Biologies of Ethnicity

Artifacts of Politics in German Life Sciences

Tino Plümecke and Isabelle Bartram

Abstract *Ethnic classifications are among the most utilized concepts in the life sciences to categorize people. This paper critically examines the diverse aims and approaches characterizing their use in life science research in Germany. For this purpose, we conducted a systematic literature review and a quantitative and qualitative content analysis of 249 studies by authors affiliated with German institutions, published between 2018 and 2020. Our analysis meticulously explores how these studies assign ethnicity to research subjects, as well as the types of differences they examine and the explanations they provide for these differentiations. Our findings reveal that most articles do not comply with the guidelines of leading science journals regarding definitions of ethnicity and classification of research subjects. Most articles we reviewed employ ethnicity to investigate biological and health-related disparities caused by social inequalities. However, they also use the concept to identify biological or genetic differences, with many studies offering genetic explanations alongside social and cultural ones for the differences they found. This highlights several problematic aspects inherent to the concept of ethnicity, which is often used in ways that are fuzzy, with a spectrum of social, biological, and genetic meanings. Ethnicity is not a clearly defined entity in the studies examined; rather, it emerges as a social-biological construct influenced by various political demands, hopes, expectations, and specific cultural-temporal research frameworks. Consequently, human diversity and social inequity are transformed into a methodologically and theoretically underdeveloped artifact.*

Introduction

The emergence of advanced genetic and computational technologies within the last twenty-five years has enabled and fostered a vast amount of research in the fields of human genetics, precision medicine, and public health, as well as anthropology and history, by facilitating the statistically mapping of groups of people, which has also increased the interest in group-based differentiations to investigate health inequities between minorities and the majority population and to trace historical events such as histories of migration, pandemics, and population growth. To capture the diversity of research subjects on a level beyond individuals, classifications referring to the origin,

descent, and social-cultural group differentiation are now, again, being increasingly applied in life science research—so much so that one can speak of a current renaissance of biological differentiation according to ethnic and racial concepts (Duster 2015). This recent expansion in the identification of race and ethnicity can also be attributed to a growing awareness of, and research interest in, social inequalities among various parts of the population (Krieger 2020; Epstein 2007). Both research goals—investigating biological differences and social inequality—are used to justify certain categories for sorting humans into groups. Moreover, even if researchers rely on different terms and concepts, these words often convey similar meanings (Malinowska and Żuradzki 2023; Fujimura and Rajagopalan 2011).

Internationally, "race," "ethnicity," "population," and "ancestry" are the concepts used most often to distinguish people into groups (Byeon et al. 2021). Nonetheless, other terms are used in specific national and disciplinary contexts.[1] It is important to note that each of these concepts is imprinted in ways that are specific to context, culture, time, and discipline in its meanings and implications. Particularly noteworthy are the different meanings that have been constructed around the concept of race as a result of the extensive critiques that have taken shape over many decades (Duster 1990; Reardon 2005; Plümecke 2010). Social scientists and scholars in the humanities have criticized the concept for its a priori assumptions regarding its supposed precision as a tool of classification, its inherent essentialism, and the way it carries forward ideas of biological determinism (Koenig, Lee, and Richardson 2008; Roberts 2011). From within the life sciences, many have argued that concepts of race are not empirically substantiated, and that they hinder the investigation of biological and anthropological questions (Lewontin 1972; Marks 1995, 2008; Fischer et al. 2019). Not only have concepts of race faced criticism; the practice of labeling human groups more broadly has also been the subject of extensive political and ethical deliberations (Bowker and Star 2000; Fujimura and Rajagopalan 2011; National Academies 2023).

In Germany, the inclusion of models for human classification in bioscientific research has become the focus of a renewed debate. Alongside references to international research—where distinctions are predominantly based on categories such as race and ethnicity—there is a growing emphasis on arguments advocating for the differentiation of research subjects into population groups. For us, the question is how human classifications are dealt with in the German context, against the background of a Nazi past and the various contemporary criticisms and problematizations of classification models. A recent comprehensive analysis our research group conducted of publications by German research institutions revealed that terms related to ethnicity—such as "ethnic group," "ethnic minority," "ethnic background," or "ethnic ancestry"—are the most frequently used in the German life sciences (Bartram et al. 2023). In contrast to the relatively

1 In Germany, for example, the term "migration background" is frequently applied by researchers in the life sciences, especially in the field of epidemiology (Schenk 2007; zur Nieden and Bartram 2020; Bartram et al. 2023). In the Netherlands, the terms "autochtoon" and "allochtoon" are widely used (Yanow and van der Haar 2013). Furthermore, in some countries, immigration status is the primary factor in making differentiations, which is why terms such as "migrant" or "refugee" are preferred (see e.g., Mangrio, Paul-Satyaseela, and Strange 2020).

infrequent use of the term "race" (13.9%), "ethnicity" appeared in nearly half (45.5%) of the 546 articles from the period 2018 to 2020 we analyzed. This finding from Germany is consistent with trends observed in international studies. For instance, an analysis by Byeon et al. (2021) of classification terms in the *American Journal of Human Genetics* from 1949 to 2018 found that the use of ancestry and ethnicity increased significantly over the time period, while the use of "race" declined. Similarly, a study by Afshari and Bhopal (2010) examining terms used in international and US-based articles from 1965 to 2005 found that the concept of ethnicity surpassed the use of race between 1976 and 1980 in the international context and between 1991 and 1995 in the United States.

The increasing use of ethnicity may seem surprising given the apparent dominance of racial classification in the debate. However, several authors have advocated for this approach since the early twentieth century, and leading institutions have long supported ethnicity as a more innocuous alternative to race (Deniker 1900; Weber 1922; Huxley and Haddon 1935). Most prominently, the UNESCO statement on race recommended that one "drop the term 'race' altogether and speak of *ethnic groups*" (UNESCO 1950, 6, emphasis in the original).[2] From these early drafts and statements, it took time for the concept to become part of a broader international political debate and conceptual shifts within the scientific community. For instance, as recently as 1999, a committee of the US Institute of Medicine (now the National Academies of Medicine) advised "an emphasis on ethnic groups rather than on race in the NIH's cancer surveillance and other population research" (Institute of Medicine 1999, 4).[3] In Germany, it was only in 2006 that the German Society for Anthropology, representing human biologists, formally urged its members to avoid the term "Rasse" (race) and instead use "the most fitting term for the observed group of people, namely the geographical variant, the ethnicity or the respective population" (Niemitz, Kreutz, and Walter 2006, 463). It is important to note that ethnicity has long served as a substitute for race in German-speaking countries, particularly in the life sciences. As one of the nations that sees itself as a "post-racial" society, Germany has increasingly removed the concept of race from everyday language, legal texts, media, and academic discourse (Liebscher 2021). However, it is crucial to recognize that racism and racialized attributions do not simply vanish as a result, but may reconfigure and reassign with the concept of ethnicity.

Lack of Research on the Concept of Ethnicity

Given the rise in its use, it is surprising that the utilization of "ethnicity" in the life sciences does not receive the same level of critical historical, ethical, or social scrutiny typically directed toward "race." This lack of attention is even more surprising, especially considering the associations tied to the term "ethnos," such as its links to nationalism and the ethnicization of social conflicts—connections extensively documented in research

2 The recommendation to replace the concept of "race" with that of "ethnicity" was not repeated in the second UNESCO Statement on the Nature of Race and Racial Differences from 1950.

3 However, this is countered by the fact that the U.S. Food and Drug Administration, as the regulatory agency for the NIH, has been recording race (as well as ethnicity, sex, and age) since 1993, for purposes such as clinical trials for the approval of drugs.

on racism and discrimination. Race theorists such as Joseph Deniker also used the term "ethnic groups" (Deniker 1900), and Adolf Hitler—who primarily used the concept of race—occasionally employed "ethno" as a term, as in a speech he gave to the Reichstag on October 6th 1939, when he spoke of a "new ordering of ethnographic relations" that would follow the destruction of the Polish state (Domarus 1973, 1863). Finally, given that ethnic groups are mostly conceptualized as sociocultural entities, the use of this term to describe biological, genetic, or natural traits should give rise to serious questions of clarification. All of this raises the important question of how ethnicity is conceptualized and applied and whether ethnicity can effectively serve as a scientific classification tool for identifying social and group-based differences, as well as whether it offers a meaningful alternative to race for such a purpose.

To address these questions, this article focuses on three key areas. First, we offer a *brief overview of the historical use* of the concept of ethnicity and its interpretations. This seems particularly important to us, as there is little literature to date that systematically documents the historical and disciplinary negotiations that form the basis of our investigation. Second, we analyze *how ethnicity is produced as a biologically meaningful concept* in life science research in Germany. With the term of "biologies of ethnicity," our aim is to explore how ethnicity is used in life science research in Germany, i.e. *how it is defined, applied, and how its variations of meaning are established*. This includes examining *how research subjects are classified* into ethnic categories, what *kind of differences* researchers claim to identify between ethnic groups, and *what reasons* they propose for these differences. Third, we aim to foster a more critical examination of the topic.

Our empirical findings will ground a "critical interrogation on the present" (Foucault 1984, 49–50, 2010, 21). Foucault's concept refers to the critical practice of interrogating and analyzing the historical conditions and power structures that underpin contemporary realities. Central to this endeavor is an examination of how current norms, truths, and practices have been historically constructed, revealing the contingent mechanisms through which human beings are classified and governed. Rather than seeking a return to the past or positing an idealized future, this critique aims to unsettle established certainties, thereby creating space for alternative modes of existence and thought. The aim of our interrogation is to uncovering the politics embedded within the use of the concept "ethnicity." Treating ethnicity as an artifact of politics, we examine how politics and scientific knowledge is constructed and sustained together through specific practices, norms, standards, and discourses. Our findings reveal that there is nothing neutral or merely descriptive about the concept of ethnicity.

Methods

To investigate ethnicity in German life sciences, we conducted a systematic review of articles from German life science research institutions. Our review focused on studies published between 2018 and 2020 that classified people into ethnic, racial, national, or

migration-related groups (Bartram et al. 2023).[4] Specifically, we searched the databases PubMed and Web of Science (WoS) to identify all German life sciences studies that applied potentially racializing classifications to human research subjects. We then used document analysis and descriptive statistics to explore how concepts of human differentiation were applied and implemented throughout the research process (Mayring 2014).

Our investigation uses this descriptive analysis to ground our inquiry of the ways in which ethnicity is given its meanings. With reference to Foucault's critical interrogation on the present, we seek to draw out the relationships between power and knowledge—and particularly the explicit and implicit political effects operating at different levels of politics—that concepts of ethnicity express. Along with Foucault, we consider power not as an abstract force but as something that shapes and drives scientific questions, research designs, chosen concepts, analyses, and forms of presentation. Human classification, in our view, provides a particularly clear example of how scientific knowledge production is intertwined with sociocultural questions, policies, and frameworks. Against this backdrop, we do not merely ask whether "artifacts have politics" (Winner 1980); instead, we approach ethnicity as an artifact shaped by a series of political interpellations.

For this study, we followed the PRISMA-P 2020 guidelines for systematic reviews and meta-analyses (Page et al. 2021). Using variations of the terms "race," "ethnic," "migration background," and "ancestry," and filtering for articles authored by individuals affiliated with German institutions (either as first or last authors), we identified 546 articles relevant to our review. We analyzed the content of these articles both quantitatively and qualitatively using MAXQDA Standard 2020 (version 20.1.0, VERBI GmbH, Berlin). Our coding system included the following categories: authorship (subcodes: all authors, first and last authors, or first or last author affiliated with German institutions), discipline (based on the research institutions of first and last authors), terminology (terms used to classify or define groups of subjects), and study location (the country where samples or data were collected). In our content analysis, we examined not only the classifications described in the methods sections to define or stratify research subjects but also the terms used in the discussion sections. For this article, we focused on the 249 studies that used the term "ethnicity" or its derivatives (e.g., ethnic group, ethnic minorities) to describe research subjects.

We further analyzed how research subjects were assigned to an ethnicity (e.g., based on country of birth, genetics, self-identification, etc.) and the types of differences identified between ethnic groups (e.g., anthropometric variables, health status, genetics). Finally, we investigated the explanations provided for these observed differences, examining whether and how study authors attributed them to cultural or lifestyle factors, health service access, biological factors, or other causes.

Focusing on the methods, results, and discussion sections, we carefully read and coded all articles. When uncertainties arose, our team discussed the publications and coding decisions until reaching a consensus.

4 Details on our selection of studies and analysis of their content can be found in this previous publication.

Brief Overview of the Concept of Ethnicity

The word "ethnicity" originates from the Greek term "ethnos" and its corresponding adjective "ethnikos," which denotes a form of we/they distinction within a nonspecific group or collective. In French, the noun "etnique" has been in use since the thirteenth century, meaning "pagan." The adjective "ethnicque" with the same meaning came into usage in the sixteenth century (Académie française 2024). In English, the adjective "ethnic" has been recorded since the fifteenth century, and in German "ethnisch" has been used since the sixteenth century. European scholars and colonial administrators applied these terms to describe the diverse groups of people they encountered in colonized territories who were not considered Christians or Jews (Oxford English Dictionary 2024; DWDS 2024). It was only in the nineteenth century, with advances in historical and ethnographic scholarship, that these terms gained broader usage to denote belonging to a (foreign) people, tribe, or nation characterized by diverse customs, religions, and appearances (DWDS 2024; Bös 2005, 2015). The development of ethnic terms has been closely tied to their relationships with nationality, culture, and, above all, race (Hattam 2004).

Ethnicity in the Social Sciences

While the concept of race was relatively widespread in the early development of social science—encompassing a spectrum of biological, Social Darwinist, and sociocultural meanings—ethnic terms appeared only sporadically and lacked analytical precision until the 1920s. They were often used synonymously with race. One example is found in the work of Polish-Austrian sociologist Ludwig Gumplowicz, who, at the end of the nineteenth century, wrote about social groups and communities and warned that states and their people should not be misunderstood as "permanent ethnic elements," as these themselves consist of "heterogeneous ethnic components of populations" (Gumplowicz 1883, 183, our translation). At the beginning of the twentieth century, American sociologist William Graham Sumner introduced the term "ethnocentrism" (Sumner 1906, 14; see also Bös 2020). In the second decade of the century, some American Zionists in New York began describing themselves as ethnic groups (Hattam 2004, 45). Jewish immigrants had to grapple with issues of group membership and national origin in different ways than other immigrants, as the common national origin labels of "hyphenated Americans" did not provide sufficient identification for them (Banton 2015, 96). In the following decades, debates around ethnicity in the United States were significantly fueled for various reasons: the expanding immigration from countries that were no longer seen as easily integrated into the "melting pot," an increasing criticism of the category of "race" in the context of debates about anti-Semitism in France and Germany, and the social and political controversies surrounding the so-called "race question" in the United States (Plümecke 2013, 81–84).

Importantly, ethnicity was not originally conceptualized as a counterpoint to race. Instead, the two were intricately interconnected in their relationships with nation and culture. The term ethnicity became more important as European immigrant groups (and only these) in the United States were increasingly be seen not as different races, but as

different ethnic groups. People previously recorded as biologically distinct races in public discourse and administrative registries were now redefined based on factors such as nationality, language, religion, and behavior.

One of the first—and still widely used—definitions of "ethnicity" was developed by Max Weber. In *Economy and Society* (1922, 389), he defined ethnic groups as "human groups that entertain a subjective belief in their common descent because of similarities of physical type or of customs or both, or because of memories of colonization and migration." Weber conceptualized ethnicity as a form of social relationship, that united group members through a shared belief in common origins, whether based on physical or cultural characteristics. "It does not matter," he emphasized, "whether or not an objective blood relationship exists" (ibid.). Importantly, Weber viewed race as a subset of ethnicity, while other social scientists emphasized their distinctions. Some of these defined race as based on biological or phenotypical characteristics, contrasting it with ethnicity, which they saw as rooted in cultural attributes (van den Berghe 1967; Omi and Winant 1986; Feagin and Feagin 2011). Others highlighted differences in identification processes. They linked ethnicity to positive tendencies of self-identification and inclusion, and argued race primarily linked to negative attributions of exclusion by others (Banton 1977, 136).

Contemporary empirical research on ethnicity mirror back this diversity of theoretical and methodological approaches. Thus, some scholars argue that there is no universally agreed meaning of the term within sociology (Banton 2015, 119; Gabbert 2015, 185). However, certain elements are common to all definitions. First, ethnicity involves a distinction between "we" and "the other." Second, this distinction is based on perceptible or imagined characteristics, such as physical features or cultural practices such as language, religion, or traditions. Third, these distinctions go beyond the (putative) characteristics themselves to create socially relevant differences—differences that carry social consequences. Fourth, ethnicity is often linked to power dynamics, structural advantages or disadvantages, and relationships of social marginalization or dominance. Many researchers see ethnicity as deeply intertwined with issues of income inequality, wealth disparities, and poverty, underscoring its intersection with class (Gordon 1964; Stein 2004).

Administrative definitions of ethnicity vary significantly across countries, with varied and often conflicting meanings and usages across political, legal, medical, and activist contexts. Many European nations do not officially record ethnicity, while in the United States, the census recognizes only Hispanics or Latinos as an ethnic group. The most recent census in the United Kingdom, by contrast, identified nineteen distinct ethnic groups. In Canada, ethnicity is an official category primarily for First Nations people, with the 2021 census offering over 580 examples to account for diverse identities (Statistics Canada 2024). Moreover, as the social anthropologist Frederik Barth demonstrated, ethnic boundaries are not necessarily based on cultural content but on strategically drawn demarcations. Ethnicity is not the sum of "objective" differences, he argues, but of those differences deemed significant by the actors involved: some characteristics are emphasized as markers of distinction, while others are downplayed or denied (Barth 1969, 14). Such demarcations are therefore not fixed; they are continually shaped through interactions, with individuals crossing into different ethnic groups and changing their identities over time. Surveys in the United States, for instance, have shown that respon-

dents often change their reported race or ethnicity. In a comparison of data from the First National Health and Nutrition Examination Survey and the Epidemiologic Follow-up Survey (published in 1975 and 1984, respectively), only 58 percent of respondents identified with the same ethnicity in both surveys (Hahn, Truman, and Barker 1996). These findings highlight the fluidity of ethnicity (and race) as self-constructed categories rather than fixed, objective markers of group membership (Jugert et al. 2022, 4).

All contemporary approaches agree that ethnicity is a social construction. This means it is a socioculturally generated classification often associated with cultural essentialism or biodeterminism. In the social sciences, ethnicity is thus understood not as a property of a group or a natural entity, as something in groups, but as a relationship *between* people (Barth 1969; Eriksen 2010). Ethnicity is thus seen as "highly situational," dependent on the "relations to other groups and persons in a given situation," and subject to frequent change (Bös 2015, 137). It is a process of boundary making and boundary maintenance (Barth 1969, 10), and more a way of "perceiving, interpreting, and representing the social world" (Brubaker 2004, 17). Work in cultural studies often emphasizes the diversity of "cultural landscapes," while disciplines such as anthropology, political science, and sociology focus on the persistence and reformation of cultural boundaries. Many studies in the social sciences aim to identify commonalities in ethnic phenomena, while others investigate construction practices, processes of othering, comparisons of national contexts, and the effects of discrimination against ethnic groups. Research on the impact of social inequality on ethnic groups, in particular, increasingly connects social science studies with bioscientific investigations.

Ethnicity in the Life Sciences

In their seminal work *We Europeans* (1935), evolutionary biologist Julian Huxley and anthropologist Alfred Haddon rigorously challenged the scientific validity of the concept of "race," advocating instead for the adoption of "ethnic group" as a more precise and constructive term (Huxley and Haddon 1935, 136). Their proposal had a profound and lasting impact, notably influencing the UNESCO statement "The Race Question" (UNESCO 1950), which similarly recommended to drop the term "race" altogether and speak of "ethnic groups." The statement and this recommendation encountered significant opposition; however, over the following decades, its perspective gained traction among a number of bioscientists, who criticized the scientific basis of the usual concepts used to classify humans (e.g., Livingstone 1962; Lewontin 1972; Marks 2008; UNESCO 1995).

With the emergence of new molecular genetic methods from the 1980s onwards, criticism of racial concepts also intensified. The molecularization of race—where the concept is increasingly defined through genetics and "reinscribed" or "refashioned" in terms of DNA (Duster 1990; Fullwiley 2007; El-Haj 2007)—has been extensively problematized. How the concept of ethnicity has evolved in the course of this development, on the other hand, is largely unclear. For example, no studies exist to date that have examined the molecularization or genetization of ethnicity apart from its connection to race. Studies show, for example, that the use of the combination term "race/ethnicity" is often used as a "cipher for innate genetic differences" (Outram and Ellison 2006, 83). Similarly, Catherine Lee's content analysis of 204 biomedical research publications (2009) found that in

many cases where "race and ethnicity" were invoked to explain observed differences, the "authors relied on biological or genetic explanations" (Lee 2009, 1188). However, these findings cannot be generalized, as the elaborations under the term ethnicity predominantly refer to race. The fact that there is also no scientific consensus on a definition was already pointed out by the director of the National Human Genome Research Institute in 2004, for example, who stated that ethnicity as well as race "are poorly defined terms that serve as flawed surrogates for multiple environmental and genetic factors in disease causation" (Collins 2004, S13).

The lack of clarity in the use of terms has already been documented in a couple of reviews. For instance, in an analysis of reporting on "race/ethnicity" in the leading academic journals for general medicine, surgery, and oncology from 2007 to 2018, the physician Therezia Bokor-Billman and colleagues found that of 995 studies, only 4.5 percent provided a formal definition of the concepts used (Bokor-Billmann, Langan, and Billmann 2020, 2). Similar reviews of surgical research (Maduka et al. 2021) and ophthalmology literature (Moore 2020) revealed widespread failure to define race/ethnicity among biomedical researchers. This lack of definition for key concepts, while otherwise unusual in scientific research, should not be dismissed as mere oversight or imprecision but should itself be the subject of a critical investigation.

Instead of focusing on definitions, we can examine the varying meanings attributed to the concept. An overview shows that these range from perspectives emphasizing its social construction, fluidity, and complexity to those presenting clear biological definitions. One example of a clear biological conceptualization of ethnicity can be seen in the work of the geneticist George Rédei, who defines ethnicity as a "human population related by biological characteristics and identifiable by anthropometric, cultural, linguistic, biochemical, serological, molecular characteristics, SNPs and gene frequencies" (Rédei 2008, 636). In contrast, medical scientist Jessica Cerdeña and colleagues emphasize ethnicity's reference to "cultural, socioeconomic, religious, linguistic, and political qualities of groups that establish cohesion and order through membership, rather than their population genetics" (Cerdeña, Grubbs, and Non 2022, 2147). Psychologist Kevin Cokley further defines ethnicity as "a characterization of a group of people who see themselves and are seen by others as having common ancestry, common history, common traditions and common cultural traits such as language, beliefs, values, music, dress and food" (Cokley 2007, 225). The phrase "see themselves and are seen by others" notably does not assert that ethnicity is objectively linked to a common origin but echoes Weber's concept of "subjective belief," introduced in the previous chapter. Nonetheless, ancestry is still presented here in a fuzzy way: it can be interpreted as something only "seen" (as subjective belief) or, also possibly, as a recognition of an at least probable "common ancestry" (as a biological origin).

Geneticist Charmaine Royal offers a perspective in which biological and cultural attributes are used to determine ethnicity. She initially describes ethnicity as a "legitimate descriptor for human groups, referring to a recognized degree of shared *linguistic, religious* or other *socio-cultural* attributes" but then adds that it "will likely also exhibit (based on an average of its members) relatively appreciable frequencies of some *physical* and/or *biological* characteristics, resulting from a combination of the effects of common geographic ancestry, physical environment, diet, socio-political environment, etc." (Royal

2006, 326, emphasis added, compare also Bhopal 2004, 443). Such descriptions intertwine biological characteristics and ancestry with cultural elements such as language, religion, and traditions.

In recent years, a plethora of suggestions and recommendations for the application of classification terms have been published. A scoping review, for example, identified 121 articles published between 2000 and 2021 that provided normative guidelines on the use of population categories, particularly in genetics research (Mauro et al. 2022). The authors of the review note a broad consensus across the articles on most points. However, they highlight substantial disagreement of opinion regarding the "appropriate definitions of population categories and contexts for use" (2116). For instance, the recommendations contain very different views on how strictly population categories should be defined, with proposals ranging from a rigorous differentiation between the definitions of race and ethnicity to proposals to define them jointly (ibid.: 2019). In summary, they state that the "considerable disagreement among these recommendations" indicates that there is a lack of "clear, centralized definitions of population categories" and that there is also "confusion and disagreement" as to when these should be used (ibid.: 2120).

In our view, the varied interpretations and lack of consensus on the definition of ethnicity highlights how important a careful approach to classifications of ethnic group is in research and publications. In any case, existing standards from institutions such as the International Committee of Medical Journal Editors (ICMJE) and the European Journal of Medical and Health Research (EJMHR) consistently emphasize that "race and ethnicity are social and not biological constructs" and that "authors should interpret results associated with race and ethnicity in this context" (ICMJE 2022; EJMHR 2024). Most importantly, they require that "authors should define how they have determined race or ethnicity and justify their relevance" (ibid.). *The Lancet*, one of the most influential medical journals, similarly mandates that authors "explain the definitions, categories, or conceptual framework used and how they were assigned (e.g., self-report, census or registry data)" in the methods section (The Lancet 2024). Given the critical importance of human classifications in the life sciences, providing empirical insights on this issue is essential. Our analysis, based on a systematic literature review, seeks to address these concerns, as we will explore in detail below.

Ethnicity in the German Life Sciences

To our knowledge, no study has yet examined how ethnicity is conceptualized by researchers at German life science institutions.[5] Nor are we aware of any investigations into how the concept is applied within specific disciplines at German research institutions, such as epidemiology, genetics, or medicine, or in human research more broadly. While treatises have been published on terms such as "race" and "migration background" (Schenk 2007; Kajikhina et al. 2023)—the latter being a term frequently used in the

5 The conceptualization of migration background and race by life science researchers in Germany has been the focus of other studies within our research group SoSciBio; see Ellebrecht and zur Nieden et al. in this volume.

German-speaking world, often accompanied by guidelines for its use in scientific studies—no such work exists for the concept of ethnicity. Even strong critiques of the concept of race by representatives of the life sciences, with statements such as "[n]ot using the term race should be part of scientific decency" (Fischer et al. 2019) or "[t]here is no scientific reason to continue using the term 'race'" (UNESCO 1995: 2), fail to specify how research should be done in its absence.

It is therefore necessary to systematically examine the publications of German research institutions in order to determine how ethnicity is defined and applied. Among the studies identified, the majority were authored by multidisciplinary teams, reflecting extensive collaboration across various fields. In terms of disciplinary affiliation, the distribution is as follows: The most studies originate from the field of medicine (194), followed by epidemiology (79), psychology (11), health services & economics (8), the biomedical and pharmaceutical industry (8), archaeogenetics (4), and anthropology (2).

In the sections that follow, we provide a brief overview of the terminology commonly used to describe ethnic distinctions before analyzing how ethnicity was operationalized by study authors, how individuals were assigned to specific ethnic groups, the differences observed between these groups, and the explanatory approaches authors offered for these differences.

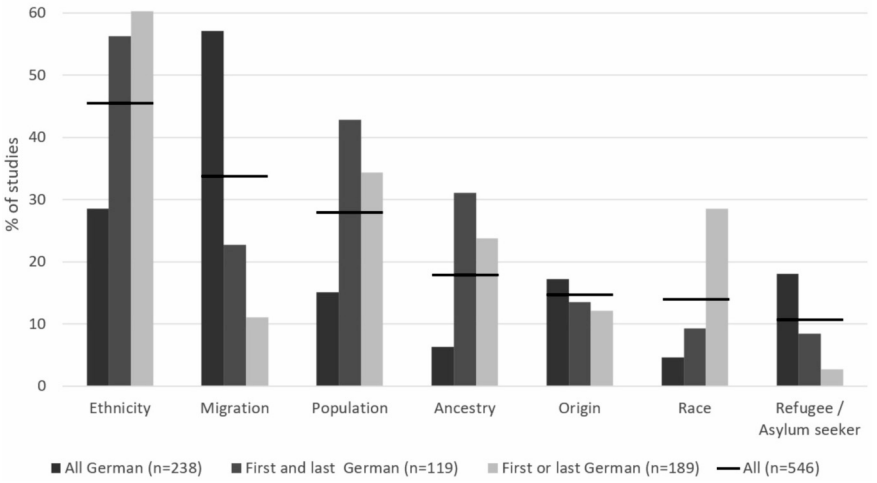
The Most Commonly Used Terms

Of all the classification terms recorded and coded in our search, ethnicity-related terms are the most frequently used. The one notable exception is the frequent use of the term "migration background" in German-speaking countries, which is also reflected in research publications—even when most are written in English. Among the 238 articles authored entirely by researchers affiliated with German institutions, the term "migration" (including derivations such as migration background, migrants, etc.) appears in more than half (57.1%) to describe the research subjects. Notably, 23 percent of these texts also use terms like ethnicity or ethnic group interchangeably with migration (for an examination of the category migration background, see zur Nieden et al. in this volume).

It is also significant that the term race is used far more often by international author teams (28.6%) than by exclusively German-based teams (4.6%). This suggests that for many German researchers, terms such as ethnicity, population, or ancestry are often employed as translations or substitutes for race.

The specifics of the German context become even clearer when we analyze the use of terms based on sampling locations. For instance, the term migration is used in 58.5 percent of studies involving participants sampled in Germany but only in 6.6 percent of studies conducted in the United States. In contrast, the terms race or ethnicity appear in 63.9 percent of studies on participants sampled in the United States. Nevertheless, among studies on participants in Germany, the term ethnicity is still used in 31.8 percent of the articles (Bartram et al. 2023).

Figure 1: Frequency of classification terms used in relation to affiliation of author teams to German institutions. More than half of the studies (54.8%) applied several terms to the subjects under investigation. For more detail, see Bartram et al. 2023.



There are also disciplinary differences in the use of ethnicity. However, since the majority of articles analyzed come from the fields of medicine, epidemiology, and psychology—with similar frequencies of ethnicity use (48.3%, 35.6%, and 41.8%, respectively)—and the number of articles from other disciplines (e.g., archaeogenetics, human genetics, pharma, and biotech) is relatively small, these differences are not the focus of our analysis here (see Bartram et al. 2023). Instead, we concentrate on the wide range of meanings attributed to the term "ethnicity," as reflected in the diversity of its operationalization.

Hardly Any Explanation of the Meaning of Ethnicity

In accordance with the principles of sound scientific practice, it is essential that the definition and operationalization of any key classificatory term be clearly and explicitly articulated in scientific literature. This requirement is not only a cornerstone of scholarly integrity but is also emphasized in the editorial standards of numerous leading scientific journals (ICMJE 2022; The Lancet 2024). In the structured format of life science publications, the methods section plays a pivotal role in detailing the concepts, procedures, and analytical steps undertaken to produce the study's findings. Such clarity is indispensable for ensuring transparency, facilitating reproducibility, and enabling meaningful comparisons across studies. This focus on terminological precision is particularly important when dealing with complex and socially loaded categories such as ethnicity or race, where common usage often diverges significantly from academic definitions, leading to potential misunderstandings or misapplications in research contexts.

In sharp contrast to these established requirements, our analysis reveals that most of the reviewed literature fails to adequately define the classification methods used for the people studied. Specifically, 137 articles—almost 55 percent of the studies examined—ei-

ther completely omitted any information about how subjects were classified (30.5%) or merely referenced data sources or previous studies without providing details on the classification process (25.3%).[6] While some sources, such as the U.S. Cancer Registry Surveillance, Epidemiology, and End Results (SEER), offer accessible online documentation, other cases present significant challenges. For instance, classification information may not be available in English (or German), may be hidden behind a paywall, or may simply not exist in the referenced article.

Articles that do not specify their classification methods typically only list the number of subjects in different groups. For example, Wuestemann et al. (2021, 483), in their study on bone morphology, state that to investigate "ethnic differences," they included "817 Caucasian femora," "245 Japanese," "240 Non-Japanese Asian," "30 African," and "13 Middle Eastern" in their dataset. However, the authors provide no information on the classification criteria used and, moreover, assign the femora studied to disparate and inconsistent classification schemes, including categories such as African, the extremely vague category of Middle Eastern (which overlaps with Asia and Africa), and nationality-based classifications such as Japanese. The article offers no explanation for how individuals were assigned to these groups or why nationality, race, and geography are collectively referred to as "ethnic."

An example of referencing the original database used (but still without explaining how subjects were classified) is the article by Amare et al. (2021). The authors study clinical data and genetic information from 2,586 "multi-ethnic" patients of the "International Consortium on Lithium Genetics" to investigate the genetics of lithium response in patients with bipolar disorder, dividing them into a "European sample" and an "Asian sample" (ibid., 2459) Neither the referenced website ("www.ConLiGen.org") nor the articles cited in the methods section provide clear information on how the study subjects were classified by "ethnicity" as "European" or "Asian." In the supplementary file of one referenced article, we found a statement that "EIGENSOFT was used to identify population outliers […], which were removed" (Hou et al. 2016). This suggests ethnicity was somehow genetically validated to exclude certain individuals, but how the subsamples were originally labeled as European or Asian remains unexplained.

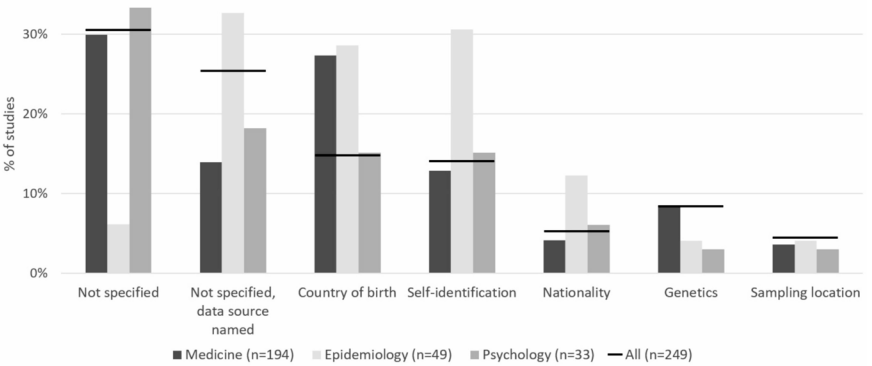
Both examples, from our perspective, contradict the guidelines of most major journals, such as those formulated by the International Committee of Medical Journal Editors (ICMJE). In its guidelines, the ICMJE requires authors to "define how they determined race or ethnicity and justify their relevance" (ICMJE 2022). Similarly, *Nature*, one of the most prestigious science journals, requires authors to specify "who provided the classification terms (the participants, the researchers or third parties)" and "how racial/ethnic identity was determined (by the participants, the researchers or third parties)" (Nature 2024).

The failure to specify how research subjects were classified runs counter to good scientific practice and the guidelines of numerous journals. However, this issue is not uniformly present across all life science disciplines. Interestingly, it is much less common in

6 There is an overlap consisting of two studies because these articles used several cohorts and mentioned a data source for one but not the other.

epidemiology, where only 6.1 percent of studies failed to specify how ethnicity was determined (Figure 2). Nevertheless, 32.7 percent of epidemiological studies referenced a data source without providing further details, making them quite similar to other disciplines in the life sciences in this regard.

Figure 2: How ethnicity is specified according to different disciplines. Some of the studies were carried out by interdisciplinary teams and were accordingly assigned to multiple disciplines by us. Only the three most common disciplines (n>30 items) are shown.



In the remaining 112 studies that provided information on the classification process, we identified a wide variety of approaches to assigning ethnicity. The most common methods were based on the country of birth of the research subject (or their parents or grandparents) and self-identification, used in 14.9 percent and 14.1 percent of the articles, respectively. Notably, twenty-one articles (8.4%) used genetic analyses to attribute ethnicity to the study subjects. For example, Schote et al., in a study on hyperhidrosis (excessive sweating), conducted a genetic analysis to confirm that the samples were "of European origin" (Schote et al. 2020, 12) Based on this analysis, the authors excluded samples from further study if they "were not ethnically matched" (ibid., 13). Similarly, Toepfer et al. (2019, 159) referred to a "genotype-based ethnicity" in their analysis of DNA regulation changes in the oxytocin gene locus for mothers after childbirth. Other studies used information about nationality (5.2%) or sampling location (4.4%) to assign ethnicity to study subjects.

Differences in the disclosure of classification methods also correlate with the degree of affiliation authors have with German research institutions. As shown in Figure 3, while the differences are not dramatic, author teams entirely affiliated with German institutions are more likely to use the country of birth (30.4%) to assign ethnicity compared to more international teams (7.6%/9.6%). This trend can be explained by the interchangeable use of ethnicity and migration background in many articles authored by "all German" author teams. Migration background is frequently operationalized using the country of birth of the subject or their parents.

It is also noteworthy that several studies provide difficult-to-understand or even confusing information regarding the attribution of ethnicity. For example, a transfusion

medicine study by Flesch et al. (2020) aimed to determine blood group allele frequencies in blood donors from "Arabian countries and Iran" to identify "donors with rare blood groups," referring to blood with genetic markers uncommon in Central Europe (Flesch et al. 2020, 397). The authors employed a combination of methods to assign ethnicity. First, donors were asked for their "mother country" (ibid.). However, this term is ambiguous and could refer to the country of birth, the parents' or mother's origin, or even that of more distant ancestors. The authors then compared the collected blood samples with a sample from the German Red Cross, describing the latter as predominantly of "Middle European origin," while assuming a small number of donors could have a different "ethnic background" (ibid.: 398). In this context, the terms "origin" and "ethnic background" appear synonymous—at least where "another ethnic background" means "not of Middle European origin" (ibid., 400). The discussion section further complicates matters. The authors state that they know "only the *mother country* but not the *ethnicities*" and speculate that many donors with a specific blood type might be "mostly of African black *ancestry*" (Flesch et al. 2020, 405, emphasis added). This phrasing suggests that the researchers differentiate between ethnicity and origin, while also introducing ancestry as a third classification. Additionally, the authors assign some individuals to "African or Arabian ancestry" based solely on surnames, estimating that around half of those with a specific rare blood group fall into this category (ibid., 405).

Overall, the studies largely fail to meet journal guidelines and standards of scientific integrity. Many provide no information—or vague, ambiguous, or even contradictory statements—about their methods for assigning ethnicity.

No Differences Investigated or a Spectrum of Differences Found

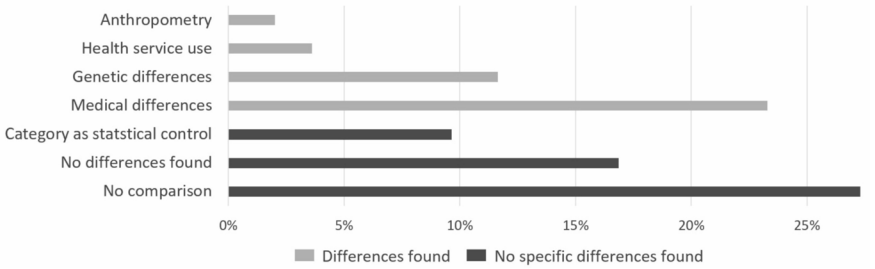
In numerous settings, ethnicity serves as a seemingly straightforward concept of differentiation. This impression is reinforced by the widespread availability of ethnic classifications in many databases and data collections. Here, it is noteworthy that in public discourse ethnic assignments are typically employed to emphasize distinctions *between* groups—often highlighting differences in an externalized population (the "minority group" or the "foreigners") in contrast to the majority group. Conversely, a significant portion of the studies we examined—27.3 percent of the publications—focus exclusively on a single population identified as an ethnic group without conducting comparative analyses with other groups (see Figure 3).

Our analysis suggests various reasons for the high prevalence of "no comparisons" in studies that classify by ethnicity. A large proportion of the texts use the term merely as a descriptor for the single sample of people studied. For instance, in a study on "predictors of heart-focused anxiety," Wedegärtner et al. (2020) examined 107 patients (87.9% male) at the Saarland University Medical Center in Homburg, Germany. The authors note in their limitations that their sample "comprised mainly Caucasian men"[7] and that no "further ethnicity" was included (Wedegärtner et al. 2020, 385). From a race-critical perspective, it may appear peculiar that a term originally coined as racial and predominantly

7 The term "Caucasian" appears frequently in studies in our corpus.

used as such in international literature is framed here as "ethnicity." Such a terminological—but not conceptual—substitution is a common attempt to circumvent the problematic connotations of the concept of race (see also Ellebrecht in this volume). The issues in the authors' approach extend beyond conflating racial ("Caucasian") and ethnic categories. A significant problem arises when psychological and social characteristics, such as anxiety, are linked to continental origins, implying a genetic basis for observed differences. Furthermore, it is unlikely that this classification reflects self-identification, as the term "Caucasian" is uncommon in German and would more likely be interpreted as referring to individuals from the Caucasus region. Lastly, it seems implausible that none of the participants would identify with a different ethnic group, given that the population of the city of Homburg is far from as homogeneous as the study suggests. This approach, likely intended to align the study with international discourse, employs racializing terminology and uses ethnicity as a broad, continental proxy that oversimplifies and misrepresents the complex social, biological, and biosocial realities of human diversity.

Figure 3: The significance of differences investigated between ethnic groups. In some studies, differences were described in several categories, resulting in multiple entries.



Beyond the local classifications observed in studies like Wedegärtner et al. (2020), other studies use indicators such as nationality, migration status, refugee experience, language, or religion to attribute ethnicity. Often, these attributions are made to align with the prevailing practices of the international (primarily US-dominated) scientific community, particularly in medical and epidemiological research, or are even mandated by scientific journals (Rubin 2021). Some studies also appear to assume a meaningful difference between ethnic groups without conducting comparative analyses that could confirm or refute this hypothesis. Furthermore, in pharmacological research and the biotechnological sector, studies sometimes seem to follow the objective of marketing drugs to the broadest possible patient population. As a result, there is often a vested interest in ensuring that no significant differences between population groups are identified.

Within our database, of the studies that conducted a comparative analysis across various ethnic groups, 23.3 percent identified significant medical disparities, evident in aspects such as disease incidence, disease burden, mental health status, and mortality rates. Among these studies, 16.9 percent found no meaningful differences in their comparisons: 11.6 percent reported discovering genetic differences between individuals cat-

egorized into different ethnic groups. For instance, Degenhardt et al. (2019) conducted a genetic study at the Institute of Clinical Molecular Biology at Kiel University. The authors stated that in their "multi-ethnic reference panel" on immune system genes, the various "subpopulations" clustered well with the "respective ethnicities of the 1000 Genomes population" (Degenhardt et al. 2019, 2078, 2080). However, it is important to note that the 1000 Genomes Project does not address ethnic groups or races but instead refers to twenty-six populations (internationalgenome.org/1000-genomes-summary).

It is also worth noting that most studies identifying genetic differences between ethnic groups focus on very rare genetic variants. For instance, Jacobi et al. (2019) reported the discovery of a rare genetic variant in a patient described as being of "Asian ancestry." Participants in this study were children with diabetes, whose blood samples were collected at outpatient clinics at Charité University Hospital in Berlin, with the public health "Study of Health in Pomerania" serving as a control.[8] As is common in many of the articles we reviewed, the authors employed multiple classification frameworks for human diversity interchangeably, noting that a specific genetic variant associated with obesity and insulin resistance "has not been detected in individuals of European ancestry but is a known variant in other *ethnicities*" (Jacobi et al. 2019, 1171, emphasis added). In another study, genetic differences were used to trace "patterns of diversity," suggesting that "human genetic diversity can reflect physical and cultural geography" (Peter, Petkova, and Novembre 2020, 943, 946). This research aimed to map out geographical zones that exhibit not only "genetic but also linguistic and ethnic differentiation" (Peter, Petkova, and Novembre 2020, 944).

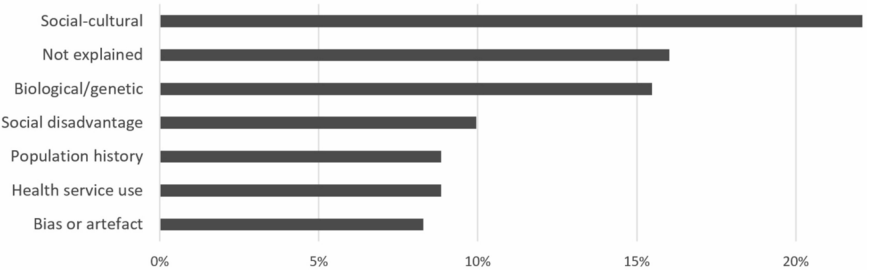
Overall, our findings indicate that the concept of ethnicity is used both to identify existing differences and to highlight the absence of such differences. Furthermore, it often serves as a seemingly self-evident category for the (frequently vague) description of the sampling population. To better understand the role of this concept in the search for and detection of differences, it is necessary to take a closer look at the explanations given—or presumed—by the studies for the differences identified.

Reasons Given for the Differences

Among the 181 articles that reported differences between groups categorized by ethnicity, 16.0 percent (29 articles) presented their findings without offering any explanation or hypothesis to account for the differences they observed (see Figure 4). Nevertheless, the majority of studies elucidate their findings, proposing at least potential explanations, encompassing factors including social, biological, or measurement artifacts.

8 For a detailed analysis of the "Study of Health in Pomerania," see Ellebrecht in this volume.

Figure 4: Stated or presumed reasons for differences found. Results from the 181 studies where differences between research subjects grouped by ethnicity. Many articles propose multiple hypotheses to explain the identified differences, leading to overlap. Only explanations appearing in more than 5 percent of the studies are listed.



In a total of 40.9 percent (74 articles) of the studies, the measured differences were explained socially, for example by referring to socio-cultural reasons such as lifestyle, cultural or religious diversity (22.1%), social disadvantage (9.9%), and differences in the use of healthcare services (8.8%). For example, a study on the prediction of attention deficit hyperactivity disorder (ADHD) in children found that, among other factors, "mixed or Asian ethnicity was a negative predictor" of ADHD, which means that Asian children were less likely to be diagnosed with ADHD than white children (Brandt, Patalay, and Kernerauch Koerner 2021, 880). Citing previous research, the authors suggested that these variations might arise from disparities in the "perception of hyperactivity by the parents," potentially shaped by "cultural factors" (ibid., 882).

Biological or genetic differences between ethnic groups were referenced in 24.3 percent of the studies (44 articles). In 15.5 percent (28 articles), such differences were suspected as potential cause for medicial differences under investigation. Another 8.8 percent (16 articles) of the studies explicitly searched for genetic differences between different groups based on population genetics questions. When biological or genetic explanations for measured differences were suggested, they were often mentioned within a list of several different hypothesis, typically without further elaboration. This was also evident in studies that emphasized social factors. For instance, a study on eating disorders among girls with type 1 diabetes mellitus reported "lower odds of eating disorders in girls with *migration background*," suggesting that "*cultural*, *social*, or *genetic* factors" might influence prevalence (Reinehr et al. 2019, 210, emphasis added). The authors further speculated that "ethnicity and cultural background are more important factors than migration itself" (ibid.).

It is also noteworthy that among studies authored entirely by researchers affiliated with German institutions, only two proposed genetic reasons for differences. Of the studies that identified genetic differences, more than half (15) linked their findings to population history. These were mostly studies focused on population genetics rather than medical aims. For example, Chaichoompu et al. (2020, 46) examined the genetic "population structure of Western African populations" by distinguishing individuals "from 25 ethnic groups" on the basis of more than 300,000 genetic variants.

Social disadvantage, which includes explanations related to socioeconomic inequalities, was mentioned in only 9,9 percent (18) of the studies. Differences in "health service use," such as those caused by language barriers, were cited in 8.8 percent (16) of studies. In the studies that indicated sociocultural reasons, 11 (6%) mentioned discrimination as a factor, while only two studies mentioned experiences of racism or structural racism as potential causes for differing health outcomes.

When comparing disciplines, few significant differences emerged, except that no psychological studies in our corpus linked ethnicity to genetic explanations for group differences. Thus, while many authors attributed differences between ethnic groups to sociocultural factors, biological or genetic explanations were also frequently hypothesized.

Conclusions

Ethnicity is a very complex and multifaceted term. As a scientific concept, ethnicity aims to capture relationships between groups distinguished by perceived or assumed physical and/or cultural differences. The publications we examined reveal that, in Germany, the concept of race has nowadays largely been replaced by the concepts of ethnicity and migration background in analyses of biological differences between population groups, minorities, and the majority society. However, a thorough reflection on the limitations and dangers of the concept of ethnicity—including its historical continuities and inadequacies as a classification tool for assessing biological differences—remains lacking.

As demonstrated in numerous other studies, merely substituting terms without enacting conceptual change fails to address the fundamental problems inherent in broad group classifications. The interchangeable use of terms such as ethnicity, race, population, continental designations, or migration background additionally exacerbates the "terminological mess" (Malinowska and Żuradzki 2023) and leads to an imprecise and therefore unscientific use of the concept of ethnicity. But it is not just a matter of scientifically inadequate use. Rather, broad and unspecific classifications tend to run the risk of overemphasizing genetic differences while neglecting sociocultural factors (Morning 2011; Kaufman, Merckx, and Cooper 2021). In this way, the publications reviewed here often exhibit misleading simplifications and bias toward biological or genetic determinisms that can lead them to misinterpret health outcomes. Ethnic classifications can be a relevant category in the study of health-related effects of social inequalities. But when applied out of the context of other social factors, they are insufficient and misguiding in addressing the diverse health needs of various groups.

As used in the studies examined, ethnicity emerges as an artifact shaped through social, institutional, discursive, and political negotiations. This means that ethnicity, far from being a life science entity awaiting discovery, is the product of a complex web of interpellations directed at researchers, authors, and journal editors. These interpellations arise from sociocultural classifications, directives from funding bodies, journal guidelines, and the prestructuring of the data collected through forms and sociodemographic surveys.

Our analysis of life science studies conducted by authors affiliated with German research institutions revealed that while ethnicity is frequently invoked, it is rarely specified. Its use reflects a broad range of meanings, with diverse connotations. Moreover, we identified overlapping and synonymous use of classification terms such as race, migration, ancestry, nationality, and origin. This imprecision contradicts journal guidelines, undermines established standards of sound scientific practice, and highlights a clear discrepancy between guidelines and the practices of editorial supervision and peer review. Standards for the application and reporting of human diversity classifications are inconsistently enforced, and violations often go unnoticed. When we sought clarification from the ICMJE regarding whether simply naming the data source without detailing how ethnicity was determined aligns with their guidelines, they responded by assigning responsibility to journal editors: "The level of detail published in the article is at the discretion of the editor, but our guidance encourages transparency" (personal email correspondence). Future research could explore whether this lack of adherence to guidelines reflects broader issues within peer review and the scientific publication process.

It is important not to dismiss the conceptual and definitional ambiguity in authors' work as trivial or careless. This vagueness often serves a strategic purpose, allowing the category of ethnicity to remain open to essentialist and biologistic interpretations. While there is widespread acknowledgment in the life sciences that ethnic categories are socially constructed, the concepts often remain internally contradictory, with a persistent tendency to imply or explicitly assume a biological-genetic foundation. As an artifact of politics, ethnicity is applied across diverse contexts, often within methodologically and theoretically underdeveloped frameworks.

Politics influence the processes of categorizing human diversity across multiple levels, ranging from individual preferences within the research process to institutional, national, and international guidelines and standards. Normative frameworks shaped by biopolitical and identity-political discourses play a crucial role in regulating life, health, and the body, especially within marginalized communities, the inherently political nature of categorizing human diversity is often obscured or denied in scientific practices, which claim to objectively measure human differences while attributing any politicization to external social forces rather than acknowledging their internal role in shaping these categories.

Thus, while ethnicity is frequently employed in scientific research, it must be recognized as an artifact shaped by norms, standards, and expectations to replace the concept of race. However, ethnicity does not appear to offer a viable solution to the challenges posed by race as a category, leaving the debate about its use in the life sciences unresolved. A crucial question is whether ethnicity, as an inevitably constructed category, can function effectively as a scientific tool for capturing human biological diversity. Furthermore, it remains uncertain whether the current conceptualization of ethnicity can mitigate issues of essentialization and stigmatization faced by marginalized communities. In fact, the vague and inconsistent use of ethnicity may perpetuate and reinforce the biologization of group categories. For example, research linking ethnic labels with genetics has stigmatized the European Roma as "inbred" and "genetic high-risk," with tangible effects on policy decisions (Lipphardt et al. 2021).

While ethnicity, as a proxy, can point to underlying phenomena that are difficult to measure, it also risks obscuring or even concealing relevant inequities. A more specific categorization of people based on their social and socioeconomic status, tailored to the particular context and research questions, may ultimately render the concept of ethnicity redundant and replace it with more precise and contextually relevant classifications.

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