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Research article

Academic dependency: the influence of the prevailing international biomedical research agenda on Argentina's CONICET

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ABSTRACT

Background: The prevailing health and biomedical sciences (HBMS) research agenda, not only determined by leading academic institutions but also by large pharmaceutical companies, has been shown to prioritize the exploration of novel pharmacological interventions over the study of the socio-environmental factors influencing illness onset and progression. The aim of this investigation is to quantitatively explore whether and to what extent the prevailing international HBMS research agenda and the key actors setting this agenda influence research in non-core countries.

Methods: We used the Web of Science database and the CorText platform to proxy the HBMS research agenda of a prestigious research institution from Latin America: Argentina's National Research Council (CONICET). We conducted a bibliometric and lexical analysis of 16,309 HBMS academic articles whereby CONICET was among the authors' affiliations. The content of CONICET's agenda was represented through co-occurrence network maps of the most frequent concatenation of terms found in titles, keywords, and abstracts. We compared our findings with previous reports on the international HBMS research agenda.

Results: In line with the results previously reported for the prevailing international agenda, we found that terms linked to molecular biology and cancer research hegemonize CONICET's HBMS research agenda, whereas terms connecting HBMS research with socio-environmental cues are marginal. However, we also found differences with the international agenda: CONICET's HBMS agenda shows a marginal presence of terms linked to translational medicine, while terms associated with categories such as pathogens, plant research, agrobiotechnology, and food industry are more represented than in the prevailing agenda.

Conclusions: CONICET's HBMS research agenda shares topics, priorities, and methodologies with the prevailing HBMS international research agenda. However, CONICET's HBMS research agenda is internally heterogeneous, appearing to be mostly driven by a combination of elements that not only reflect academic dependency (the adoption of the prevailing research agenda by non-core research institutions) but also local economic determinants associated with Argentina's place in the international division of labor as an exporter of primary goods.

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1. Introduction

The field of health and biomedical sciences (HBMS) constitutes a classic case of diffuse limits between academic and commercial research [1], consequently representing an optimal system to scrutinize the influence of corporate interest on research agendas. Partnerships between industry and public research institutions give rise to a skewing dilemma (also known as a skewing problem): the orientation of public research agendas towards private interests. This possible bias was introduced in the literature as a dilemma between pursuing an academic or a commercially oriented research agenda [2, 3]. Private interests can also steer research agendas away from those topics that are most pertinent to public health [4].

Large pharmaceutical companies typically sponsor and establish agreements with research institutions from core countries. Nowadays, this group of dominant countries includes the United States of America (US), China, the United Kingdom, Central European countries, and Japan, among others, which are characterized by high levels of industrialization, urbanization and scientific production patterns [5]. These direct links between private corporations and research institutions is so concentrated in the countries mentioned above that globally recognized institutions from the rest of the world, which can be considered as the periphery or peripheries [6], seldom call large pharmaceutical companies direct attention; in particular, they are not among their most frequent research collaborators [5].

Furthermore, the academic literature agrees that there is a lack of demand for technology transfer in non-core countries. In particular, Latin America is characterized by a lack of new innovative firms [7] and most local corporations do not invest in Research and Development (R&D), being mostly firms demanding technical assistance, generally not requiring to conduct new research [8, 9, 10]. Therefore, we may (misleadingly) conclude that the skewing problem in research institutions from this region is absent. Since local companies do not tend to demand new-to-the-world research [11], direct contacts between local research institutions and global leaders are rare and, if they take place, they tend to be concentrated in a small group of internationalized research teams [12], it could be concluded that the bias of the overall local research agenda towards private interests will be negligible.

However, direct contacts between actors are one, but not the only way in which large private firms can influence public agendas. Indeed, beyond the acknowledgement of a direct influence of corporate interests in setting research agendas when corporations fund academic investigations or publish papers, Testoni et al. have recently shown that the influence of large pharmaceutical companies drives HBMS' prevailing research agenda, represented by the prevalent terms stemming from the 30 journals with the highest impact factors within the HBMS field [13]. By performing a bibliometric and lexical analysis of more than 95,000 scientific articles published between 1999 and 2018 in the highest impact factor journals within HBMS, the authors found that the HBMS prevailing research agenda results from the intertwining of leading academic institutions and large private firms' agendas. The resulting HBMS prevailing research agenda at the international level, as shown in that research, is more inclined towards molecular biology approaches and methodologies and cancer related research. Furthermore, it prioritizes investigations on drug discovery and development over research on the environmental and social factors affecting illness onset or progression [13].

An open question in relation to these findings is whether this HBMS prevailing research agenda permeates into the priorities of institutions that do not actively participate in shaping it. Researchers from institutions that do not participate in defining the international research agenda may also emulate it, even if they share no direct link with the institutions that set it. The need to publish in internationally recognized journals, to remain or move forward in academic careers, and the perception of certain topics and methods as frontier science could be among the reasons why these other institutions adopt the prevailing international research agenda in HBMS. If this were the case, the reach of large pharmaceutical companies' influence in setting research agendas would be even larger than what Testoni et al. found [13].

This question is even more pressing when considering institutions that might have other social and/or economic priorities. In the case of public research organizations from non-core countries, the international research agenda may compete (and eventually replace), complement, or co-evolve with an agenda focused on contributing to local priorities. In low- and middle-income countries, the latter could include a focus on promoting a different paradigm in science and technology that addresses urgent social and environmental issues [14, 15, 16, 17].

The academic literature has coined the term “academic dependency” to explain the influence of international prevailing research agendas -mainly driven by core countries' elite research institutions-on local research agendas, priorities, and the overall research of non-core countries' academic institutions [14, 18, 19]. In its simplest form, the academic dependency approach suggests that both low and middle-income countries' scientific research adopts that prevailing agenda [20], and that researchers from those countries occupy subordinate positions in science’s global division of labor [18]. Similarly, Lander called “coloniality of knowledge” the complex social and epistemological framework that determines the modes of production of science and technology, including which core countries (in particular, which institutions from those countries) concentrate power, domination, and wealth [21].

Other authors, however, provide a more nuanced understanding of the interplay between international and local research agendas [14]. They argue that the notion of academic dependency is linked to a simplifying perspective of the relation between international and local scientific agendas, since it overlooks the complex asymmetries that are present in a field intertwined by different recognition circuits (local, regional and international) [14]. In this same line, Beigel argues that research fields in the peripheries are internally heterogeneous [15]. Her work highlights the limitations of considering non-core countries as passive importers of knowledge. From that standpoint, the author concludes that scientific autonomy and heteronomy can coexist in certain historical situations [15].

Overall, previous studies used qualitative methodologies, especially case studies, to assess academic dependency. These investigations do not account for the general impact of academic dependency on the definition of a local research agenda. To overcome this shortfall and to study the potential existence of an additional indirect skewing problem, we analyzed the research agenda of Argentina’s National Research Council (CONICET). A recent article built a proxy of the HBMS prevailing research network defined by the top 200 institutions and corporations, defined as those with the highest co-publishing frequencies in the 30 top impact factor HBMS journals [13]. CONICET, which is a leading research institution in Latin America (occupying the 183rd and 141st position in the 2019 and 2022 Scimago rankings, respectively), was not part of this HBMS prevailing international research network of organizations. Given that CONICET is a non-core institution but at the same time it is a recognized and prestigious institution in the field, it represents a good case for tackling this question. CONICET can be defined as a semi-peripheral institution because it is not part of the leading organizations that determine the prevailing HBMS research agenda but still contributes to the field with state-of-the-art-research.

In this work, and regarding the definition of *agenda*, we built on the concept developed by Discourse Analysis that conceives it as a hierarchically ordered set of topics common to a particular community [22]. Following McCombs, we studied the content of the agendas rather than the attempts to dictate them (for instance, public policies regarding HBMS) [22]. In our definition, the agenda is also a reconstruction of shared representations and their values for each community [23]. For example, in the HBMS community, it includes the relevance given to a scientific issue (its position in the hierarchically ordered set of topics shared by this scientific community), the validity of a method, or the objectivity of an approach. Therefore, network maps that interconnect

contents of the agenda are an adequate methodology for studying agenda setting from a discourse analysis perspective.

Here, we aimed to examine three related issues: (1) whether CONICET's HBMS research agenda privileges the study of the same illnesses as the prevailing HBMS research agenda; (2) whether CONICET's HBMS research agenda favors or neglects the same research approaches and methodologies as the prevailing HBMS research agenda; and (3) whether CONICET's HBMS research agenda is internally homogeneous. The general aim of this investigation was to quantitatively explore if the prevailing international research agenda, set by large pharmaceutical companies and leading academic institutions, indirectly influences academic research in non-core countries and to which extent.

2. Materials and methods

Testoni et al. defined the leading research institutions that detemine the prevailing HBMS research agenda as the top 200 in terms of their frequency of co-publication in the 30 highest impact factor journals within the HBMS field [13]. First, to determine CONICET's position in this ranking and thus justify that it is indeed a research institution that is far from setting the prevailing HBMS research agenda, we replicated the methodology proposed by Testoni et al. [13]. Briefly, we used the Web of Science (WoS) to retrieve all available documents (including research articles, protocols, reviews, opinions perspectives, editorials, etc.) in those 30 journals between 1999 and 2018: 96,045 papers. After discarding those papers that did not include all the required information or displayed errors (0.7% of the total sample), we analysed 95,415 publications. Authors' affiliations in the WoS database are given as a separate field under the "research institution" field. We used this field to determine the ranking of scientific institutions and corporations, including the CONICET, based on their total publishing frequency in different documents for the corpus under study [13].

Next, we adopted the same methodology -social network analysis- applied in Testoni et al. for building proxies of the content of HBMS prevailing research agenda to study CONICET's HBMS research agenda [13]. Briefly, we extracted a corpus of HBMS articles from the WoS database that included at least one CONICET author. The corpus obtained through the WoS included only international articles in English since the CONICET HBMS community publishes and is evaluated mainly according to its publications in these journals. Since the WoS categorizes journals with reference to scientific categories, we manually selected the same particular categories corresponding to the field of HBMS that had previously been chosen [13]. Afterwards, we acquired the complete list of journals that belonged to any of those particular categories, and we acquired all their available publications (including, among others, original research articles, reviews, perspectives and editorials) that had at least one author from the CONICET between 1999 and 2018. We chose this period of time for two reasons: 1) so that the large number of publications in relation to the COVID-19 pandemic since 2019/2020 would not bias the results in relation to the content of the agendas prior to an event of such magnitude; 2) to be able to compare our analysis with previous results obtained for the international prevailing agenda during the same period of time [13]. Overall, we retrieved 16,309 papers. To get a sense of the evolution of the prevailing HBMS research agenda, Testoni et al. analyzed the content of the papers published in the highest impact factor journals in two different periods of time. In this paper, we used the same split, dividing the corpus of CONICET publications into two regular time periods: 1999–2008 and 2009–2018. CONICET's publications grew 161% (from 4523 to 11,789) in the second time period under consideration [13].

The data were processed employing the CorText platform [24], which enabled us to determine the ranking of CONICET's top co-authoring institutions (Supplementary Table s1) and to build co-occurrence maps by utilizing specific algorithms that associate entities based on their co-occurrence frequency within a chosen corpus of texts [25]. Specifically, the corpus consisted of a set of CONICET scientific publications' in HBMS, and we analyzed the prevailing content of the research encompassed in it, proxying CONICET's HBMS research agenda. We followed Tancoigne et al. [24] in their procedure to generate the maps, including the filtering of the corpus. Summing up, this paper partially replicates the methodology proposed by Testoni et al. [13]. A main difference is that our sample is not a sample of papers from a set of journals but the full corpus of publications in the HBMS field (extracted from WoS) in which the CONICET was among the affiliations.

We carried out a lexical analysis of the retrieved corpus of CONICET's HBMS papers to reconstruct the CONICET's HBMS research agenda. We withdrew the top 500 multi-terms (most frequent combinations of up to five words found in our corpus) from our corpus titles, keywords and abstract as a proxy of favored research topics among HBMS and techniques associated with these topics. To elaborate the list containing the most common multi-terms, each combination of terms was counted only once per article so that those that were named several times in the same article but that were not relevant at the level of the entire corpus do not weigh more than terms that are overall mentioned less times but in more articles. Monograms (terms with only one word) were excluded in CorText ("monograms forbidden: yes"), and each list was subjected to an in-depth cleaning process. This filtering was carried out to exclude words not related to the HBMS field and whose high frequency originates from either their grammatical function (such as "and" and "or") or the level of grammaticalization within the scientific genre ("significance and impact", "proposed method", "results show", etc.). The cleaned list consisted of 393 multi-terms which were manually classified into general categories based on research topics (such as "Immunology" or "Pathogens"). We found that many multi-terms referred to methods and procedures. Since they yield relevant data on the nature of the research being scrutinized, we decided to include them. For example, a paper could contain terms such as "gel electrophoresis" or "western blot" in its title and/or abstract, which may be indicative of the fact that the topic is being investigated from a molecular and cellular biology perspective and/or using tools linked to this field.

Network maps were plotted for each time period, displaying most frequently connected multi-terms as nodes. We prioritized the top 100 multi-terms for each time period (similar results were obtained selecting the top 150 multi-terms for each time period). Higher co-occurrences between nodes were grouped forming clusters, distinguishable on the maps as circles of a certain color. To determine these clusters in an automatic way, we followed the same methodology of Testoni et al. [13]. Since we classified each multi-term into more general categories, we also included the most frequent general categories associated with the multi-terms that conform each cluster [13]. We graphically represented the top three general categories associated with each cluster. We considered that the most frequently connected multi-terms corresponded to those research topics and methodologies that define CONICET's research agenda in HBMS [13, 25].

3. Results

In the ranking of organizations publishing in the 30 HBMS journals with the highest impact factor, CONICET appeared in the 767th position. This means that even if it does publish in such journals, it is far below leading academic institutions and several pharmaceutical corporations, reinforcing our assertion of CONICET as a semi-peripheral research institution (Table 1). Moreover, the affiliations of researchers who co-authored articles with CONICET scholars in the HBMS field mainly corresponded to other Argentine academic institutions, not to leading research institutions (Supplementary Table s1), which implies that the vast majority of CONICET researchers neither co-publish with elite institutions nor publish in leading international journals.

We analyzed the terms found in the titles, keywords, and abstracts of the CONICET HBMS scientific publications from a 20-year period (1999–2018). Similar to what was found for the international HBMS agenda [13], multi-terms linked to molecular and cellular biology

Table 1. Ranking of research institutions according to their frequency of publication in top HBMS journals. Time period: 1999–2018. The table displays the top 25 institutions, the top 6 private corporations, and CONICET's position. For each case, the number of articles are also displayed.

Rank	Institution/Corporation	Number of distinct documents
1	Harvard	12067
2	Univ Calif	11090
3	Univ London	5598
4	Univ Texas	4874
5	Univ Washington	4801
6	Univ Stanford	3624
7	NIH	3462
8	Johns Hopkins Univ	3256
9	Univ Oxford	2968
10	Max Planck	2831
11	MIT	2600
12	Univ Columbia	2529
13	Univ Toronto	2474
14	Univ Cambridge	2432
15	Duke Univ	2419
16	Univ Penn	2377
17	Mem Sloan Kettering Canc CTR	2300
18	Univ Yale	2194
19	Univ Michigan	2171
20	Univ Cornell	2043
21	Mayo Clin	1889
22	Univ Colorado	1733
23	MT Sinai Health System	1718
24	Univ Copenhagen	1705
25	Univ Chicago	1611
87	Roche	820
125	Novartis	633
161	GlaxoSmithKline	496
183	Pfizer	435
189	AMGEN INC	420
198	Merck	402
767	CONICET	74

hegemonize CONICET's agenda, representing more than 60 percent of the total (Table 2). Again, like in the international HBMS agenda (but less prevalent), multi-terms referring to cancer research (approximately 4% of all multi-terms) represent the category with the strongest presence within the specific groups of pathologies displayed in Table 2 in both time sub-periods (metabolic syndromes, for instance, represent less than 2% of all multi-terms). However, this prevalence is about three times lower than in the international HBMS agenda. Similarly, research in cardiovascular diseases is also around three times lower in the CONICET versus the international HBMS research agenda.

While a single cluster integrated by cancer-related multi-terms appears in the first time span (Figure 1, light blue circle), a second cluster arises in the second time period. One is associated with breast cancer (encompassing terms such as "breast cancer cell" and "estrogen receptor", among others) and the other one with prostate cancer (Figure 2, light blue and salmon circles, respectively).

Multi-terms related to other specific categories, such as immunology, metabolic disorders, or neurological diseases and mental health show almost the same presence as in the international HBMS agenda (Table 2). Multi-terms connecting health and disease research with ecological, environmental, or social cues were, again as in the international HBMS agenda, marginal. The strong alignment of both agendas for these dominant categories can be observed in Figure 3.

Table 2. Frequency of multi-terms linked to each category in the CONICET HBMS agenda. The tables show the cumulative frequency of appearance of multi-terms linked to each category. Each table corresponds to a different period: 1999–2008 (A) and 2009–2018 (B).

A

CONICET 1999–2008

Category	Number of distinct documents	Percentage
Molecular function/Biological proccess	1789	24,4
Molecule/Chemical Structure/Protein	1518	20,7
Methods/Techniques/Model: Chem Mol and Cell Biol (level)	792	10,8
Methods/Techniques/Model: Animal (level)	540	7,4
Cell type/kind	436	5,9
Microbiology/Applied microbiology	382	5,2
Cellular component	286	3,9
Cancer/tumor	259	3,5
Immunology	222	3,0
Pathogens	187	2,5
Chagas	185	2,5
Methods/Techniques/Model: Plant (level)	134	1,8
Metabolic syndromes/Diabetes	130	1,8
Neurological/Neurological diseases/Mental health	126	1,7
Cardiovascular	103	1,4
Evolution/Genetics/Systematics	81	1,1
Methods/Techniques/Model: Human (level)	71	1,0
Reproduction	66	0,9
Ecology/Environmental	18	0,2
Food industry	13	0,2
Hereditary diseases	8	0,1
Total	7346	100,0

B

CONICET 2009–2018

Category	Number of distinct documents	Percentage
Molecular function/Biological proccess	4441	25,3
Molecule/Chemical structure/Protein	2727	15,5
Methods/Techniques/Model: Chem Mol and Cell Biol (level)	2118	12,1
Cell type/kind	1219	6,9
Methods/Techniques/Model: Animal (level)	989	5,6
Microbiology/Applied microbiology	916	5,2
Cancer/tumor	719	4,1
Immunology	666	3,8
Pathogens	614	3,5
Cellular component	585	3,3
Chagas	404	2,3
Methods/Techniques/Model: Plant (level)	403	2,3
Cardiovascular	349	2,0
Evolution/Genetics/Systematics	320	1,8
Metabolic syndromes/Diabetes	271	1,5
Methods/Techniques/Model: Human (level)	221	1,3
Neurological/Neurological diseases/Mental health	203	1,2
Reproduction	151	0,9
Ecology/environmental	122	0,7
Food industry	83	0,5
Hereditary diseases	33	0,2
Total	17554	100,0

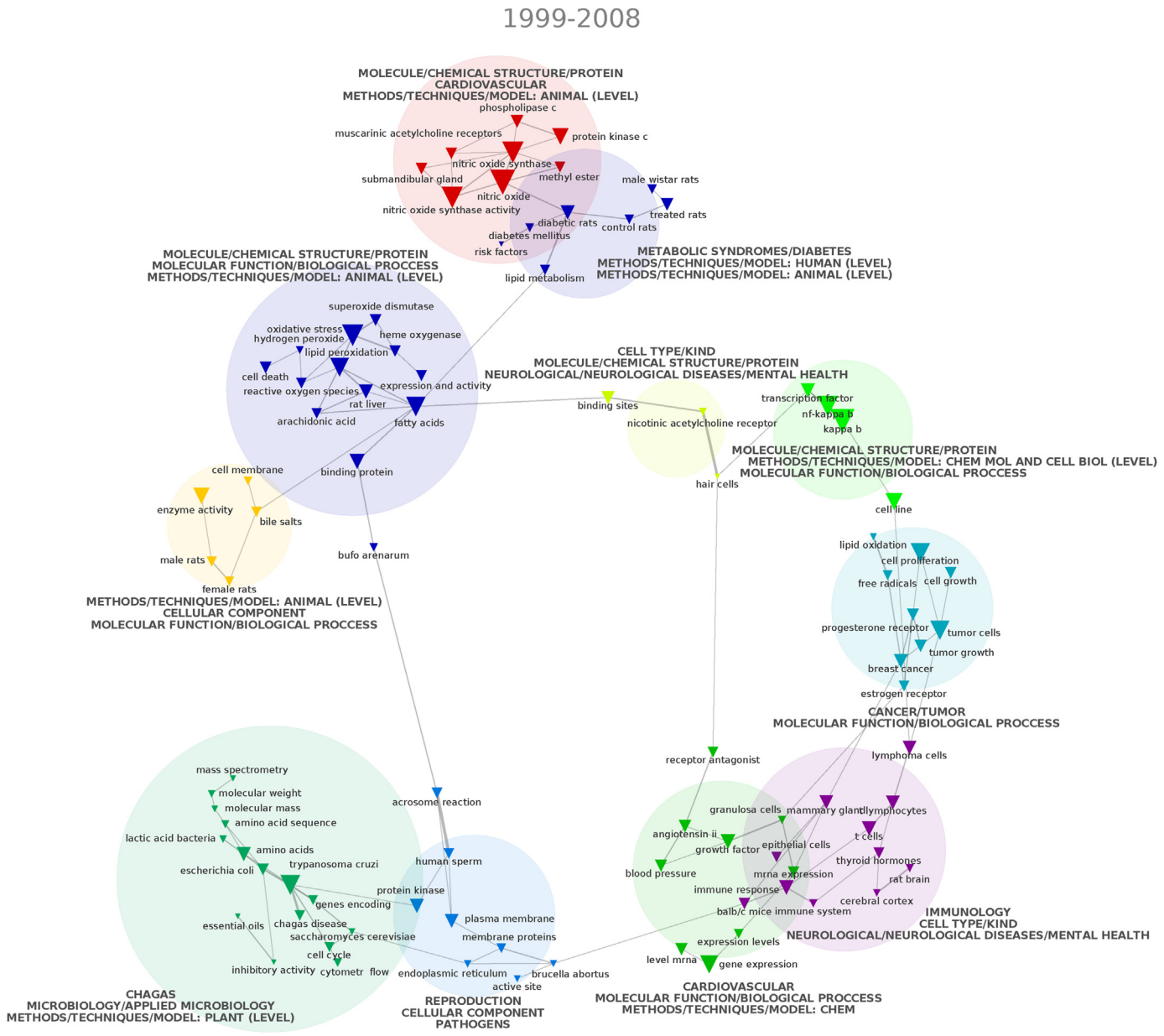


Figure 1. Top 100 CONICET HBMS research multi-terms (1999–2008) plotted according to co-occurrence using a chi-squared distribution. *Source:* authors' analysis based on WoS data extraction plotted via CorTexT.

Interestingly, we also found specific differences between the international and CONICET HBMS research agendas. In striking contrast with the former, the presence of multi-terms linked to translational or clinical research (human level) in the latter was negligible. It represented around one percent of all multi-terms during both time periods (about twenty times less than in the international HBMS agenda, Table 2 and Figure 3).

In turn, CONICET's HBMS research agenda displayed an increased proportion of multi-terms dealing with categories related to other research levels (models or approaches) -such as molecular and cellular, animals, plants, or microbiology-as compared to the international HBMS research agenda (Figure 3A-B). Particularly, the enrichment in multi-terms referring to plant research and agrobiotechnology is also reflected in the emergence of a specific cluster in the second time period (Figure 2, light green circle). Consistently, this category exhibits a 30 percent increase in multi-terms compared to the first time period (Table 2).

Also, as it can be observed in Figures 1 and 2, we found multi-terms associated with pathogens, virulence factors, microbiology, and endemic diseases such as Chagas ("*Trypanosoma cruzi*", "*Triatoma infestans*", light green circles), which are marginal in the international agenda. Together, multi-terms related to categories such as microbiology, pathogens, and endemic diseases like Chagas are five to ten times more represented than in the international agenda (Table 2) [13].

4. Discussion

In this paper, we explored the potential existence of an indirect effect exercised by private corporations and leading academic institutions on research institutions from countries that do not participate in HBMS international agenda setting. For this purpose, we analyzed the research agenda of the CONICET as a case study. Our results show that CONICET's HBMS research agenda, just like the prevailing HBMS international research agenda, privileges molecular biology methodologies and approaches and neglects research on the socio-environmental determinants of disease (Figure 3). These findings apply to both analyzed time periods independent of the near three-fold augment in the number of HBMS

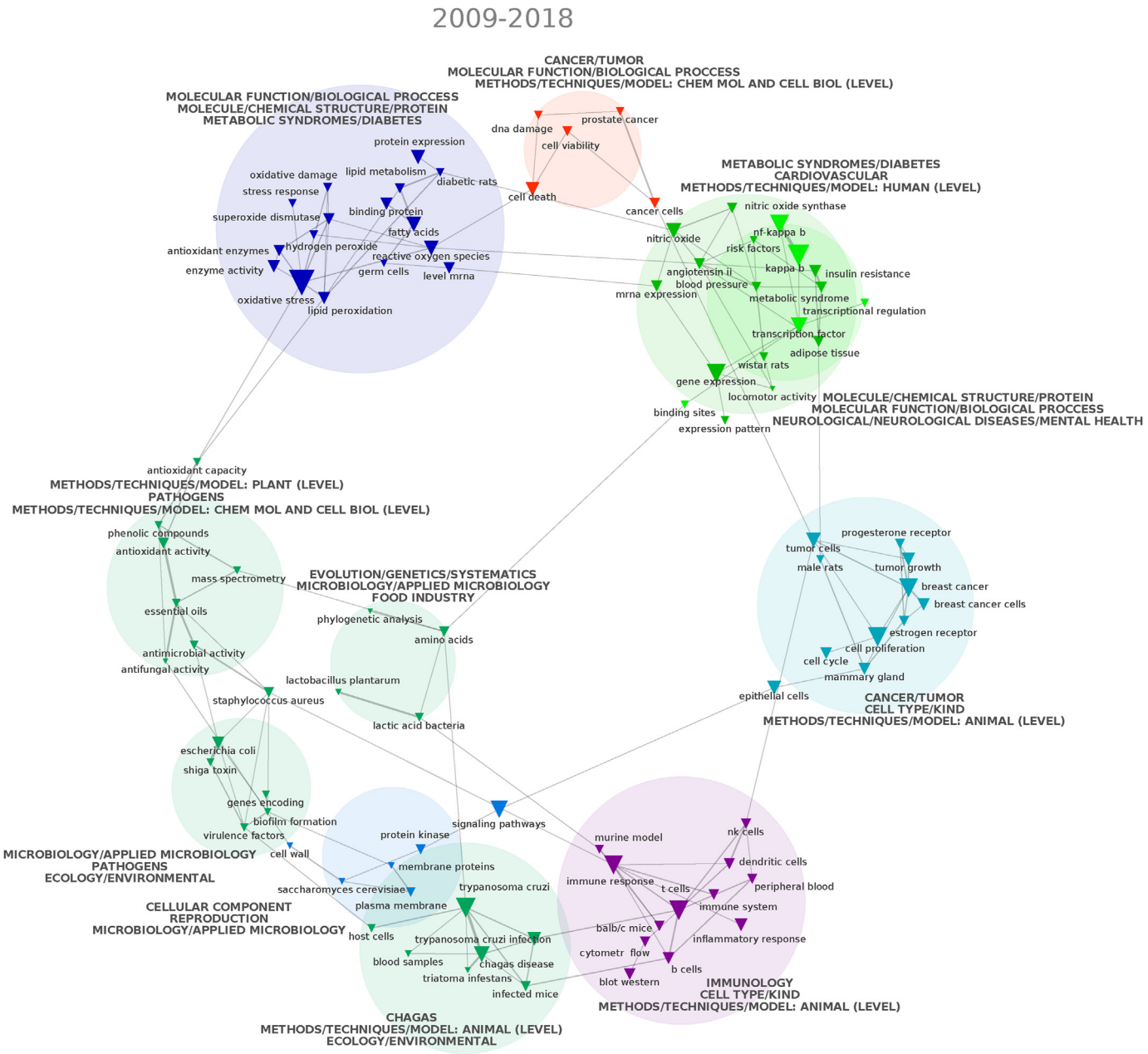
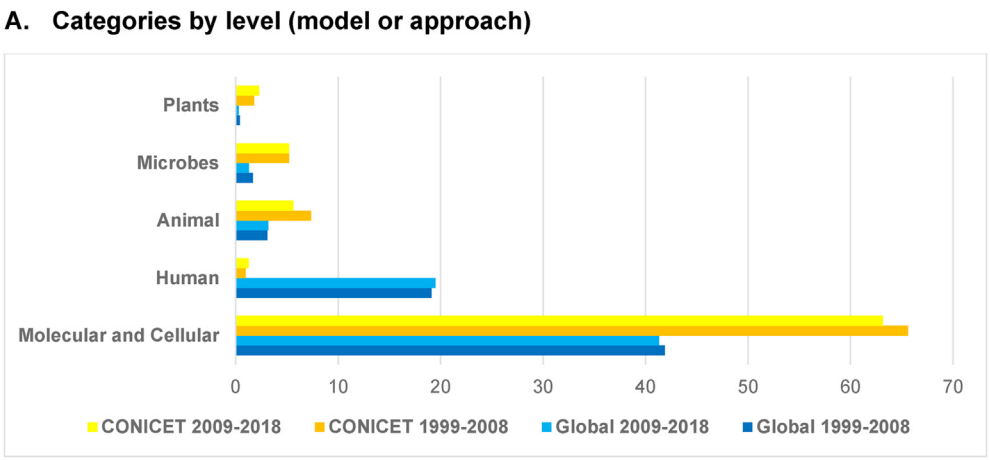


Figure 2. Top 100 CONICET HBMS research multi-terms (2009–2018) plotted according to co-occurrence using a chi-squared distribution. *Source:* authors' analysis based on WoS data extraction plotted via CorTexT.

published articles in the second time period analysed. The great majority of CONICET researchers neither publish in leading international journals (Table 1) nor co-publish with elite institutions (Supplementary Table s1). Therefore, the alignment between the prevailing and CONICET's agendas is not merely explained by a direct connection but probably by the indirect influence that these elite institutions and international journals exert beyond direct links with non-core institutions. These findings are consistent with the academic dependency theory [14, 18, 19] and with the concept of coloniality of knowledge [21].

Nevertheless, in line with Beigel's qualitative analysis [14, 15, 26], our results also show that the CONICET's HBMS research agenda is internally heterogeneous introducing some specific differences in relation to the prevailing HBMS research agenda, as depicted by Testoni et al. [13]. Multi-terms associated with categories that include pathogens and endemic diseases are five to ten times more represented than in the international agenda, implying that endemic diseases do receive more attention than in the international HBMS research agenda. These multi-terms integrate clusters with multi-terms related to the field of molecular biology, like "protein kinase" or "molecular weight". This confirms that molecular biology is the privileged approach in this field, consistent with previous results reflecting that socio-environmental determinants of human health as well as other methodological approaches are relegated [13].

Interestingly, while CONICET's HBMS agenda shows only a marginal presence of multi-terms linked to clinical or human-level medical research, multi-terms associated with other organization levels or models (such as animal, plant, microbe, or molecular and cellular systems) are over-represented in comparison with the international HBMS research agenda. For instance, multi-terms linked to molecular and cellular biology are even more prevalent in the CONICET HBMS research agenda than in the international one (in which they are already strongly enriched). The same happens with multi-terms related to animal models.



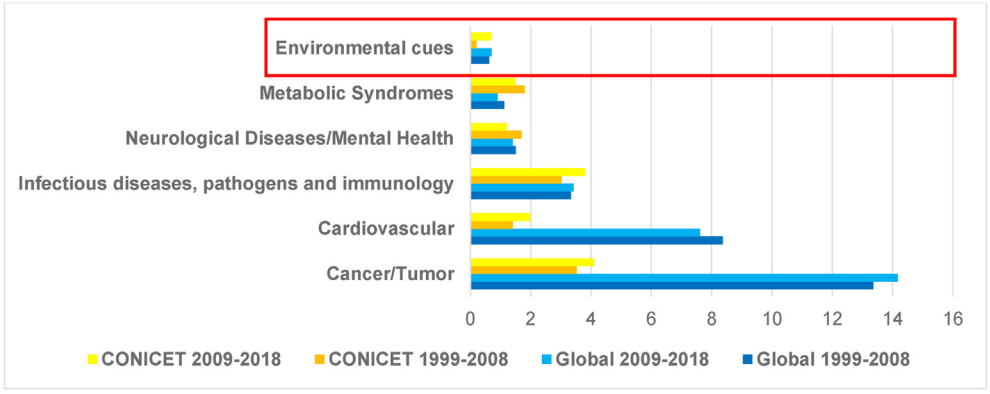


Figure 3. Alignment of the international prevailing and CONICET HBMS agendas. The charts compare the accumulated frequency of occurrence of multi-terms corresponding to different categories in the international and CONICET HBMS agendas. A. Categories by organization level (model or approach). B. Categories by pathology. The category "Environmental cues" was included in order to compare its relative importance with other categories on the agenda. The agendas are divided by time period: 1999–2008 and 2009–2018.

This could be explained by a global division of labor where translational medical research, which is sophisticated and expensive, is performed in core countries. In these countries, the cooperation between leading academic and health institutions is robust and dynamic [27]. On the contrary, the institutions from the rest of the world are mostly relegated to suppliers of basic experimental results, which are then exploited by leading academic institutions from core countries as well as by large pharmaceutical corporations. This is consistent with a recent report from the World Health Organization showing that only one percent of global clinical trials occur in Argentina in 2021, as compared to 24 percent in the US [28].

These differences, far from pointing to local autonomy, are consistent with the theories of coloniality of knowledge and academic dependency in relation to a model of knowledge extractivism. The latter was defined as a process by which science and technology produced by public institutions in the peripheries (or semi-peripheries) is monetized in core countries, generally by companies that monopolize access to knowledge [5, 29, 30]. A way to measure knowledge extractivism is the identification of blind transfer of knowledge, i.e., the citation of scientific publications in patents where the former's authors are not among patent co-owners and often are not even aware of the existence of such patents [31, 32]. A concrete example of this form of knowledge extractivism concerns COVID-19 related papers. Even though large pharmaceutical companies have benefited heavily from the pandemic, Beall et al. (2021) have recently shown that industry-affiliated articles represented only 2% of worldwide publications on COVID-19 [33].

Another important difference between the international and CONICET's HBMS prevailing research agendas is the enrichment in multi-terms associated with plant research, agrobiotechnology, and food industry. This is consistent with the leading role of Argentina as a producer of primary goods derived from agrobiotechnology, through the consolidation of its agroindustry during the 1990s [34]. Similarly, the over-representation of multi-terms associated with categories from applied microbiology and food industry in the CONICET HBMS research agenda is consistent with the role of Argentina in the international division of labor as a commodity producer and exporter [35]. Our results are, therefore, coherent with theories arguing that there is a more global model where core countries' firms capture not only knowledge but also natural resources from the rest of the world, causing significant environmental damage and social conflicts [36, 37, 38, 39, 40]. Consistently, the second time period shows a relative growth of 3.5 times in the category "Ecology/environmental", associated with an increase of almost seven times in the number of publications in that category (Table 2 and Figure 3).

To conclude, CONICET's HBMS research agenda resembles the prevailing HBMS research agenda. This similarity, however, presents significant caveats. On the one hand, part of the research privileges certain diseases and favors specific research approaches and methodologies that coincide with those of the HBMS international research agenda depicted by Testoni et al. [13], particularly dominated by the field of molecular biology. On the other hand, our results also show that CONICET's HBMS research agenda is internally heterogeneous, providing evidence of the co-habitation of heteronomy and a certain degree of autonomy.

Yet, the presence of several distinctive research topics (i.e. agrobiotechnology, applied microbiology, and food industry) found in CONICET HMBS research agenda can be explained by the (dependent) place of Argentina in the international division of labor [41, 42]. It could be argued that this position influences part of the academic community to

dedicate HBMS research efforts on topics that can inform this economic sector's innovations. In this sense, the research agenda of the CONICET seems to be the result of a combination of elements that reflects a degree of academic and economic dependency [15, 43]. Regarding the latter, CONICETs' distinctive research topics could respond to the action of private firms and research groups that build a local or regional position of power that allows them to dispute funding and prestige. This has been the case of agrobiotechnology and food companies. These private corporations fostered a discourse on the need for science and technology based innovation, which was echoed by part of the scientific community, leading to collaborations between these companies and various public research organizations [44]. For instance, Bioceres (Argentina's biggest agrobiotechnology firm), the CONICET and the National University of Litoral have developed a strong long-term R&D link that led to co-owning international patents for two genetically modified seeds. Moreover, the National Institute of Agrobiotechnology of Rosario (INDEAR) is a joint venture between two companies, Bioceres and Biosidus, and the CONICET. As it has been shown, this context strengthens the integration of science and agriculture beyond direct collaborations by creating institutional, regulatory and financing frameworks in Argentina [45].

Private companies have been shown to be among the top 20 funding sources declared in the HBMS publications of scholars from prestigious academic institutions in Argentina between 1998 and 2017 [46]. This represents an indication of the direct influence of private corporations on research agendas. However, the results presented here map bibliometric evidence on the invisible power relations network underlying the HBMS international research agenda, which indirectly influences research agendas in the rest of the world. A key contribution of this article is to shed light on the way in which international prevailing research agendas subordinate the public research of a semi-peripheral country. This is consistent with the emergence of what we call a *scientific dominant discourse* (SDD). In line with the dominant discourse theory proposed by Raiter [23], this concept can be defined as a reference axis that assigns value to the signs in a discursive community (in this case, the HBMS research community), therefore conditioning the circulation of each production (i.e. papers) and the position that certain items occupy in the agenda (HBMS topics and methods). The existence of an SDD implies a disciplinary role during scientific production, thus aligning local research agendas to the international prevailing agenda [47]. Consequently, the SDD regulates the prevalence (or marginalization) of certain research lines. Moreover, if there are economic reasons to privilege certain topics, approaches, methodologies, and sub-fields within a field, it is expected that they will be privileged not only in terms of scientific production but also regarding public and, in particular, private funding. In the case study analyzed in this work, heteronomy and a certain degree of academic autonomy coexist. However, the other crucial finding of this paper is that this apparent autonomy seems to be mostly the expression of another form of dependency, Argentina's economic dependency, which links the production of knowledge with Argentina's economic productive structure.

To our knowledge, there are three main limitations to be pointed out. First, network maps do not allow us to assure a causality from the prevailing HBMS research agenda towards CONICET's agenda. However, their similarity suggests such directionality given the fact that the prevailing HBMS research agenda is set by global leading organizations publishing in the top impact factor journals, while the CONICET has only marginally published in those journals. Second, the scope of the WoS may leave behind local publications in Spanish with a potentially low international interest. These publications may be further addressing Argentina's specific pathologies and/or other topics different from those of the international HBMS research agenda. Finally, there may be other factors affecting what prevails in an agenda, including the fact that there are different publication rates or publication practices between HBMS subdisciplines. However, the latter limitation also applies to the results of the prevailing HBMS research agenda. Therefore, the conclusion remains: the CONICET agenda is aligned with the prevailing one.

We understand that from these results a series of questions emerges that it would be interesting to pursue in future investigations. It is relevant to study the potential of research groups rooted outside global leading research institutions to push forward emergent discourses inside their local/national academic community. On the other hand, since the CONICET is a public research institution, it would be interesting to analyze the relation between public policies oriented to set its research agenda and the agenda depicted by our bibliometric maps, considered as proxies of the actual research performed in those years. Finally, it would be interesting to explore the content of other peripheral or semi-peripheral HBMS research agendas, since our work predicts that in addition to the presence of methodologies and approaches related with the SDD, a specific set of topics will be found according to the place that each country occupies in the international division of labor.

Declarations

Author contribution statement

Mercedes García Carrillo: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Federico Testoni: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Marc-André Gagnon: Contributed reagents, materials, analysis tools or data.

Cecilia Rikap: Conceived and designed the analysis; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Matías Blaustein: Conceived and designed the analysis; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Declaration of interest's statement

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Additional information

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