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VERTICAL SEGREGATION IN CHEMISTRY DURING THE COVID-19 PANDEMIC IN BRAZIL

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Abstract

To date, no studies on gender identity have been identified that would single out any institution of excellence in the field of Chemistry in the context of the COVID-19 pandemic in Brazil. Although there is a gender gap, the Institute of Chemistry at the Federal University of Rio de Janeiro (IQ-UFRJ) has a high proportion of teachers compared to the national average in the area. However, several phenomena described in the epistemology related to gender identity were evidenced, among them the scissors effect and the glass ceiling, since men are the majority of post-doctorates, dominate the four main positions of the academic career, make up the absolute majority of departments and receive double the number of research productivity grants from the National Council for Scientific and Technological Development.

WOMEN • SCIENCE • CAREER • GENDER RELATIONS

SEGREGAÇÃO VERTICAL NA ÁREA DA QUÍMICA DURANTE A PANDEMIA DE COVID-19 NO BRASIL

Resumo

Até o presente momento, não foram identificados estudos sobre identidade de gênero que particularizassem alguma instituição de excelência na área da química no contexto da pandemia de covid-19 no Brasil. Embora exista disparidade de gênero, o Instituto de Química da Universidade Federal do Rio de Janeiro (IQ-UFRJ) apresenta uma elevada proporção de professoras se comparado à média nacional da área. Entretanto, foram evidenciados diversos fenômenos descritos na epistemologia relativa à identidade de gênero, dentre eles o efeito tesoura e o teto de vidro, pois os homens são a maioria dos pós-doutorados, dominam os quatro principais cargos da carreira acadêmica, compõem a maioria absoluta dos departamentos e recebem o dobro do número de bolsas de produtividade em pesquisa do Conselho Nacional de Desenvolvimento Científico e Tecnológico.

MULHERES • CIÊNCIA • CARREIRA • RELAÇÕES DE GÊNERO

SEGREGACIÓN VERTICAL EN LA QUÍMICA DURANTE LA PANDEMIA DEL COVID-19 EN BRASIL

Resumen

Hasta la fecha, no se han identificado estudios sobre identidad de género en alguna institución de excelencia en el campo de la Química en el marco de la pandemia de covid-19 en Brasil. Si bien existe una disparidad de género, el Instituto de Química de la Universidad Federal de Rio de Janeiro (IQ-UFRJ) posee una elevada proporción de profesoras en comparación con el promedio nacional del área. Sin embargo, se pusieron en evidencia varios fenómenos descritos en la literatura; entre ellos el efecto tijera y el techo de vidrio, ya que los hombres son mayoría entre los posdoctorados; dominan los cuatro primeros cargos de la carrera académica; son mayoría absoluta en los departamentos y reciben el doble de becas de productividad en investigación del Consejo Nacional de Desarrollo Científico y Tecnológico.

MUJERES • CIENCIA • CARRERA PROFESIONAL • RELACIONES DE GÉNERO

SÉGRÉGATION VERTICALE EN CHIMIE PENDANT LA PANDÉMIE COVID-19 AU BRÉSIL

Résumé

À ce jour, aucune étude sur l'identité de genre n'a été identifiée qui permettrait de distinguer une institution d'excellence dans le domaine de la chimie dans le contexte de la pandémie de covid-19 au Brésil. Bien qu'il existe un écart entre les sexes, l'Institut de chimie de l'Université fédérale de Rio de Janeiro (IQ-UFRJ) compte une proportion élevée d'enseignants par rapport à la moyenne nationale de la région. Cependant, plusieurs phénomènes décrits dans l'épistémologie liés à l'identité de genre ont été mis en évidence, parmi lesquels l'effet ciseaux et le plafond de verre, puisque les hommes sont la majorité des post-doctorants, dominent les quatre principaux postes de la carrière universitaire, constituent la majorité absolue départements et reçoivent le double du nombre de subventions de productivité de la recherche du Conseil national du développement scientifique et technologique.

FEMMES • SCIENCE • CARRIÈRE • RELATIONS DE GENRE

ON JUNE 4, 2020, AMIDST THE ESCALATING SPREAD OF THE PANDEMIC CONTAGION OF THE new Coronavirus SARS-CoV-2 (COVID-19) (Silva, Soares et al., 2020), the international community of Chemistry found itself perplexed and strongly outraged by offensive, inconceivably sexist, xenophobic and racist statements issued in the essay entitled "'Organic synthesis – Where now?' is thirty years old. A reflection on the current state of affairs", published online by the prestigious journal *Angewandte Chemie* international edition of the German Chemical Society (Sanford, 2020). The next day, in the face of the immense negative repercussion in social networks and the numerous public statements of repudiation launched by major scientific institutions around the world, the editors of the Willey Online Library intervened and withdrew the article (Sanford, 2020; Beck-Sickinger et al., 2020), as well as initiated a process investigation that culminated in the temporary suspension of two editors of *Angewandte Chemie* and the permanent expulsion of the two reviewers of the article from the board of evaluators these scientific journal (Beck-Sickinger et al., 2020). The scandal has acquired enormous international magnitude (Sanford, 2020), since the journal *Angewandte Chemie* is considered one of the world's leading chemistry journal (Factor impact = 12.257 in 2018), including having published numerous articles of various Nobel Prize in Chemistry (NPC) scientists.

Although women's disproportionate representation in Science & Technology (S&T), in view of male participation, is not a new theme in Philosophy/History of Science and being widely approached nationally and internationally in the last decades, it has been arousing increasing interest, especially when there are unfortunate facts such as those described above that are very far from being constituted as isolated events, unfortunately. However, studies on issues of gender in S&T have acquired a new power and urgency, because since the emergence and the dissemination of the COVID-19 pandemic in Brazil, the vast majority of teachers in university students started to adjust, compulsorily, to a new work reality remote (home office) – imposed by the partial lockdown decreed both by the government as by state public authorities – (Silva, Soares et al., 2020; Soares et al., 2020), in which they were released from daily administrative tasks, of the time dedicated exclusively to the classroom and the way home to work-home. What could be seen as a great opportunity, in a serious moment of crisis, for the elaboration of academic production relevant and consequent leverage of prestige with the scientific community, it comes if revealing in a perverse reality for women, due to gender inequality still persistent in Science (Staniscuasky et al., 2020). In addition, the current pandemic landscape of COVID-19 further accentuates and unveils the perception that the false dichotomy between nature and culture (O'Callaghan-Gordo & Antó, 2020; Chin et al., 2020), so pressing in the current geological Epoch, still informally recognized as Anthropocene (Silva, Soares et al., 2020; Chin et al., 2020), in which humanity has become an unprecedented geological force in the Earth System (Silva, Arbilla et al., 2020; Silva, Soares et al., 2020; Soares et al., 2020).

When analyzing the history of Science in general and chemistry in particular, it is possible to verify the strong disparity between male and female performance in his development, and it is possible to observe how little women have been cited historiographically or, on rare occasions, appeared as mere supporting; when the most common is that they're even quoted (Chassot, 2004). You can also check this disparity under the NPC, where, since its creation in 1901 until the last edition in 2019, only five women (3%) have earned such an honor (Naide et al., 2020), even though they are not lacking in strength and competent candidates (Santos et al., 2019). This may serve as an indirect indication of the existence of a culture of historical discrimination against women, which is systemic, universal and permeates the entire social structure (Miller-Friedmann et al., 2018). However, this problem has its sociological dimension little explored and contemplated, since, although women have conquered

its space in Science, its performance is still unequal in relation to the male performance (Moschkovich & Almeida, 2015; Naidek et al., 2020).

Although relevant, inspiring, and emblematic, there are few female contributions in chemistry properly recognized within the scientific community international (Soares, 2001; Miller-Friedmann et al., 2018). A representative example is the brilliant trajectory of Madame Marie Sklodowska Curie: it was necessary that her husband, the already consecrated physicist Pierre Curie, if he refused to share the Nobel Prize in Physics (NPF) only with the also illustrious physicist Antoine Henri Becquerel, so that the evaluation commission of the NPF recognize the contribution of this important physicist in the nascent area of radioactivity, the which later also gave him a NPC (Chassot, 2004).

The causes for the problem of gender inequality in science, especially in the academy, are complex and have multiple possible approaches, whether they are of order sociocultural, economic, or cognitive (Soares, 2001; Fox, 2015; Miller-Friedmann et al., 2018). It is known that since the dawn of the human civilization, individuals belonging to the male sex were more valued than women, and that woman are less recognized not only in the academic, but also in technological and scientific areas, and relegated to the housekeeping sphere, taking care of household chores and being the guardians of family values (Whittington, 2011; Barros & Mourão, 2018). These barriers often prevent women's intellectual contribution to the progress of Science and are therefore unfair. Therefore, the silence of the academic community on this subject may lead to the conclusion that all scientists are silent complicit (Lewin, 2002; Whittington, 2011). However, the massive international repercussion condemning the polemical essay published in *Angewandte Chemie* may signal that the Chemistry community does not intend to be silent in the face of iniquities or public manifestations of prejudice or hatred of minorities (Sanford, 2020), whatever they are.

SDG-5 in the COVID-19 pandemic

The largest existing social division is that of gender, which has led to this issue occupying the third place among the eight major Millennium Development Goals (MDGs) established by the United Nations (UN) in the year 2000. Subsequently, in 2012 there were created the Sustainable Development Goals (SDGs), built on the successes of the MDGs, which now replace them. Using the notion of gender as a social division, it is possible to highlight the idea that these differences are predominantly of structural and social origin, and that man is more protagonist than the woman. Thus, one can say that gender is a historical social construction used to create, define, justify, and legitimize inequalities (Barros & Mourão, 2018). In this scenario, one can even consider inequality between men and women as a waste of women's intellectual contribution to the world (Olinto, 2011). Therefore, science is a strategic area for gender studies, even more so in the panorama of the global pandemic of COVID-19 that already brought to death more than 470,000 people, in Brazil until June 2021 (Soares et al., 2020). In addition, this pandemic has the effect of potentiating and accentuating conflict and challenges of gender inequalities, significantly impacting women due to the worsening of existing socioeconomic inequalities, provided by the social isolation and Lockdown necessary to control the contagion of COVID-19.

According to Fox (2001), Science is an institution with immense inequalities in status and in material and symbolic rewards. In addition, gender inequality persists in academic science, since, when compared to male scientists, the women have lower honorary ranks, fewer prestigious affiliations, and fewer degree of recognition (Fox, 2001; Fox, 2015). Thus, because Science is an instrument of power hierarchy, and also the continuity of gender divisions in this branch of the knowledge, status and conditions of women in different scientific fields not only reflect vertical hierarchical segregation in society, but also legitimize and support hierarchical segregation between men and women (Fox, 2001;

Fox, 2015; Vaz, 2013). The position inferiority to which women in society in general are subjected – and in Science in particular – is a reflection of human development based on a structure predominantly male, being conceptualized today as the "patriarchy".

The concept of patriarchy comes from the etymological combination of the Greek words "*pater*" (father) and "*arkhe*" (origin and command), so that word would literally be the "father authority" (Delphy, 2009). Although the term refers to a Hellenic origin, its meaning has been changed at the end of the 19th century, when, in this new sense, patriarchy became synonymous with "male domination", in other words the patriarchal culture that is male domination determines gender-specific tasks and castes (Delphy, 2009). In academia, the patriarchy is clearly demonstrated in the lower vertical progression of women: they dedicate themselves more to teaching and less to research; and, in the horizontal segregation in the different areas of knowledge, especially those of greater recognition of economic (Lima, 2013). The sexist hierarchy, resulting from the application of gender stereotypes, women (Lima, 2013). Consequently, through horizontal segregation, the women are led to follow different paths and make markedly different choices of those chosen, followed, or even allowed to male scientists. They pass to devise life strategies in which they consider or are led to consider certain activities as the most appropriate for the female gender (Olinto, 2011).

In a study conducted by Lombardi in 2006, it was observed that women in professions or courses that are seen as constantly masculinized are required proving professional competence to not only assert themselves in relation to the large group of men, but also to assert themselves before themselves (Lombardi, 2006). In the pioneering works of Sandra Harding (1987), two concepts are demonstrated that refer to the barriers imposed for the insertion of women in Science and the facility that men find for that same type of insertion. This obstacle gives an androcentric character to science, providing a social structure whose universe is historically built on gender male and excluding women (Harding, 1987; Lima, 2013).

The patriarchal, androcentric – and even misogynistic – configuration in many of the times results in under-representation of women (quantitative and/or qualitative) in the areas of S&T, where they are supposed to be unable to compete in certain careers, as they would lack the talents and cognitive skills necessary for the full exercise of their professions. Thus, it can be said that, in S&T, the present logic, beyond androcentric, is sexist, because it emphasizes the male side in a set of dualisms generated (mind versus matter/body, objectivity versus subjectivity, rationality versus irrationality/emotionality) (Harding, 1987).

The issue of academic female representation in S&T, combined with the phenomenon of vertical segregation in Brazil, is still little studied in science in general and in chemistry in particular, constituting almost an academic taboo (Miller-Friedmann et al., 2018; Naidek et al., 2020). Consequently, this article seeks to analyze and generate reflection on the relationships of gender in S&T, with special focus on the area of Chemistry, and offer visibility in its production and dissemination during the COVID-19 pandemic in Brazil. In addition, is intended to fill an important knowledge gap by focusing on stratification of gender and in the vertical segregation of teachers/scientists of the Institute of Chemistry (IQ, *acronym in portuguese*) of the largest Federal Educational Institution (IFES, *acronym in Portuguese*) in the country, the Federal University of Rio de Janeiro (UFRJ, *acronym in Portuguese*). Finally, it is intended to offer public policy suggestions for addressing gender inequality in the context of COVID-19 and possible futures Anthropocene pandemics.

Material and methods

The Institute of Chemistry of the Federal University of Rio de Janeiro (IQ-UFRJ, *acronym in Portuguese*) was founded in 1959. Its creation was aimed at implementing a unit specialized in research and in the study of chemistry, as it was an area with a great shortage of professionals qualified in the

country at the time (UFRJ, 1971). However, the teaching activities of this IFES in person have been fully suspended since the promulgation by the state of Rio de Janeiro of the Decree 46.970 of March 13, 2020, as a government alternative for the decrease in the contagion of the COVID-19 pandemic (Silva, Soares et al., 2020; Soares et al., 2020).

Initially this study would cover all departments and Institutes of Chemistry of all federal universities in the state of Rio de Janeiro (Universidade Federal Fluminense – UFF, UFRJ and Universidade Federal Rural do Rio de Janeiro – UFRRJ), but only IQ-UFRJ keeps its official data up to date and available on your institutional home page, unfortunately. So, to identify the contingent of teachers/scientists and perform the stratification by gender, was carried out, for remote work, a survey of the data at IQ-UFRJ, considering its professors/scientists officially linked (CNPq, 2020a). The generation of production data scientific to carry out this study also followed the search criteria based on data from CNPq's *Curriculum Lattes*, considering gender, formation, department (CNPq, 2020a; CNPq, 2020b), academic position/rank and if these professors are being awarded the prestige of the Research Productivity Exchange (PQ, *acronym in portuguese*) offered by CNPq and in force in 2020 (Naidek et al., 2020; CNPq, 2020c). This scientific research adopted a dialogical and complementary view between the qualitative and quantitative approaches, as well as interacting with the most current epistemology regarding gender studies.

As much as the qualitative approach presents greater theoretical methodological freedom for studies, it will be limited, in this specific case, to a robust objectivity, consistency and appreciation of the results obtained. This, too, is, a descriptive search, since the characteristics (gender) of a certain population (IQ-UFRJ), relating them to vertical and hierarchical segregation during the COVID-19 pandemic.

The methodological approach is embedded in the context of gender analysis oriented to Science from: Once the sample population was stratified, it was assessed whether there was a significant quantitative distinction between professors among men and women; as well as was analyzed the possibility of occurrence of vertical segregation motivated by gender in the mentioned departments of IQ-UFRJ. The analysis of the generated results was compared with the few studies by national, and international, authors devoted to the studies of gender in academic professions in general and in chemistry in particular.

Results and discussion

Distribution of teachers by gender and academic qualification

The debate on gender relations and women's position in the history of Science is practically seen as an inevitable reflection on the concept of division of labor (Lima, 2013). Some authors theorize that the concept of work should begin to be problematized from domestic work, unpaid work, the formal and informal work (Moschkovich & Almeida, 2015; Barros & Mourão, 2018), which would enable the "visibility" of a significant part of the working class generally attributed to women (Santos et al., 2010). In addition, one should have in minds that the current gender outlook in chemistry during the COVID-19 should be analyzed and particularized when compared to other natural sciences, as Physics or Biology, so that a more reliable picture of the specific reality of these professionals.

Contrary to what Naidek and colleagues (2020), observed when evaluating data on 2018, IQ--UFRJ no longer has a symmetrical and parity relationship between the number of male and female teachers: the total community consists of 156 teachers, being 53% men and 47% women, respectively (Table 1). These results also against those obtained so much by Soares (2001), as for Naidek and colleagues (2020) that pointed out that the female fraction in the productive force in Science in Brazil

would be composed of by at most 33%; and those obtained by Moschkovich and Almeida (2015), who have identified by a maximum of 29%, the female participation among teachers in the area of Chemistry in the State University of Campinas (UNICAMP, *acronym in portuguese*). However, the results demonstrated at IQ-UFRJ are close to those observed for female representation in chemistry in the United States of America and Portugal (Soares, 2001; Santos et al., 2019), and significantly higher than other centers of reference in Chemistry in Brazil (UFMG, UFPE, UFPR, UFRGS, UFSC and USP[1]) (Naidek et al., 2020). Although a small male dominance (6%) has been identified in IQ--UFRJ, the Chemistry as a specific discipline of science has achieved significant recent achievements for women in early stages of their academic careers, making it attractive for women to fill this once classically masculinized professional segment and thereby diminishing the invisible obstacles provided by horizontal segregation, also known as firewalls, which affect the insertion of women into historically male professional areas (Moschkovich & Almeida, 2015; Barros & Mourão, 2018; Miller-Friedmann et al., 2018). However, with the advent of the COVID-19 pandemic, these professionals are in an even greater position of precariousness (Staniscuasky et al., 2020), as they run the risk of not adapting to the new home office reality, compromising to some degree the achievements made so far.

TABLE 1
TOTAL DISTRIBUTION OF IQ-UFRJ TEACHERS BY GENDER

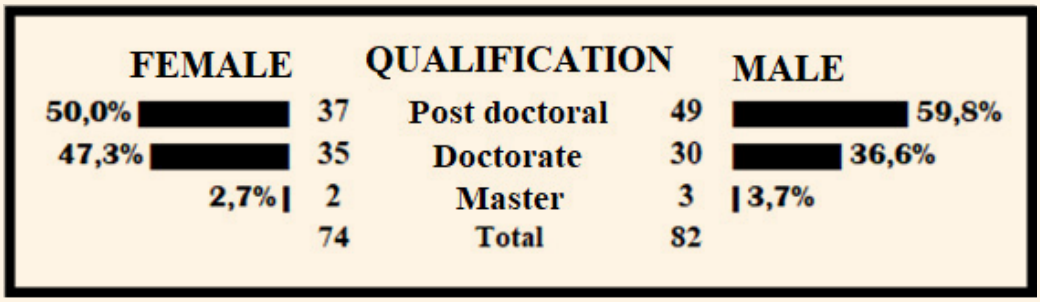
	Men	Women
Teachers	82	74
Total	156	

Source: Authors' elaboration.

In the evaluated sample universe, it is possible to verify, according to Figure 1, that the IQ--UFRJ has highly qualified human resources above the national average (Naidek et al., 2020), where only 3% of teachers have a Master's degree, 42% are PhDs and 55% have a certificate of research in a post-doctoral project. However, it is noticeable that there are two distinct trends when comparing the distribution of teaching qualifications by gender: teachers who have only the Master's degrees been practically non-existent (< 3%). The distribution is almost equal among the academics who have a PhD (47%) and those who obtain the certification of post-doctorate (50%). On the other hand, although male teachers have 50% to more professionals, when compared to teachers with only the master's degree, this fraction is also practically null in this gender (< 4%) and, contrary to the observed among teachers, do not present a close distribution between the two levels higher; most male professionals (≈ 60%) are between those bearing the certification and representative status of a post-doctorate (Figure 1). It should be noted that the IQ-UFRJ, as well as the vast majority of the IFES in Brazil traditionally encourage and authorize their teaching staff to develop post-doctoral research, for a fixed period, releasing them from their duties during that qualifying period.

1 Universidade Federal de Minas Gerais, Universidade Federal de Pernambuco, Universidade Federal do Paraná, Universidade Federal do Rio Grande do Sul, Universidade Federal de Santa Catarina and Universidade de São Paulo, respectively.

FIGURE 1
DISTRIBUTION OF ACADEMIC QUALIFICATION BY GENDER OF IQ TEACHERS-UFRJ



Source: Authors' elaboration.

In addition to the analyses performed, it is possible to verify a predominance of 17% in PhD training and a 32% male hegemony in training of post-doctorate, which may be an indication that men are seeking to accelerated post-doctoral certification – which, although not a title officially recognized academic, provides a symbolic prestige in the community scientific, thus leaving the previous stratum more quickly behind. However, due to the COVID-19 pandemic, it can be expected that women will not reach a distribution like that of men in the short or even medium term, not by lack of capacity, but for the impossibility of being able to develop projects of postdoctoral empirical laboratory that are predominant in chemistry, as historically consolidated techno-science.

Generally, the male gender is better qualified than the female gender, not being different among IQ-UFRJ teachers, as 57% of those who have post-doctorates are male. This may be due to the "Scissors Effect", an indicative of women's professional trajectory in traditional professions understood to be male, usually interrupted by pregnancy and/or dedication temporary to family life (domestic and/or parental care) (Barros & Mourão, 2018), occurrences that may be even more frequent during the COVID-19 pandemic, which does not have forecast completion in a short period of time (Staniscuasky et al., 2020). Add to the table unfavorable the possibility of further Anthropocene pandemics (Chin et al., 2020; Silva, Soares et al., 2020). The men working in these same professions, free of such charges, hold conditions more satisfactory to devote themselves exclusively to career and qualification professional (Menezes, 2017; Staniscuasky et al., 2020). Such conditions value your professional resume, which is reflected in both in prestige and salary, as observed in this study. The notions of Scissors Effect can be viewed in the female magisterium in chemistry in Brazil in statistics related to the presence of women at different levels of teaching (Moschkovich & Almeida, 2015; Naidek et al., 2020).

Distribution of teachers by gender and position

Since the promulgation of the Constitution of the Federative Republic of Brazil (CFRB) in 1988, the public contest became the only enrollment method for the action professional in an IFES of a public nature (CRFB, 1988). Therefore, IQ-UFRJ teachers who joined this IFES after 1988, did so by habilitation in an open competition of tests and titles, presenting the degree in higher education. In addition, still in effective Law 12,863, of September 2, 2013, which updated the Career and Position Plan of Magisterium (CPPM) (Lei n. 12.863, 2013). Also, according to this law, the faculty of the federal universities present only two modalities in relation to the stability in the position: permanent and temporary (Lei n. 12.863, 2013). Access to IFES through prior approval in competitions and titles could lead to a false sense of equality of treatments to the different genders of the teachers, indicating that the vertical segregation would be less pronounced (Vaz, 2013), which is not evident in practice.

Permanent teachers are those who, after having achieved success in specific invitations to tender for investiture in office and after having completed praise the probationary period, are supported by

the stability of the service federal public. On the other hand, temporary teachers are those considered to be "visitors" and/or "substitutes" hired for a limited time to meet a demand temporary at the IFES (CRFB, 1988). Although subordinated to Federal Law 12.863/2013, the UFRJ, given its autonomy university guaranteed by the CFRB, has some peculiarities and unforeseen positions in that law. The Institute of Chemistry, as well as the entire UFRJ, has the positions of Emeritus and Collaborating Professor. The professor Emeritus would be an honorary title granted by the institution to retired teachers with an outstanding track record in academic, to keep them in the university environment, allowing them to teach, guide theses, among other teaching activities (UFRJ, 1971). On the other hand, the Collaborating teacher would be the chemistry professional invited to act on a voluntary basis, without remuneration or any kind of employment relationship, being authorized to participate in activities of teaching, research, and extension in the IQ-UFRJ (UFRJ, 1971).

However, when making a stratified analysis of the teaching staff using the criteria demarcated by the federal government's CPPM is a more accurate picture of the actual situation of IQ-UFRJ (Figure 2). Coincidentally, when they are excluded from the analysis of professionals who have no formal employment relationship (collaborating and substitute), the ratio between teachers remains unchanged at 53% and 47% for men and women, respectively. In addition, in certain categories there is the predominance of a given gender, whether male or female.

FIGURE 2
DISTRIBUTION OF IQ-UFRJ TEACHERS BY GENDER AND POSITION

FEMALE		POSITION		MALE
1,4%	1	Emeritus	5	6,1%
16,2%	12	Titular	15	18,3%
25,7%	19	Associate	22	26,8%
47,3%	35	Adjunct	36	43,9%
0,0%	0	Assistant	0	0,0%
4,1%	3	Auxiliary	1	1,2%
1,4%	1	Collaborating	1	1,2%
4,1%	3	Substitute	2	2,4%
	74	Total	82	

Source: Authors' elaboration.

When evaluating the distribution of positions by gender, obtains a perception most sensitive of the institution's gender relations, in which it is found that there is a male predominance in all four top positions (Top 4) within the IQ-UFRJ (Figure 2). This in itself suggests the phenomenon known as "Glass Ceiling" or vertical segregation (Olinto, 2011), which consists of women's difficulty in ascending in the areas considered of the greatest prestige in their respective fields of performance (Lima, 2013; Barros & Mourão, 2018). Still, the results have shown that the higher a certain position, less chance of a woman obtaining it, constituting a "hierarchical tapering", and becoming an invisible obstacle in their career of these professionals (Vaz, 2013), practically impossible to overcome, which prevents them from reaching positions of greater responsibility and leadership (Moschkovich & Almeida, 2015). It is invisible because there are no laws or devices established and official social charge which impose an explicit limitation on the professional development of women. This impediment to women's ascension makes with which professionals move through the intermediate positions arranged in the career, indefinitely, until a certain point (Olinto, 2011). This happens even in fields where women are the majority. As noted by Moschkovich and Almeida (2015), among the professors in chemistry at UNICAMP, it is found that there is only female predominance within the lower ranks, consequently those of lesser prestige at IQ-UFRJ.

Although not surprising, it is quite emblematic that the categories remunerated women who have a 50% or triple teacher predominance substitute and auxiliary teacher, which are precisely the two lowest in the career plan and which require the lowest professional qualification, with only the graduation or one post-graduation *lato sensu* (Lei n. 12.863, 2013). In turn, the category of collaborating teachers has parity between men and women (Figure 2). No individuals were found in the assistant professor category, which would be the one where the chemistry teacher at IQ-UFRJ should at least have the title of máster (Lei n. 12.863, 2013). In the categories in which it is mandatory to possess the PhD title (adjunct professor and associate professor) (Lei n. 12.863, 2013), there is a relationship asymmetric between the genders of teachers. In the adjunct professor category, there are 51% and 49% of men and women respectively. In the associate professor category, there is 16% to more men than women (Figure 2). This should also be considered, which has been customary in the last two decades that the IFES have been privileging, minimally, the title of PhD in their examinations and titles for the filling teaching positions (Vaz, 2013), and that IQ-UFRJ is very likely to have joined to this trend in their competitions and titles for the permanent provision of teachers.

Although differences between male and female teachers exist, indicating disadvantage for female teachers in the lower categories, is in the analysis of the top of the career, at a time when IQ--UFRJ teachers are at the peak of their profession, that it is also possible to observe a greater disparity in relation to the gender of the respective chemistry teachers. The number of Titulars teachers men is almost 25% larger than the number of their female professionals (Figure 2). According to Santos andcolleagues (2010, p. 492, own translation[2]), "... despite the growth in the participation of women in S&T activities, the chances of success and recognition in the career are still reduced" (Santos et al., 2010). This behaviour is perpetuated, among other reasons, because the system is controlled predominantly by men, which makes it difficult for women to higher levels (Soares, 2001; Santos et al., 2010; Moschkovich & Almeida, 2015).

Thus, it can be said that when evaluating the number of recipients with the professorship emeritus at IQ-UFRJ, it is observed that basically only men can make up this select group, since of the six current teachers emeritus only a woman (17%) was invited to continue collaborating with the university after having obtained his retirement (Figure 2). This unequal proportion between men and women in this category could be explained by the Marianism present in Brazilian culture, according to Soares Marianism would be the "... social behavior which glorifies motherhood as the main social role of women and advocates the obligation of this in acting as guardian of moral values" (Soares, 2001, p. 285, own translation[3]). Therefore, the retired teachers would have the role of acting in defense of the family, helping in the creation of eventual children or grandchildren, or even deserved rest due to the hardships of the double journey (home/work) assumed throughout life (Soares, 2001; Su et al., 2014).

The Science enterprise ignores the distinctions between the careers of men and women and therefore imposes in an authoritarian way that the women adapt to the male profile of performance so that they do not fall into professional ostracism (Barros & Mourão, 2018). Concerning vertical segregation, it can be inferred that the hierarchical principle overestimates, qualifies and overvalues male work to the detriment, disqualification, and undervaluation of female labor (Barros & Mourão, 2018). The COVID-19 pandemic, which according to Silva, Soares et al. (2020) is a paradigmatic Anthropocene disease, as well as government measures to combat, may further accentuate the gender gap between IQ-UFRJ teachers, because no matter how immune men are to the impacts of lockdown

2 In th original: ". . . apesar do crescimento da participação de mulheres nas atividades de C&T, as chances de sucesso e reconhecimento na carreira ainda são reduzidas".

3 In the original: ". . . comportamento social que glorifica a maternidade como o principal papel social da mulher e defende a obrigação desta em atuar como guardiã dos valores morais".

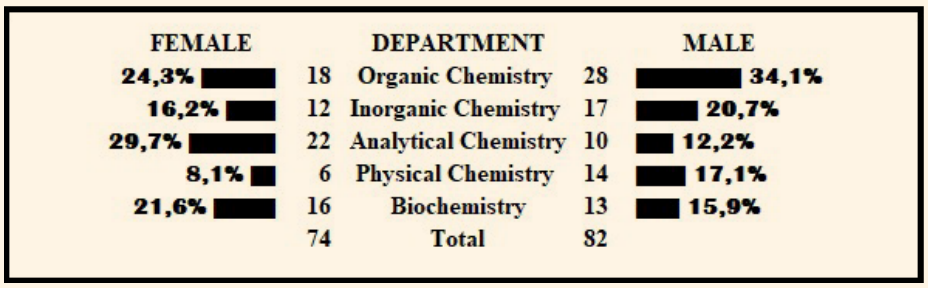
partial, traditionally, women carry the heaviest burden, making maternity a "penalty" in pandemic times of the anthropocene (Staniscuasky et al., 2020).

On the other hand, one cannot completely rule out the hypothesis that the massive filling of teaching positions by teachers at IQ-UFRJ would be a late historical phenomenon when compared to the trajectory of teachers in this science traditionally masculinized. Considering this hypothesis, there would still be no sufficient time for a significantly high number of women to possess a remarkable academic trajectory that would make them eligible to be titular/emeritus; or that these same professionals would end up choosing to retire in a manner early, when compared to the longer social security contribution time imposed on the men, so they can retire.

Distribution of teachers by gender and academic department

The academic departments are a privileged *locus* for the evaluation of commitments to the gender diversity of an institution, since they are the units of basic organizational where career prospects are shaped (Su et al., 2014). As of interdepartmental analysis of IQ-UFRJ, it is possible to verify the predominance of a data gender at the expense of another within some departments. According to Figure 3, the Department of Biochemistry and the Department of Analytical Chemistry are mostly female. In the Biochemistry Department, there is a predominance female of 23% and in Analytical Chemistry 120% in relation to the male gender. However, when analyzing the Organic Chemistry Department, it is possible to observe that this is mostly male (61%), as well as that of Inorganic Chemistry (59%) and Physical Chemistry Department (70%) (Figure 3). Except for Analytical Chemistry, Santos, and collaborators (2019) identified a distribution by gender very close to this study in the chemistry departments spread throughout Brazil (30%; 30%; 25% and 35% women in Organic Chemistry, Analytical Chemistry, Physical Chemistry and Inorganic Chemistry, respectively) (Naidek et al., 2020; Santos et al., 2019).

FIGURE 3
DISTRIBUTION OF IQ-UFRJ TEACHERS BY GENDER AND DEPARTMENT

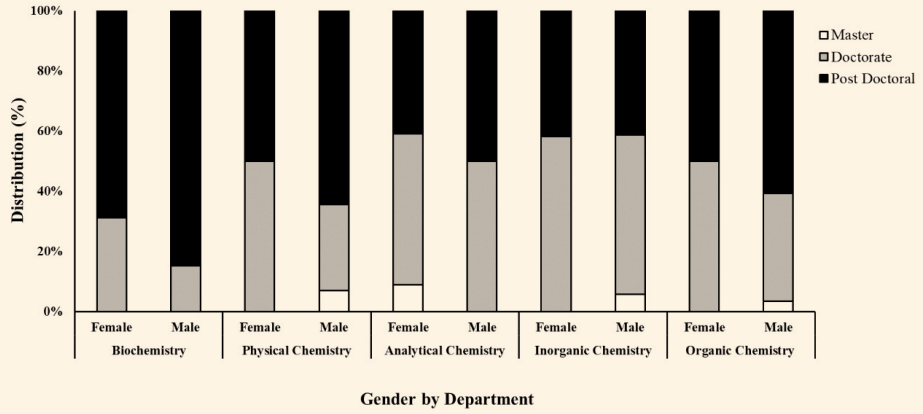


Source: Authors' elaboration.

According to Critical Mass Theory (CMT), there must be a growing demand for gender equity in academic departments to achieve a minimum proportion of female scientists. With this, the dynamics can be positively changed, and the frictions provided by gender relations interdepartamental may decrease significantly (Miller-Friedmann et al., 2018). The CMT also points out that an environment where there would be a greater presence of teachers would provide more opportunities and security for teachers to invest in technical activities and necessary for career advancement (Moschkovich & Almeida, 2015).

Still performing the analysis by departments, one can also check the degree of qualification among the genders of IQ-UFRJ (Figure 4). Except for the Department of Analytical Chemistry, male teachers predominate numerically in degree of qualification, when compared with the respective teachers, possessing or more Post-doctoral certifications or more PhD degrees in an interdepartmental analysis (Figure 4).

FIGURE 4
DISTRIBUTION OF ACADEMIC QUALIFICATION OF IQ-UFRJ TEACHERS BY GENDER AND DEPARTMENT



Source: Authors' elaboration.

Returning to the dialogue on the sexual division of labor, it should be emphasized that even if approximately 40% of Brazilian families are headed by women (Barros & Mourão, 2018), the economic inequalities rooted historically and culturally in the society allowed teachers the possibility of having employees housekeepers, nannies, nursing auxiliaries and/or caregivers of the elderly to assist with parental care, extended family and maintenance of the house and the family nucleus (Moschkovich & Almeida, 2015). Which would, in theory, allow better conditions to be obtained for such professionals to devote more time to teaching and research activities (Moschkovich & Almeida, 2015). However, it is noted that even with the ease of access to this huge reserve army of cheap and low-skilled labor, the traditional social and sexual division persists (Vaz, 2013), and is aggravated by the implementation of the partial lockdown due to the COVID-19 pandemic, which already makes it impossible to hire these same women workers, as well as to use networks of solidarity and mutual help personified in family figures (mothers, sisters and other relatives), or even in health or basic education professionals (kindergartens and schools) (Staniscuasky et al., 2020).

Distribution of teachers by gender and academic production

The Scissor Effect not only affects the level of academic training, but also is perverse to the level of professional intellectual productivity. One of the difficulties that women scientists have always faced the challenge of reconciling motherhood with the other tasks of domestic life with the research activities (Vaz, 2013; Menezes, 2017). As can be seen in the Table 2, within IQ-UFRJ, only a select group of approximately 22% of teachers has the prestige of the CNPq's Research Productivity grant (PQ, *in Portuguese acronym*), which is considered academically a certificate of research excellence or an award of recognition of scientific merit in Brazil (Santos et al., 2019), with men having 83% to plus PQ grants at this institution. These PQ grants have a meritocratic character in the which aim to reflect, at an increasing level, the recognition of academic quality of the scientist (Naidek et al., 2020), starting by rewarding those at the beginning of their career (PQ-2), following until the recognition of the most outstanding researchers (PQ-1A) until reaching the apex (PQ-SR) (Santos et al., 2019), constituting a true scientific capital with the power to attract more financial resources and even more professional prestige (Lima, 2013; Naidek et al., 2020).

TABLE 2
DISTRIBUTION OF RESEARCH PRODUCTIVITY FELLOWSHIPS (PQ) AMONG THE GENDERS OF IQ-UFRJ TEACHERS

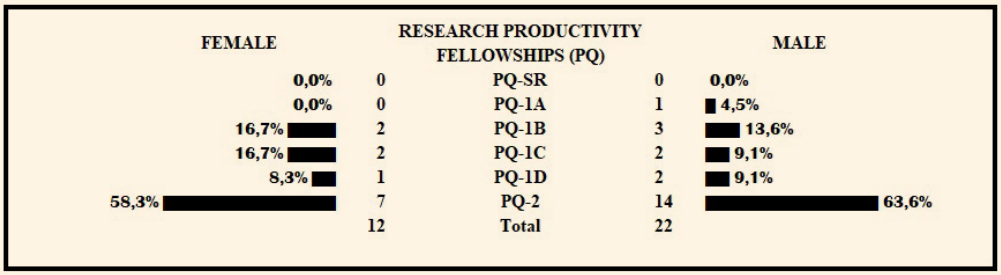
PQ Grants	Men	Women
Yes	22	12
No	60	62
Total	82	74

Source: Authors' elaboration.

As is observed nationally it is quite obvious in Figure 5 that the higher the level of the PQ bag in the Chemicals area, the lower the corresponding fraction of women who own it and (Santos et al., 2019; Naidek et al., 2020), even at the first level (PQ-2), only 33% are from the female gender, practically following the national trend, but only for this initial stage (34%) and being far behind in the other classes of the PQ scholarship (Naidek et al., 2020). Should to note that, except for PQ-1C level, where parity was identified between the general (50/50), at all other levels of the PQ scholarship, a supremacy is evidenced quantitative of the male gender, culminating in the finding that, at the high level of highlight (PQ-1A), there is total male hegemony, demonstrating that merit IQ-UFRJ women scientists are still very under-represented, in what Lima (2013) called "subaltern inclusion", which could become worsen and form an insurmountable gap because of the COVID-19 pandemic. According to Naidek and colleagues (2020), the low representation of women chemists in the highest of the PQ grant (1B and 1A) represent a great impact, as they are the researchers at these levels who often make up the Committees of Advice (AC) from development agencies and assist in policy formulation public, thus obtaining status, leadership positions and great influence in the Brazilian scientific community (Naidek et al., 2020).

One can try to justify this disparity by the fact that the members of the Board of Directors of CNPq for Chemistry are in the Coordination of the Science Research Program Chemicals and Geosciences (COSCG) which is composed mostly of men (Naidek et al., 2020; CNPq, 2020a). In that COSCG, there are 42% female and 58% male (Naidek et al., 2020); however, of the twelve members of this committee, only eight are members, with 75% being from the male gender (CNPq, 2020a; Naidek et al., 2020).

FIGURE 5
DISTRIBUTION OF CNPQ FP GRANTS BY LEVEL AND GENDER OF TEACHERS



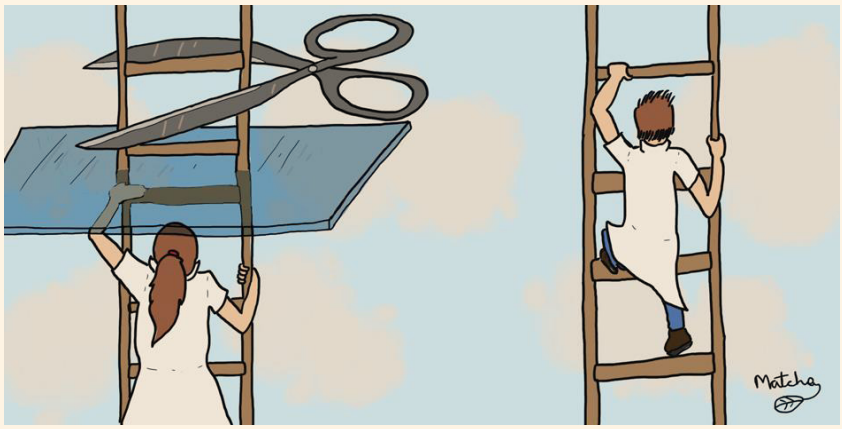
Source: Authors' elaboration.

These results show that there is a clear difficulty of progression to women in the scientific field if used as reference to professional dynamics in male, as if the steps to women's professional advancement were larger than for men. Notoriously, these distributions change significantly over the historical series within large areas (Menezes, 2017). However, the maintenance of the low proportion of women in the productivity (PQ) of high academic performance in recent period calls attention and calls for institutional commitment to provide initiatives that provide support for changes in social structure that reproduce inequality between men and women in science and education in general (Santos et al., 2019).

Seeking a new state of equilibrium

The results exposed in this study allow us to go far beyond the mere gender accounting in IQ-UFRJ or indicate the quantitative prominence of men in occupying positions of greater importance and importance than women in this institution. These results can help unveil more complex plots that feed back the mode to do Science in Brazil (Soares, 2001; Barros & Mourão, 2018), as well as to allow *a posteriori* analysis so that objective conditions for the reversal of the framework are evaluated by elaborating forecasts and action. Unfortunately, the current panorama of IQ-UFRJ, aggravated by the COVID-19 pandemic, is in line with the body of evidence obtained from the over time they attest that women advance more slowly, receive less resources and are less likely to be promoted relative to men (Su et al., 2014; Moschkovich & Almeida, 2015). This phenomenon is also internationally recognized as leaky pipeline (Staniscuasky et al., 2020), in which, by identifying the extent of gender inequality, the disability is highlighted of taking full advantage of the feminine potential in science on account of organizational superstructures based on gender bias (Moschkovich & Almeida, 2015). This shocking fact and inadmissible, as it is widespread that countries that reduce the inequality of gender, especially in economic participation and higher education, obtain advantages strategies on those who omit themselves in the face of iniquity (Barros & Mourão, 2018; Naidek et al., 2020).

FIGURE 6
SCISSORS EFFECT AND GLASS CEILING IN THE AREA OF CHEMISTRY IN BRAZIL IN TIMES OF PANDEMIC COVID-19



Source: Prepared by illustrator Matheus Chahoud.

The current Pandemic moment of COVID-19, where they are even more accentuated disputes and conflicts related to gender identity, can become a improvement opportunity in which IQ-UFRJ can take advantage of its position privileged to have a high proportion of teachers, when compared to others centers of excellence in Chemistry in Brazil (Naidek et al., 2020), and become the protagonist and leadership in the necessary reflection and claim for decision-making for a just change of the table in which the position of women in Brazilian Chemistry is found. Far from wanting to exhaust the theme, some alternatives and suggestions adapted from the literature are presented more recent for national and institutional public policymaking which meet the ODS-5 (Achieving gender equality and empowering all women and girls):

- Postponement of deadlines by the CNPq and other promotion agencies to the submission of reports for the granting/renewal of research grants (PQ) or financing of projects that consider the Lockdown period imposed by COVID-19 (Staniscuasky et al., 2020).
- Adjustment of the time limit for evaluation of scientific production minimally proportional to the compulsory withdrawal caused by the Lockdown.

- Creation of concession programs by development agencies which consider the reality of academics involved in parental care during and after Lockdown.
- Creating or expanding childcare places in nurseries or kindergartens near or on campus at post-COVID-19 (Naidek et al., 2020). The *campus* of UFRJ (*Fundão* Island) where IQ is located has these public early childhood education facilities and can serve as an example for other IQs from Brazil.
- Disclosure with the communication offices of the respective universities on relevant projects or work developed by female researchers and other minority groups under-represented during and in post-COVID-19 (Sanford, 2020).

In Brazil, it is found that all the social changes have not yet transformed the patriarchal model in society, as women's responsibilities are still the same as in the past domestic activities, in addition to parental care of the elderly and children. Thus, the women always have the need to articulate the professional role for their performance in the labor market and the family role (Moschkovich & Almeida, 2015; Barros & Mourão, 2018). Therefore, it is necessary to make more and more progress in the discussions, in the serious and urgent confrontation of the issue of gender in science and the consolidation of model overcoming strategies retrograde historically crystallized. In recent years, important initiatives that have helped to mitigate these problems, but which are in check with the current COVID-19 pandemic and possible future pandemics of Anthropocene (Staniscuasky et al., 2020).

Although only IQ-UFRJ was evaluated, with the help of this study it was possible if you make a preliminary reflection on the division of feminine/masculine roles within the Brazilian Chemistry community, where women have the responsibility of also taking care of the home. Therefore, it is strongly suggested that further studies evaluate the panorama of gender identity particularized in other reference centers of Chemistry in Brazil, so that a broader and more comprehensive scenario can be understood, as well as the IQs keep up to date and easily localized in your home institutional pages the data relating to the teaching staff for the elaboration of series time periods in which the effectiveness of future actions may be indirectly assessed to combat gender inequality to be taken.

Conclusions

The discussion of gender in society, as intended in this study, can help in the deconstruction of the relations of oppression and power, whether vertical or and try to denature the relationships and stereotypes built by those actors. To this end, it is essential to observe how the behavior of these men and women have been built and reported, throughout human history, as normal and dominant.

This research on the composition of the faculty of IQ-UFRJ allowed to point out the quantitative and qualitative distribution between women and men in the institution. The analysis careful and meticulous of each of the positions pertinent to the career plan provided an overview of female participation in the teaching field. There is considerable quantitative disparity (6%) regarding gender. In addition, the men have 16% more in the number of individuals when considering only the most important positions in the teaching career at IQ-UFRJ (Top 4), thus obtaining greater renown and professional status, a situation that may become even worse in because of the COVID-19 pandemic and which may bring discouragement to future generations women in chemistry who wish to persist in the academic area or to gain positions in leadership and prestige.

The vertical and hierarchical segregation between the masculine and the feminine becomes even more evident when one observes that in the total number of IQ-UFRJ FP grants approximately 65% belongs to male teachers; a trend that is repeated when only individuals holding the most valuable

PQ grants (PQ-1A and PQ – 1B) in which exactly 2/3 are held by male teachers. This phenomenon reiterates the functioning of a binary asymmetrical logic, which makes women unviable and denies them opportunities that could be obtained by merit. Since the hierarchical superiors' functions are under the responsibility of male teachers, this practice is not contested and ends up being considered normal, keeping an androcentric staff characteristic of S&T environments, thus perpetuating immaterial obstacles that produce symbolic places to be occupied by teachers.

The current scenario, even with the COVID-19 pandemic, finds input in the hegemonic scientific discourse in force, by making man as a reference and consequently women as the "other". A perpetual process is reproduced and cyclical in which a stereotypical *status quo* is historically constructed and legitimized which maintains differences, ratifies inequalities and exclusions, and produces prejudices from conceptions of truth. However, IQ-UFRJ can assume the role of national protagonist and stop reiterating stereotypes through subjects' attitudes who take over the management and other formal power spaces, as well as the oppressed need to demonstrate their indignation and occupy their legitimate space as teachers calling for institutional and governmental public policies that provide for gender equity.

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Note on authorship

Both authors contributed equally to the elaboration of the article.

Data availability statement

The data underlying the research text are reported in the article.

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