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Producing Knowledge in the Alps. Collaborative Research in Dairy Microbiology, 1960–Present

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Elise Tancoigne

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Introduction

- 1 Mountain environments have physical characteristics that have made them unsuitable for the productivist development model established after the Second World War (Ricard, 1994, p. 121). Its altitude, climate and slopes have long made it difficult to use mechanisation or to keep very large herds—two of the main ways in which agricultural productivism is measured. Since the 1970s, mountains have therefore been the subject of special development measures that take these specificities into account and have given rise to alternative development models (Delfosse, 2007, p. 203). The mountain dairy sectors play a structuring role in these alternative development models, by promoting a quality approach based on the terroir and the use of denominations linked to origin. There are many Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs) in the Pyrenean, Alpine and Central massifs: until the early 1990s, 80 percent of PDOs concerned mountain products (Bertussi, 2020, p. 59). The oldest PDOs for cheeses include Roquefort (1925), Bleu de Gex (1935), Comté (1952), Saint-Nectaire (1955), Cantal (1956) and Reblochon (1958).

- 2 Although various mountain areas have prioritised quality and denomination of origin schemes, actors in these sectors have not all made the same development choices. Some have decided to set up very demanding specifications in terms of production areas, maturing sites or techniques used, such as banning the freezing of products or the compulsory use of raw milk (Ricard, 1994, p. 222). Others, on the other hand, have chosen to set up much less restrictive specifications, having extended production areas, authorising maturing sites outside the production zone or even using heat treatment on the milk in the form of pasteurisation or its milder version, thermisation. This creates a very clear opposition between two regions: on the one hand, the “central East” (Jura, Savoies) and its restrictive PDOs; on the other, the Massif Central and the Vosges and their more liberal PDOs (*ibid.*).¹
- 3 Very early on, researchers began to work on these various local products and contributed to their development. A peculiarity of this research is that attention has not been drawn to it so as not to spoil the image of a traditional product (Mustar, 1998; Bertussi, 2020). In this article, I revisit the long history of these partnerships in the service of the mountain cheese sector. By focusing on the PDOs of the central East, I show how research questions specific to these collaborative spaces have emerged. By specifically taking the example of dairy microbiology and the emergence of what I will call the “microbial terroir,” I contribute to shedding light on the production of knowledge in an Alpine context. In the first section, I will try to show that a set of factors played a major part in establishing partnership research in the Alps. These factors included, first, the implementation of public policies specific to the mountains; second, the birth of a “collaborative turn” in scientific policies during the 1980s; and finally the recognition of PDOs at the European level. In the second section, I will take the example of dairy microbiology to show how these mechanisms have allowed the notion of “microbial terroir” to emerge. In this part, I will also develop the idea that participatory research, which has been widely discussed throughout the article, remains a minority form of knowledge development in dairy microbiology. I will base this work mainly on a synthesis of the reflexive literature published by the actors of these different research projects, as well as on scientometric analyses from two sources: the publications of the “Ruminant Research Meetings” (3R) congress from 1994 to 2016 and the microbiology publications of the French National Institute for Agricultural Research (INRA) present in the bibliographic database Web of Science (1972–2020). I will also use the archives of the Scientific and Technical Committee of the Technical Institute for Gruyère (ITG, now Actalia, a technical centre for the food industry, La-Roche-sur-Foron, Haute-Savoie) between 1976 and 2000. Finally, my analysis will draw on a series of 26 semi-directive and informal oral history interviews (Bruneteaux & Lanzarini, 1998) that took place between 2016 and 2020 in the Northern Alps with producers, industry representatives, technicians and *affineurs* (cheese-ageing specialists).

Collaborative research in the Alps: a political will

- 4 The evolution of collaborative spaces around the dairy sectors in the central East can be divided into four phases: informal partnerships (1960s–1970s), the institutionalisation of these partnerships (1980s), the deepening of these partnerships (1990s), and the creation of synergies with PDOs outside the central East (2000s).

1960s: informal partnerships with INRA, creation of technical centres

- 5 At the end of the Second World War, the traditional cheese sectors of the Alps and the Jura (Comté, Reblochon, Morbier, Mont-d'Or, Beaufort, Abondance, Emmental, etc.) benefitted from the technical support provided by partnerships created on a case-by-case basis between producers and the National Dairy Industry Schools (ENIL) set up at the end of the 19th century. Technical centres dedicated to the sectors only came into being in the 1960s and 1970s, due to several factors.
- 6 The first factor is demographic, since many young men are not interested in working on the alpine pastures (Lynch & Harvois, 2016, pp. 83, 86). The demanding nature of the work and ever-lower earnings may explain this “decline in the pastoral economy” in favour of factory work or tourism. The sectors’ loss of attractiveness has led to a decrease in the number of farms. At the same time, the rise of the dairy industry in the west of France has generated significant competition for certain products from the central East not protected by PDOs, such as Emmental.² Between 1970 and 1988, the share of Breton Emmental in French production rose from 0.6 to 38 percent (Ricard, 1994, p. 158). To respond to this drop in interest and increased competition, mountain cheese chains chose to work on the quality of their products. They set up technical services and technical institutes: in 1967, the Comté Technical Centre was created (interview, former head of the Comté sector, November 2020) as well as the Technical Institute for Gruyère (ITG), with representatives from Emmental and Comté. One of the aims of this institute was to “achieve the standardisation of the product, avoiding the current disparity in quality that was ruining the profession.”³ In 1976, the ITG was quickly joined by the Beaufort chain and set up a scientific and technical committee into which INRA researchers were integrated. This participation can be seen as an extension of the informal relations that already existed between the actors of the Comté, Emmental and Beaufort cheese sectors and INRA researchers (Lynch & Harvois, 2016; Mustar, 1998; Roybin & Cristofini, 1995; Galant *et al.*, 2006; Dasen, 2013). This advisory committee was tasked with advising and making proposals to the ITG Board of Directors, which is composed of representatives of the cheese chains. The ITG’s statutes also stipulated that cheese industry professionals should have a majority on this committee.⁴ Very quickly, the ITG set up research programmes for the benefit of its sectors, and acquired experimental facilities, including an experimental cheese factory (1983).

1980s: “collaborative turn” and regionalisation

- 7 In the 1980s, a series of factors profoundly changed these informal partnerships and the way research was conducted in the Alps. First of all, the place given to different actors in the innovation process, including agricultural innovation, was reassessed (Temple *et al.*, 2018). The French National Centre for Scientific Research (CNRS) set up research groups, later renamed Scientific Interest Groups (GIS), in order to “promote the results of [fundamental] research” by facilitating collaboration with “industrial companies” (Fabius, 1984). In 1979, INRA created a department to encourage forms of research linked to stakeholders: it was within this department that the first structured research on the quality of food production “based on local know-how” (*ibid.*) was

conducted, as a result of questioning the productivist model (Delfosse & Lefort, 2011, p. 30).

- 8 This collaborative turn benefitted Alpine research, with the creation of a Northern Alps GIS in 1985 on the basis of previous partnerships. It brought together researchers (ITG, INRA, Cemagref) and agricultural development agents (Chambers of Agriculture). The use of terms such as “valorisation,” “co-construction” and “partnership” within the GIS (Roybin *et al.*, 2001) demonstrates a desire to conduct research in close collaboration with those who were previously referred to in scientific policies as the “users” or “beneficiaries” of each innovation⁵.

1990s: regional development and European recognition of PDOs

- 9 Following a report affirming the need to develop “real collaborative research” (Sebillotte, 1996, p. 214), INRA launched a partnership research programme in 1993, called programme “For and About Regional Development” (PSDR). The inclusion of this intention on an institutional, rather than departmental, level marked a turning point (Mollard & Pecqueur, 2007). The quality of food products was one of the research components of the PSDR (Sebillotte, 1993). The Rhône-Alpes region was one of the three pioneering regions in this territorial development support system and the PSDR supported the work already developed by the Northern Alps GIS on the quality of food products. The PDO cheese sectors joined the Northern Alps GIS in 1995 (Roybin *et al.*, 2001), and another GIS, the Amalthée GIS⁶ (1998–2002), was created to “strengthen the links between different structures which focussed on cheese” (*s.n.*, 1998).
- 10 This growing dynamic of work on the promotion of local products was reinforced by the process of overhauling the PDO governance system in France in 1990 and the recognition of PDOs for all agri-food products at a European (1992)⁷ and international (1994)⁸ level. Cheese designations, which had been managed since 1966 by a national committee of cheese designations of origin (CNAOF), came under the aegis of the French National Institute of Origin and Quality (INAO) in 1990, which had previously been responsible only for wine registration. The INAO then pushed the cheese sectors to specify the conditions of production of their products and to explain their link with the terroir (Delfosse, 2015). At the same time, their recognition by the World Trade Organization required PDOs to “demonstrate” the link between quality and geographical location (Vincent *et al.*, 2019). This requirement has contributed to the development of specific research on terroir products involving specialists from the natural, human and social sciences (Bérard *et al.*, 2004). Building on this, the PDO sectors of the Massif Central also created a GIS in 1994 (Jolivet, 1999).

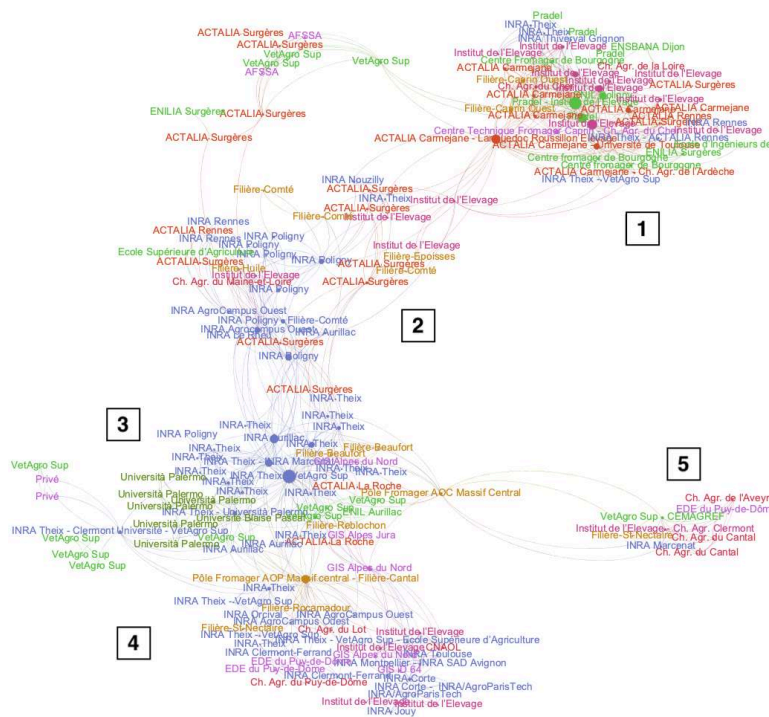
2.4 2000s: synergies with other PDOs

- 11 Formal partnerships with other sectors and regions were set up in the 2000s. In 1999, the ITG was opened up to cheeses other than the three original hard cheeses and became the Technical Institute for French Cheeses (ITFF). The Northern Alps GIS (1985–2006) integrated actors from Franche-Comté and became the Alps Jura GIS (2007–2011). A final instrument, the Mixed Technological Networks (RMT), set up by the 2006 Agricultural Orientation Law in order to “move the research and innovation system towards more integrated partnerships between research, training and development

organisations” (Bergeret, 2011), have encouraged synergies between PDOs: here again, national policies emphasise distributed forms of innovation. A RMT “Terroir cheeses” was created in 2008. This very active RMT opened up in 2020 to new PDOs (Roquefort, Normandy PDOs) and research institutes (CNRS, University of Caen). Finally, a new GIS “Cheese sectors under geographical indication” (2018–2024) was founded by some of the actors of the Alps Jura GIS as well as territorial actors and PDOs of the Massif Central.

- 12 This strong interconnection can be seen through a textual analysis of a corpus of French scientific publications on cheese research. This type of approach sheds additional light on the method of conducting research through interviews and archival work. Based on the annals of a major conference in the world of animal husbandry, the Ruminant Research Meetings (3R), created in 1994 by INRA and the French Livestock Institute, I reconstructed the co-publication links of all authors working on cheese in France (Figure 1)⁹. Each node represents an author, whose name has been replaced by his or her professional affiliation. The figure shows different types of associations, which allow us to make several observations. First of all, there are many collaborations between INRA researchers, Actalia (ex-ITG) and PDO cheese sectors. These collaborations are mainly structured around the products studied: farmhouse goat cheeses (cluster 1), Comté and Epoisses (2), Beaufort, Reblochon, Massif Central PDOs (3), Rocamadour, Cantal, and Saint-Nectaire (4, 5). Most of these products are cheeses produced in mountainous areas. The cheeses from the Rhône-Alpes region are particularly visible and their sectors are of great importance for research. It is also noteworthy in this figure that it is mainly professional structures (Actalia and the Massif Central PDO cheese cluster) that intersect with the different collaborative clusters.

Figure 1. Co-publication links between authors working on cheese and participating in the 3R meetings, from their creation (1994) to 2016.



Blue: Inra stations. Dark green: other research organisations. Red: Actalia (ex-ITG) centers. Yellow: PDO cheese sectors. Green: educational institutions. Pink: others (development actors, GIS, technical institutes).

Source: analysis by the author.

- 13 One of the advantages frequently highlighted in the literature on partner-oriented research is its capacity to raise questions that are not addressed by traditional research structures, such as work specific to cheeses and milk from the Northern Alps (Hauwuy *et al.*, 2000; Lacour, 2006). This work has allowed the emergence of the notion of what I propose to call “microbial terroir”: the idea that bacteria naturally present in raw milk are an integral part of what defines terroir, just like the cattle breed or the flora in the meadows.

Microbial terroir, a concept born out of collaborative research

Emigrants from the Thônes valleys went to produce [Reblochon] in the Ain, the Côte-d’Or, Isère, and even in Italy, without taking into account that the flora of these countries is not at all the same as that which, in the Bornes and Aravis, gives such a good taste to the original Reblochon, and I am not talking about the nature of the soil, nor the altitude, nor the ferments which, in the plains, do not behave as they do in the mountains.¹⁰

- 14 As we have seen, the central eastern PDOs imposed the use of raw milk very early on, unlike other mountain PDOs. This decision led these PDOs to face particular problems from the mid-1970s.

Scarcity of microflora and new ferments on the market

- 15 The first problem was the observation that there had been a significant drop in the amount of flora in milk and that it could eventually become endangered. In practice, this led to problems with production. Thus, in the mid-1980s, Reblochon producers got into the habit of buying commercial yoghurts to inoculate their milk and thus compensate for this decline in flora (Tancoigne, 2021). The second event was the appearance in the mid-1980s of frozen ferments, the use of which changed the methods of milk preparation (Dasen, 2013, p. 176). Unlike traditional methods of preparing leaven, which allowed bacteria to multiply during the manufacturing process, frozen ferments could be added directly to the vat without prior maturation. When the Comté Technical Centre noticed that more and more cheesemakers were using them, it “sounded the alarm” for fear of a “loss of specificity.” “When we saw this [the use of frozen ferments], we took legal action to have it banned. It was banned [in 1987] without any objective justification, for fear of losing something,” recalls one of the actors in the Comté sector (interview, former manager of the Comté sector, November 2020).
- 16 The scarcity of flora and the adoption of working methods considered illegitimate were at the origin of a reflection carried out by the Comté sector, and with it the other PDOs of the central East, to better characterise the link between microbes and specificities of the product. To do this, they benefitted from the support of the ITG and INRA, and particularly of Germain Mocquot (1910–1989), considered to be the father of dairy microbiology at INRA.
- Pasteurisation is the “universal leveller”! [...] A comparison between pasteurised or thermised cheese and raw milk cheese shows that the former are more uniform but that the latter have a greater fullness of taste and aroma.¹¹
- 17 According to him, each workshop was an “ecological niche,” the result of a “balance between microbial species” (*ibid.*). Each workshop would thus have its own signature, through this ecological niche that “gives the curd and the cheese very ‘personalised’ organoleptic qualities” (*ibid.*). The presence of Germain Mocquot and his colleagues from the INRA Poligny research station in the ITG’s Scientific and Technical Committee played a key role in the construction of partner-oriented research on milk flora. The PDOs were also anticipating the new health legislation that was being discussed at the European level at the time, which posed a major threat to raw milk cheeses.

Partnership research on milk flora. Ex situ approaches

- 18 Several research directions were pursued simultaneously at the end of the 1980s, sometimes by the same PDOs. On the one hand, several PDOs such as Reblochon, Comté and Abondance chose the path of *ex situ* preservation of bacteria taken from their products. They set up a project to collect strains, then developed what was known as “specific” ferments, adapted to their production, in collaboration with the ITG and the region’s dairy school, ENIL in La-Roche-sur-Foron. A whole knowledge based on the selection, production and development of ferments was created within these territories and various appellations of origin were able to include in their specifications rules concerning milk flora and microbial seeding practices. This research led to the realisation that the role of micro-organisms in creating the product’s specific nature was as important as the cattle breed or the flora in the grazed pastures. All the terms

used to defend traditional products, such as “heritage,” “authenticity” or “terroir,” are now linked to the microbial world, as shown by the catalogue of strains now available and produced by ENIL:

More than 30 years ago, the cheese unions of our region wanted to preserve the diversity of PDO and PGI cheeses. Strains from cheese dairies free of all industrial ferments have been collected to preserve this heritage and create a unique collection, reflecting the authenticity of our terroir.¹²

- 19 The questioning of the quality of food products, as explored by this research, was neither specific to mountain regions nor shared by all mountain regions. Nevertheless, it can be seen in a number of forms in the PDO cheese sectors of the Jura and the Alps. A counter-example is particularly enlightening in this respect. At the end of the 1980s, research into the development of specific ferments was also carried out by the Massif Central PDOs. The Director of the INRA cheese research laboratory in Aurillac saw the reduction in milk flora not as a problem but as an opportunity:

For these cheeses [PDOs of the Auvergne region] a new era has begun where, with milk of **good bacteriological quality** (i.e. whose initial seeding is negligible from a technological point of view), it is possible to envisage the development of specific leavens grouping together **the most effective** strains provided by the natural seeding.¹³

- 20 As the number of germs has decreased, it has become possible to introduce leavens selected according to a criterion of specificity as well as efficiency: the aim is to simplify the microbial ecosystem to retain only the most “efficient” strains, and thus obtain a regularity that is currently lacking. Above all, this researcher sees participation as a means of convincing professionals of the validity of her approach:

The purpose of the experiment [among cheese makers] was also to guide the professionals away from widespread scepticism and towards active participation, which would lead them to choose for themselves the strains that are best adapted to cheeses with an *appellation d’origine*.¹⁴

- 21 This example clearly shows that research into specific ferments was particularly developed in mountain regions, but that the desire to maintain raw milk production for all PDOs in the central East led to different forms of partnership research, initially carried out by the sectors rather than by the researchers. This has also led to the emergence of another approach, that of *in situ* studies and preservation.

Partnership research on milk flora. In situ approaches

- 22 At the same time as this collection was being set up, the Comté sector began research into milk flora, in order to better understand its evolution over time and how to take the necessary measures to protect it. These pioneering studies were part of the Northern Alps GIS and were supported by the region. In the early 1990s, the Comté sector hired a microbiologist to work on these issues, who was given accommodation at INRA in Poligny (interview, microbiologist, October 2020). Joint research programmes between the Massif Central GIS PDOs and the Northern Alps GIS were set up (Hauwuy *et al.*, 2000), which led to the “emergence of an ecosystemic conception of microbial life” in the dairy sector (Demeulenaere & Lagrola, 2021) and to the promotion of livestock breeding practices that preserve microbial life on the farm.

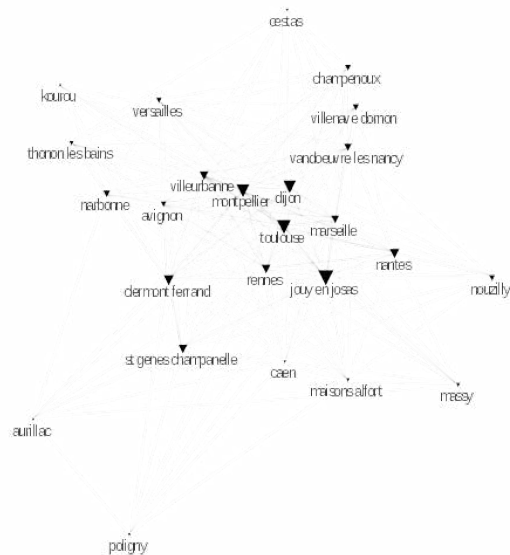
Research that remains on the fringes of microbiology

23 In this final section, I develop the idea that these partner-oriented studies, which are widely discussed throughout the article, are still a minority in French microbiology as a whole. On the one hand, although they have contributed to a better understanding of dairy microbial ecosystems, they have taken place without the large industries supplying ferments, which now control the market for cheese microbial seeding (Gibbons, 2016). On the other hand, these studies also remain a minority within INRA itself. One way of assessing their place in the overall microbiology of INRA is to evaluate the centrality of the Aurillac and Poligny stations, the two stations that have contributed most significantly to these approaches, in the entire collaborative network of the Institute's microbiology research stations. Figure 2 shows the collaborative network of the main INRA laboratories publishing research in the field of microbiology since the 1970s¹⁵.

Figure 2. Collaborative network of INRA's microbiology laboratories, 1972–2020.¹³

Image

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Dairy research stations on traditional products are in a peripheral position, unlike dairy microbiology stations with an industrial focus, such as Jouy-en-Josas or Rennes.

- 24 Each point on the map represents one of INRA's microbiology research stations. Two stations are linked if they appear together in the address field of a scientific publication. Figure 2 clearly shows that the two dairy stations specialised in supporting traditional cheese production, Poligny and Aurillac, are on the fringe of INRA's microbiology collaborative network.
- 25 Their positioning contrasts with the very central positioning of Jouy-en-Josas and Rennes, the two large dairy stations that support the development and optimisation of

industrial dairy processes (Poupardin *et al.*, 2000)¹⁶. Moreover, Rennes and Jouy also differ from Aurillac and Poligny in their use of patent law or operating licences for their inventions, such as the ultrafiltration process for milk, which was patented in 1969 and made it possible to increase cheese yields by 15 to 20 percent (Cornu *et al.*, 2018, p. 187).

- 26 The Poligny and Aurillac stations' positioning on the fringes can also be explained by the fact that the results of this type of research do not always take the form of scientific publications (Faure *et al.*, 2010, p. 169). The creation of selected ferment production services in the mountain massifs can also be considered one of the repercussions of this research. There are therefore two main types of research on milk technology being conducted at INRA: firstly, research in partnership with large industries, which leads to the registration of protected inventions; and secondly, research with small operators from quality sectors which are on the fringes of INRA's global microbiology network. This is an observation made throughout much of the period by the actors themselves: the informal partnerships of the 1960s were detrimental to the careers of the researchers who took part in them (Galant *et al.*, 2006), and the first GIS functioned "on the fringes of the academic system" (Roybin & Cristofini, 1995).

Conclusion

- 27 The existence of highly structured forms of collective organisation, such as PDO sectors or cooperative *fruitières*, is often presented as the result of the "singular space" that is the mountain (Mélo, 2015). This prior existence of collectives can be seen as an element favouring the creation of partnership research collectives (Faure *et al.*, 2010, p. 70). Does this mean that mountain environments are an advantageous terrain for setting up partnership research? It would rather seem that it is the concordance between these sectors' projects and a territorial project, orchestrated on a regional and national scale, which has enabled this development. Without being specific to mountain regions, nor shared by all mountain regions, the questioning of the quality of products, as explored by this research, was nevertheless expressed in an emphatic way and in particular forms for the PDO cheese sectors of the Jura and the Alps. The desire to maintain raw milk production for all PDOs has in fact contributed to guiding research in directions specific to these products. Therefore, the emergence of these research questions has stemmed from the forms of expression of mountain rurality and the need to preserve the representations made of it in equal measure: representations of a mountain spared from the processes of modernisation, favouring ways of life and products described as traditional. If our answer to the question, "How do we produce knowledge in the Alpine region?" is "In a participative way," we must keep in mind that this is not only linked to the characteristics of these territories, and that this form of knowledge production remains a minority relative to the disciplines considered.

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NOTES

1. The milk, which is practically sterile in the udder, is gradually inoculated during milking and all the manufacturing stages by micro-organisms present in the environment. These micro-organisms give the product its flavour, texture and aroma.
2. Emmental cheese originates from Switzerland, where it has been protected since 2006 by an *Appellation d’origine*. French Emmental was protected by a *Label rouge* (1979) and then by a PGI (Protected Geographical Indication) (1996).
3. Dominici J.-J., 1966.- “Rapport technique”, 6 p. Archives of the Actalia technological centre.
4. Technical Institute for Gruyère, 1978.- “Statuts de l’Institut Technique du Gruyère”, 3 p. Archives of the Actalia technological centre.
5. This form of participation in research differs from older and more traditional forms such as volunteer science, in which amateurs carry out a set of tasks predefined by researchers. It is now seeing a resurgence of interest under the name of “citizen science” (Houllier & Merilhou-Goudard, 2016; Strasser *et al.*, 2019).
6. Bringing together the ITG, INRA, the French Livestock Institute, dairy schools (ENIL), and the French National Center for Interprofessional Dairy Industries (CNIEL).
7. Council Regulation (EEC) No 2081/92 of 14 July 1992 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs.
8. WTO TRIPS Agreement.
9. I downloaded the proceedings from the 3R website with the import.io software and sorted them to eliminate duplicates (n=3718). Only studies classified by the 3R website as cheese studies (those that the website had assigned the keyword “cheese”) were retained (n=90 references). I then extracted the co-publication network of these authors with the Cortext Manager tool (<<http://managerv2.cortext.net/>>) and imported this network into Gephi (<<http://gephi.org>>) for readability and interaction with the graph. Spatialization was performed with the ForceAtlas algorithm. I then searched for each author’s affiliation and assigned a colour to each type of affiliation.
10. Cochat F., 1938.- *Petit historique du reblochon, fromage des vallées de Thones. Conférence faite à Annecy, le 2 mars 1938, à l’Académie florimontaine par M. François Cochat*, Imprimerie Hérisson Frères, Annecy. Author’s emphasis.
11. Mocquot G., 1986.- “Fromages d’hier et d’aujourd’hui”, in *Culture Technique*, Dossier n°16, pp. 246-251.
12. ENIL (ed.) 2018.- “Catalogue de souches de bactéries lactiques. Votre terroir, notre savoir-faire”, La-Roche-Sur-Foron, 12 p.
13. Pradel G., 1987.- “Développement de levains spécifiques pour l’amélioration de la qualité des fromages régionaux d’Auvergne”, in *Biotechnologies et industries laitières: annales du colloque, 11 mars 1987, Clermont-Ferrand*, pp. 81-87. Online: <https://infodoc.agroparistech.fr/index.php?lvl=notice_display&id=55457>. Author’s emphasis.
14. (*ibid.*)

15. Data from the Web of Science, obtained on 13 December 2020 (n=6238 documents). The documents obtained all include the word “microb*” in the title, keyword or abstract fields, and contain INRA, I.N.R.A, “Institut national de la recherche agronomique”, “National Institute of Agricultural Research”, “National Institute for Agricultural Research” or “French national body for agronomic research” in the address field. The collaborative network between INRA’s microbiology research stations was then mapped. The co-publication measure chosen is the “raw” measure. This means that if an author from Jouy-en-Josas co-publishes an article with an author from Rennes and an author from Aurillac, each of these collaborations will count as 1, i.e. a total of 3 for the whole article. All analyses were carried out with the Cortext Manager tool (<<https://managerv2.cortext.net/>>).

16. While the Jouy station also gained a reputation for its research into the microbiology of digestion, the Rennes station concentrated mainly on the fermentation, maturation and digestion of milk.

RÉSUMÉS

Mountain environments have long been the site and target of partner-oriented research policies which favour approaches based on the co-construction of research problems between development actors, professionals and scientists. Research on the French dairy sectors in the Alps and the Jura is an example of this situation. Taking the example of dairy microbiology and the emergence of the notion of “microbial terroir” in the Alps and the Jura, I propose in this article to answer the following question: how does one produce knowledge in an Alpine context? In the first part, I will present the different forms that this collaborative research has taken since the 1960s. In the second part, I will show how the notion of “microbial terroir” has emerged within these research systems and I will develop the idea that this participatory research remains a minority form of knowledge production in microbiology. I will base this work on an analysis of the reflexive literature published by these different research projects as well as on scientometric analyses and archival work carried out between 2016 and 2020 in the Northern Alps.

INDEX

Keywords : partner-oriented research, dairy products, protected designation of origin, terroir, microbiology

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