydrogen oxidizing bacteria" OR "microbial biomass" OR "saccharomyces cerevisiae")
5. ("cultivated meat" OR "cultured meat" OR "cell cultured meat" OR "lab grown meat" OR "cell-based meat" OR "cellular agriculture" OR "synthetic meat" OR "cell grown meat" OR "cellular meat" OR "stem cell meat" OR "cultivated seafood" OR "cultured seafood" OR "lab grown seafood" OR "cell based seafood" OR "lab grown fish" OR "cell-based fish" OR "cell cultured fish" OR "cell cultured seafood" OR "cellular aquaculture" OR "cell grown seafood" OR "cell-grown fish" OR "cellular seafood" OR "in vitro meat" OR "cultivated fat" OR "cultured fat")

The time period was limited to 2020-2024 inclusive. Countries selected for analysis were Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden, Norway, Switzerland, and the United Kingdom.

Preprints and proceedings were excluded from the search scope, and the 'Title and abstract selected' search setting was used to ensure results were more specific to the scope of the keywords, as per guidelines from the Dimensions technical support team. All data was accessed from Dimensions.ai between March and April 2025 and screened offline in a spreadsheet format.

Data screening

Results of the publications searches were screened against a set of inclusion/exclusion criteria to determine whether they were in scope for this analysis. Publications on plant-based, fermentation-made, or cultivated proteins and ingredients that satisfied the following **inclusion criteria** were considered to be within the scope of this analysis:

Publications on the classification or characterisation of a plant, algal or microbial species or cultivated animal cells as a source of protein or other ingredients (including, but not limited to, lipids, enzymes, or fibres) which can contribute to improving the sensory and techno-functional properties of an alternative protein ingredient or product with a potential use case in human food.

Publications on how the processing of plant, algal, microbial, or cultivated animal tissue affects protein functionality or quality for use as a food.

Publications on crop or strain optimisation or agronomic or bioprocessing practices that examine or aim to improve protein quality or yield or improve ease of processing.

Publications on the characterisation and/or optimisation of alternative feedstocks or cell culture media or bioprocessing methods, which examine strategies for their utilisation, including life cycle assessments, with the aim of improving the sustainability, efficiency, and/or economic viability of the process.

Publications on the characterisation of blended products where the results are relevant for the development of improved hybrid alternative protein products and/or the improvement of the functionality of individual plant, microbial, or cultivated proteins.

Publications that compare the functional properties of plant, microbial, or cultivated protein ingredients or products with conventional animal proteins where the findings are relevant for optimising the techno-functional attributes of the alternative protein ingredient or product.

Publications on the biochemical properties (flavour, aroma, nutritional properties, allergenicity) of plant, algal, microbial or cultivated proteins.

Publications on the societal, policy, and regulatory aspects or studies relating to consumer acceptance or techno-economic analysis of alternative proteins.

English language publications

Publications that met one or more of the following **exclusion criteria** were judged to be outside the scope of this analysis:

Publications on broad-spectrum comparisons of animal- and plant- or microbial-based protein diets, or consumer attitudes towards these diets, where the outcomes were not relevant for the development of alternative protein products.

Publications on the classification of a plant, algal, microbial species, or cultivated animal proteins, with a stated use case for pet food or animal feed only.

Publications on the general characteristics of underutilised plant, algal, or microbial species as foods where protein is not a focus or is only a minority focus.

Publications on the characterisation of blended products where the aim is the improvement of the functionality of animal protein products or ingredients.

Publications on the characterisation of a plant, algal, or microbial protein ingredient functionality where the stated aim is the development of nutraceuticals, bioactive peptides, or some other health-promoting ingredient.

Publications on the characterisation of plant, algal, or microbial proteins, or associated processing techniques, where the stated aim was the development of a food that does not substitute animal proteins (eg, bread, pasta, snacks).

Publications on the on the biochemical properties (flavour, aroma, nutritional properties, allergenicity) of plant, algal, or microbial proteins where the stated use case is not substituting animal products (meat, egg, dairy analogues) or no specific use case is given.

Publications on the development of plant-, algal-, or microbial-based foods as medical nutrition solutions or publications on the development of alternative protein products where the stated end user is a vulnerable person (eg, children, end users with a diagnosed medical condition).

Corrections to previously published studies already included in the dataset.

Publications on any other topics not listed in the inclusion criteria.

Non-English language publications.

Researcher ID reverse search

To improve the accuracy of the dataset used for this analysis, we implemented a new search step in addition to the methodology used in the previous iteration of this report. Caveats and limitations to this new search step are considered below.

Following the screening step, the publication IDs for all publications deemed to be in scope in the years 2020-2024 (*n*=2,372) were input into the Dimensions.ai database. In the Dimensions.ai Landscape & Discovery application, researcher IDs were downloaded for the 500 most productive authors in the dataset. Researcher IDs were limited to 500 individuals by the Dimensions.ai platform and represented approximately 10% of the total for in-scope countries (*n*=5,346 researchers). However, we estimate that this 10% collectively contribute approximately 40% of the total publications output in the time period analysed.

The researcher IDs were then searched in the Dimensions.ai interface with the same filters as used in the original search step, and the full publication data for these researchers were downloaded, screened as before against the inclusion/exclusion criteria, and added to the final dataset. This brought the total number of publications for analysis to 2,695.

Data processing

Publications were manually sorted on the basis of alternative protein pillar and research category in spreadsheet format. Bibliometric data were then analysed using the Dimensions Landscape & Discovery application by inputting the relevant publication IDs to this platform and extracting the results. Data is correct as of July 2025.

When ranking countries based on a per capita or per gross domestic product per capita based on purchase power parity (GDP PPP) basis, figures for country populations were sourced from Statista, while figures for GDP per capita (PPP) were sourced from the World Bank.

Where numerical figures are presented as a percentage, they are rounded to the nearest whole number unless it is necessary to make a distinction between similar figures.

Figures and tables were generated in Google Sheets. Maps were generated in Datawrapper.

Caveats and limitations to this analysis

Limitation	Rationale and possible implications
Ongoing activities are not captured	The majority of the public funding for alternative protein research in Europe has come in recent years, with 2024 seeing a record €300 million investment by European public and nonprofit research funders into the space. As such, this report does not capture the volume of research activity that is currently ongoing. Equally important is the fact that much of the historical R&D work on this topic has been done in the commercial realm by startups, established industry, and contract research organisations. As a result, the data presented in this analysis do not give a full overview of the total body of research that has been done on alternative proteins in Europe.
Data limitations	While this analysis was developed using a rigorous protocol, due to inevitable limitations around the identification of appropriate search terms and the total number of publications available in the Dimensions.ai platform, it is likely an underestimate of the true size of the alternative protein research community in Europe. The addition of a new researcher ID reverse search step to this analysis means we have been able to develop a more accurate assessment of the trends and dynamics of this research community than in the previous iteration of this report. However, it may also bias the data towards certain highly productive researchers and research areas. As a result, while the dataset is undoubtedly more comprehensive than in the previous iteration of this report, it probably still underrepresents the true size of the research community.
Researcher classification	We acknowledge that not all of the researchers who have contributed to the publications included in this analysis would consider themselves 'alternative protein researchers' and this exercise is not about labelling them as such. Rather, it aims to understand which researchers are contributing to moving alternative proteins towards taste and price parity with conventional animal proteins and what can be done to better support them.
Measuring impact	Throughout this report we rank countries and institutions on the basis of their total research output as measured by unique publications. We acknowledge that overall research *output* is not a reliable indicator of *quality* or *impact* and, as a result, the overall contribution that specific actors have made to the growth of this field may not be accurately represented.