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# Is aging a disease? The theoretical definition of aging in the light of the philosophy of medicine

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**Abstract**

In the philosophical debate on aging, it is common to raise the question of the theoretical definition of aging in terms of its possible characterization as a disease. Understanding aging as a disease seems to imply its medicalization, which has important practical consequences. In this paper, we analyze the question of whether aging is a disease by appealing to the concept of disease in the philosophy of medicine. As the result of this analysis, we argue that a pragmatist approach to the conception of disease is the best alternative to highlight the relevance of the medicalization of aging. From this pragmatist perspective, it can be seen that the notion of aging is going through a conceptual change, and aging can today be understood as a not radically different process from any other condition that is usually considered a disease.

**Keywords:** aging, disease, philosophy of medicine, pragmatism.

## 1. Introduction

In recent years, a debate has developed around the question of whether aging is a disease (see, for instance, de Winter 2015; Novoselov 2018). Broadly speaking, it can be said that this debate is made up of two main opposing positions. On the one hand, there are authors who – without denying the medical relevance of treating aging processes – reject the disease condition of aging on the grounds that it does not meet the definition of "disease". In this sense, the works by Leonard Hayflick (2000, 2007) are particularly noteworthy. On the other hand, other authors argue that aging is a biological condition that shares so many

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characteristics with diseases that are normally treated medically that there is no reason why it should not be seen as such. In addition, they argue that we have good reasons to advocate including the relief of conditions related to aging as a legitimate goal of medicine. In this vein, theorists like Arthur L. Caplan (2005, 2017) have argued that aging should be understood as a disease in order to facilitate public policies that aim to treat the pathological processes of old age.

In this paper, we attempt to shed light on the theoretical definition of aging by looking at the debate on the concept of disease found in the philosophy of medicine. As a result, we introduce a concrete approach – the *pragmatist approach to aging* – to account for the theoretical relationship between the notions of disease and aging as they are addressed in the philosophy of aging. To that end, the structure of this work is as follows: first, in section 2, we analyze the discussion between the two major positions in this debate, and introduce the influential accounts of authors such as Daniel Callahan and Eva Topinkova, Arthur Caplan, Leonard Hayflick, Timothy Murphy, and Thomas Schramme. We will show that in this discussion it is often assumed that the definition of disease is univocal and is best understood as a "non-natural state". We argue that this conception of disease is not beyond criticism and that it is, in fact, untenable. We claim that to decide if aging is a disease it is necessary to go to the philosophy of medicine. The motivation of this is straightforward: in order to decide if aging should be defined as a disease, we need to clarify first what a disease is and what criteria are used to characterize something as such. In section 3, we will show that the disagreement between those who argue that aging is a disease and those who claim that it is not is ultimately based on different notions of disease. In addition, we will also turn to the debate on disease in the philosophy of medicine to analyze the proposals of Callahan and Topinkova, and Murphy. These authors advocate avoiding the question of whether or not aging is a disease for pragmatic reasons. The important thing would not be to define aging as a disease but to medically treat it as such. In this paper, we maintain that these proposals have the merit of putting the focus on the practical aspects of the use of concepts in medicine, but that they are unsatisfactory as they continue to implicitly retain the belief in an unsupported, objectivist notion of disease. We propose to reformulate this proposal of pragmatic motivation to frame it in an approach to the concept of disease,

which we call "pragmatist", that has been advocated by philosophers of medicine such as Rachel Cooper or Bjørn Hofmann. We argue that, from this perspective, aging can be seen as not radically different from any other condition that is usually considered a disease. We claim that this pragmatist approach addresses the issue of medical categorization of aging[2] in a more scientifically and philosophically fruitful way.

## 2. What is aging?

### 2.1. Aging as a natural state

Several authors argue that aging cannot be defined as a disease (Glannon 2002; Hayflick 2007; Olshansky et al. 2002; Schramme 2013). The rationale is that aging is a natural process, an unavoidable feature of our nature. The notion of disease, they argue, alludes to an unnatural state (in the sense that diseases depart from the biological norm). Aging cannot be a disease because it is not a failure in the functioning of organisms, but a defining property of their organic design.

There are two main justifications for defending the "naturalness" of aging. Firstly, it has been argued that aging is a product of evolutionary history. Many past and present-day biologist, as well as health scientists, medical researchers, and philosophers have adopted evolutionary approaches to aging. Peter Medawar (1952) proposed that the force of natural selection decreases once an organism reaches an age at which it has been able to reproduce. Medawar's *mutation accumulation theory of aging* claims that aging is a process resulting from random mutations, and that the benefit or disadvantage of a long life span is not of great importance in evolutionary terms. Mutations involving changes in biological traits of old organisms do not significantly impact on fitness. In fact, the older an organism is, the less evolutionary significance these mutations have and, consequently, the less influence natural selection plays. Aging is a result of mutations that is not evolutionarily relevant and therefore has not

[2] It is worth noting that here "aging" is not simply understood as the accumulation of life time, but as the set of degenerative processes –many people perceive it as negative– which normally accompanies time passing in organisms. In this sense, the term "aging", as used in this paper, would be synonymous with "senescence". Since it is the most widely used in specialized literature, we will exclusively use "aging" in this paper.

been removed through the action of natural selection. George C. Williams (1957) proposed the *antagonistic pleiotropy hypothesis*, which claims that a single gene can produce two phenotypic traits, with one being beneficial to the organism and one detrimental. Thus, a trait can be evolutionarily selected for the beneficial effects that it can have on the early life of an organism, even though it may have negative effects on the organism at an old age. That is the key to understanding aging: an organism ages as a result of the combined effect of a number of pleiotropic genes that have beneficial effects in young age but negative side effects when older age is reached. Biological traits are selected for their impact on the reproductive capacity of organisms, which tends to reach its zenith in their youth. If a trait has an impact on increasing the reproductive fitness of an organism, despite having long-term negative effects, then it will probably be evolutionarily selected (e.g. follicular depletion in human females causes more regular menstrual cycles during maturity and a loss of fertility after the reproductive stage). Thomas Kirkwood and Robin Holliday (1979) presented the *disposable soma theory* according to which organisms have to distribute their limited amount of energy between the activities and processes destined to their reproduction, and those dedicated to the maintenance of the non-reproductive functions (that is, the sustenance of their "soma"). Aging is the natural degradation that an organism, or soma, could repair only at the expense of reproductive efforts, which, from an evolutionary perspective – that is, a perspective that gives primacy to plant breeding – would not be efficient (Goldsmith 2006, Ch. 4). In conclusion, according to all these evolutionary interpretations of aging (the mutation accumulation theory, the antagonistic pleiotropy hypothesis, and the disposable soma theory), the signs of aging are the inevitable result of our evolutionary history. Aging would not be an error in our design, but its natural outcome.

Secondly, regardless of whether or not it is a product of biological evolution, there are many have argued that aging is natural because it is a progressive, irreversible, and universal phenomenon (Glannon 2002; Hayflick 2007; Olshansky et al. 2002). Accordingly, aging is an inevitable and essential hallmark of living beings. If this is so, aging is radically different from the conditions that we usually interpret as diseases since it does not involve any "abnormality" or "dysfunction", but is instead only the normal way of

functioning in biology from a certain age onwards.[3] Aging is simply an inescapable fact for all organisms that live long enough. Along this line, Hayflick considers that there are six characteristics which justify that aging is a natural process. In his words, age changes:

> (1) Occur in every multicellular animal that reaches a fixed size at reproductive maturity.
> (2) Cross virtually all species barriers.
> (3) Occur in all members of a species only after the age of reproductive maturation.
> (4) Occur in all animals removed from the wild and protected by humans even when that species probably has not experienced aging for thousands or even millions of years.
> (5) Occur in virtually all animate and inanimate matter.
> (6) Have the same universal molecular etiology, that is, thermodynamic instability (Hayflick 2007, 8-9).

In sum, medicine should only address the "unnatural" processes of organisms, and aging is natural, either because it is an evolutionary outcome or because it is universal and inevitable. This position seems to be based on an intuitive idea of a kind of "natural normativity" according to which organisms present an optimal or "healthy" design which is precisely what determines the standard of health. "Natural" would be equivalent to "healthy".[4]

[3] Of course, the age at which senescence begins is not universal. Here, we consider a vague idea of "a certain age onwards" at which the dysfunction associated with aging could be considered "normal". The age at which senescence begins is different in each species and, within humans, it does not only depend on strictly biological factors, but it is also strongly dependent on social and cultural determinants. People do not start getting old at the same age in Japan as they do in Sierra Leone. For the purposes of this paper, it suffices to point out that aging, despite these differences, is considered by many to be the normal way of functioning from one age onwards, although this age may be different for different groups of people. We thank an anonymous reviewer of *The Journal of Medicine and Philosophy* for pointing this out to us.

[4] This belief that aging is an essential characteristic of our nature has led some authors to believe that including life extension as a goal in the medical agenda would have pernicious effects on our lives (Fukuyama 2002; Kass 2001). Seeking to live longer might involve wasting resources for therapies that are not really imperative, or it could exacerbate unfair inequalities between individuals. In addition, there are also spiritual and religious restraints about suppressing aging, such as the risk of losing the precious fleeting character that gives deep meaning to human life. By contrast, for other authors, an indefinitely long life would not result in a lack a deep meaning of human life. Rather, we would enjoy a substantially better life because we would transcend our biological limitations (see Kurzweil 2005).

This position has been widely criticized within the philosophy of medicine on the grounds that it shares the same flaw as the famous "naturalistic fallacy" in ethics (Goosens 1980). In fact, many of the authors who endorse the naturalness of aging are in favor of including it in the medical agenda. For example, Hayflick himself affirms that aging is a natural process but, at the same time, he thinks that it is possible to scientifically explain the aging process, and that this is very relevant to understand and treat the age-related diseases such as cancer, cardiovascular diseases, or strokes (2007). Aging *per se* would not be a disease, but it is a natural process underlying many diseases. The goal of gerontology is not to develop interventions to cure aging (which is impossible given its universal nature) but rather treatments that can slow down, stop, or reverse the deleterious effects of aging processes in humans in order to help people to have "an active longevity, free from disability and functional dependence" (Hayflick 2000, 269).

**2.2. Aging as a disease**

The definition of aging as something natural – and consequently as something that cannot be interpreted as a disease (since diseases are unnatural states) – is precisely the assumption that is challenged by those who argue that aging is a disease (notably, Caplan 2005, 2017; see also Gems 2014).

For Caplan, it is questionable whether aging is a natural process, since aging is not a product of evolution, but rather an "accident of evolution" or a by-product of natural selection, in line with the antagonistic pleiotropy hypothesis (Caplan 2017, 238). Moreover, he asserts that naturalness is a poor indicator of whether some state is a disease. Caplan holds that the notion of naturalness in terms of universality and inevitability also fails to demonstrate that aging is not a disease. Even if it could be admitted that aging can be something natural in the sense that it is something that affects all living beings, this is not enough. Tooth decay is also universal, and infections are unavoidable, and yet both are still considered diseases. What is relevant for judging whether or not a state is a disease is not its "naturalness", understood either in terms of evolutionary functionality or universality. On the contrary, Caplan argues, aging is a disease because it is clearly dysfunctional for the organism.

Dysfunction, instead of naturalness, is a relevant criterion for determining whether something should be considered a disease. A disease is a dysfunctional biological state. Here, Caplan identifies the notions of "functional" and "teleological" with "evolutionarily selected". He argues that those who argue that aging is a natural process are basically assuming that aging has a "natural purpose", i.e. it is a functional biological trait. In this sense, a selected-effect approach to functionality seems to be assumed (Millikan 1989; Neander 1991; Saborido 2014). Insofar as the function of a trait is an evolutionarily selected effect, to say that aging is natural (i.e. functional) is equivalent to saying that aging is a process that has been evolutionarily selected because it represents an evolutionary advantage in terms of its contribution to fitness, which, for Caplan, is not true (Caplan 2017, 238). Caplan successfully argues that it would be an error to assume that the mere presence of a trait in an organism means that said trait is adaptive for that organism, In fact, Caplan claims that aging does not fulfill any biological function because it is not an adaptive trait of organisms, but a by-product of natural selection, which is focused on reproductive success at the expense of the long-term physical and mental capacities of individual organisms, in line with the evolutionary perspectives we have explained in section 2.1. Consequently, it is wrong to argue that aging is not a disease on the basis that it is an essential biological characteristic of our organic design because aging actually has no evolutionary function. For Caplan, aging should be treated as a condition analogous to other pathologies mainly because it entails the cognitive and physical decline of the key functional capacities of organisms.

Arguably, aging as such is not normally treated as a paradigmatic disease — a condition comparable to myopia or tuberculosis — by the medical profession. Even though medicine may have led to significant advances in alleviating the consequences of aging, there is not a popular or medical notion of aging as a disease. However, as with other biological conditions in the past, this consideration is subject to change if good reasons are given. As medical knowledge has evolved, medical classifications have been transformed. For Caplan, there does not seem to be any reason not to include aging as another disease in medical classifications. In fact, as the transhumanists argue, it does

not seem foolish to think that medical and technological advances could completely delay or even reverse aging in a not-too-distant future (Bostrom 2005). In that case, aging would clearly be a disease in a very similar sense to that of other complex multifactorial pathological conditions, such as various cancer types.

Thus, Caplan claims that not only are there no sound theoretical arguments for denying the concept of aging as a disease, but there are also good practical reasons for dealing with it *as such*. It is obvious that aging is commonly related to age-related conditions, such as cognitive impairment or bone fragility, which increase in prevalence as people age. Classifying aging as a disease would help us to address age-related diseases by addressing them at their source. Instead of fixing the damage caused by a flood, the water leak could be sealed off, thus preventing the flood from occurring. If we were able to intervene in aging, humans would suffer fewer age-related symptoms that are usually considered to be pathological.

In conclusion, Caplan agrees with authors like Hayflick in their negative view on the repercussions of aging and in his wish for these processes to be addressed by medicine. However, they disagree on whether aging should be called a disease. Caplan bases his argument on a criticism of the reasons offered to claim that aging is not a disease, mainly the argument of naturalness, and asserts that the best way to deal with the negative impact of aging is to consider it a disease. However, medicine addresses many conditions that are not considered to be diseases. Cosmetic surgery is a prime example. If something is sufficiently undesirable and is legally open to medical intervention, it is likely that medical skill and knowledge will be used to address the undesired state, regardless of its status as a disease. What do we gain by categorizing aging as a disease? What does it mean to define aging as a disease that was not already in Hayflick's notion of a "medically treatable" condition?

In this paper we will argue that in order to answer these questions we need to examine the very definition of the concept of disease. It may be true that advocates of aging as a natural process do not have good reasons to deny the conception of aging as a disease, but Caplan lacks a well-developed definition

of disease itself.[5] In section 4, we will introduce an approach to the notion of disease that philosophically justifies why some experts, such as Caplan, actually have good reasons for categorizing aging as a disease. However, before explaining this approach, there is one fundamental question that must be answered: is there a net benefit to medically addressing aging?

### 2.3. Aging from a pragmatic view

Callahan and Topinkova (1998) review the debate on the definition of aging as a disease and, in addition to pointing out the two general positions, they introduce a third approach, which they also considered to be the most promising. According to Callahan and Topinkova, the best strategy is *to treat aging as a disease*. They claim that biomedicine must include aging within the biological conditions that we can and should medically fight; i.e. aging should be interpreted as a disease for pragmatic reasons. Thus, Callahan and Topinkova propose to avoid the question of the ontological categorization of aging and to look instead at the benefits of viewing aging as a medically treatable condition.

Callahan and Topinkova argue that the best way to understand the relationship between the concepts of disease and aging is to take a pragmatic view. It does not matter if aging is a disease or not, what matters is what you gain or lose by thinking about it as such. In many aspects, they argue, the biological consequences of aging are similar to the symptoms of diseases, such as various cancer types.[6] Viewing aging *as a disease* aids in the task of looking for its causes, controlling the underlying processes once discovered, and reducing or reversing the damage that is currently inevitable and irremediable for humans. Consequently, these authors assume that aging could have a medical treatment analogous to that of any disease, but they do not believe that aging can be defined as a disease. To overcome this tension, they propose to take an

[5] There are few authors in the philosophy of aging who do explicitly endorse a specific definition of disease. One of them is Thomas Schramme (2013), who argues that aging is not a disease because it does not fit the predominant definition of disease, i.e. the biostatistical proposal by Christopher Boorse.

[6] Actually, Callahan and Topinkova explicitly say that they assume that aging is not really a disease. In this sense, Callahan and Topinkova present an ontological position that interprets diseases as natural states and a pragmatic approach according to which these natural states should be treated as if they were diseases, even if they are not (Callahan and Topinkova 1998, 93-94).

"agnostic" stance, which argues that it is best to consider aging *as if* it were a disease, no matter whether or not it is one.

Callahan and Topinkova believe that this pragmatic approach fits well with the way in which researchers understand the notion of aging in practice. Gerontologists, these authors argue, focus on how to address and manipulate the aspects of the aging process that we consider undesirable. Callahan and Topinkova shift the focus from the question *"What is aging?"* to *"What is the most useful approach to understanding aging?"*. This shift is supposed to have beneficial repercussions in addressing what the medical and social consideration of aging should be.

A similar position is that defended by Murphy (1986), who advocates moving from the question *"Is aging a disease?"* to *"Is aging objectionable such that its prevention and cure ought to be sought?"*. Murphy claims that this would highlight the moral issues behind the problem of the definition of aging. The real challenge, this author argues, is not theoretical, but ethical, and it is in this sphere that the philosophical reflection on aging must be placed.

In fact, several authors have pointed out that there are compelling ethical and political reasons to focus on the benefits and risks of treating aging as a disease. It does not matter what aging *really* is (whether or not it is a disease) but rather, what theoretical characterization has better implications for our health and welfare. Considering that research on aging as a part of the agenda of health programs would help to emphasize its implications for public health. Bulterijs and collaborators put it this way when referring to the specific case of the US healthcare system:

> Our current healthcare system doesn't recognize the aging process as the underlying cause for the chronic diseases affecting the elderly. As such, the system is setup to be reactionary and therefore about 32% of total Medicare spending in the United States goes to the last 2 years of life of patients with chronic illnesses, without any significant improvement to their quality of life. Our current healthcare system is untenable both from a financial and health and well-being prospective. Even minimal

> attenuation of the aging process by accelerating research on aging, and development of geroprotective drugs and regenerative medicines, can greatly improve the health and well-being of older individuals, and rescue our failing healthcare system (Bulterijs et al. 2015, 208).

An obvious response to this pragmatic approach might be that it is not necessary to consider aging as a disease for it to be medically treated. Medicine addresses many conditions that are not considered diseases (from risk factors to cosmetic surgery). However, the motivation for viewing aging as a disease is clear: this would put aging directly on the medical agenda. *Not everything that medicine treats is a disease, but all diseases are treated by medicine.* This is something that advocates of the pragmatic approach consider imperative. The severity of the consequences of aging (not only for individuals but also in terms of public health) has led authors such as Aubrey de Grey (2003) to assert that just as there was a "war on cancer" there will most likely be a "crusade against aging" in the next decade.

However, the fact that the social and personal impact of aging is a central (perhaps the most important) issue does not mean that the question of how we theoretically understand aging can be completely ignored. In fact, normative issues are deeply determined by their theoretical characterization. As Caplan says: "the debate over what aging is comes prior to a decision to what anyone ought to try and do about it. If we can agree it is disease, then certain barriers to interfering with it, neglecting it, or accepting it fall away" (Caplan 2017, 236).

We can therefore conclude that we are faced with two well-established presumptions in the debate on the definition of aging. The first is that aging is a condition that is correlated with cognitive and physical decline that leads to deterioration in the quality of life of individuals (which also has significant implications for public health). The second is that deciding if aging is a disease is important because considering it to be a disease would decisively make research regarding, treatment of, and prevention of aging legitimate goals of medicine. To alleviate its negative consequences, medicine must treat aging in a similar way to how it treats other conditions usually categorized as diseases. In

other words, for practical and moral reasons, aging must be included in the medical agenda as a disease.

On the basis of these presumptions, we find two possible alternatives: either aging is directly considered a disease, which means that it should necessarily be medically treated (Caplan), or aging is something different from a disease but it should be seen *as if* it were a disease (Murphy, Callahan and Topinkova). The second alternative – epitomized in Callahan and Topinkova's pragmatic view – is presented as a very promising way of avoiding an apparently irrelevant metaphysical disquisition by shifting the discussion to practical concerns.

However, even though this position is presented as neutral with respect to the characterization of aging as a disease, its rationale ultimately lies in the implicit assumption of a definition of disease that does not apply to aging. Callahan and Topinkova argue that there are compelling reasons to believe that seeing aging as a disease is a positive thing, but we have to be satisfied with making the pragmatic movement to think of aging as if it were a disease because, in real terms, it is not (see footnote 5). If aging were seen as a full-fledged disease, as Caplan claims, this pragmatic turn of Callahan and Topinkova would not be necessary. This "agnostic" proposal is mainly motivated by the fact that it is assumed, albeit implicitly, that it is not possible to understand aging as an actual disease, no matter how convenient this would be.

It seems quite obvious that the definition of aging as a disease depends not only on what we understand by aging, but also on our prior definition of disease. Significantly, in the philosophical debate on aging the definition of disease seems to be taken for granted or considered irrelevant. At best, the authors distinguish between a disease and a natural state. However, medical theorists are far from seeing the notion of disease in this simplistic way. It should not be uncritically assumed that the notion of disease has a single, uncontroversial definition. In the next section, we review the debate on the definition of disease in the philosophy of medicine. The concept of disease is no less intricate than that of aging, and its theoretical characterization is at the core of one of the most important discussions within the current philosophy of medicine.

## 3. What is disease?

### 3.1. Naturalists versus normativists

Despite being central to the theory and philosophy of medicine, the notion of disease is particularly contentious. It has two different but intimately intertwined dimensions. As Marc Ereshefsky (2009) has argued, to characterize a condition as a disease implies both a state description about the characteristics of the individual that we consider sick and a normative claim, that is, an evaluation in terms of correct or incorrect, good or bad, of that condition. A diseased individual is someone who has been ascribed a state that has been medically described and evaluated as a bad thing to have. Distinguishing the healthy from the pathological does not only imply an observation but also a value judgment.

It is not surprising that there are theoreticians of aging who have tried to use the notion of disease to justify medical action. The concept of disease, in addition to referring to states whose characteristics we can describe, has a strong normative component, since its categorization implies the duty to "try to fix" (i.e. to treat) a negative condition. To assume that aging is a disease is to assume that aging is a localized phenomenon that we can describe and that it is something negative that should be medically addressed.

However, in order to decide whether aging is a disease, first it must first be clarified what a disease is, and the philosophers of medicine have defined "disease" in very different ways. Broadly speaking, it can be said that there are two main approaches in the philosophical debate on health and disease.

On the one hand, there is an approach that argues that it is possible to objectively characterize the biological properties that determine certain states as healthy or diseased. According to this approach, called "naturalism", biological organisms may present certain conditions that can be qualified as healthy or pathological in themselves, regardless of our personal or cultural criteria.

The most important naturalist theory is Boorse's Biostatistical Approach. For Boorse — probably the most influential theoretician in this debate— health is

the statistically normal functional behavior, and disease is an organic dysfunction that makes an individual to behave at a lower level of efficiency than the rest of the members of her reference class (i.e. beings of the same species, age[7] and sex) (Boorse 1977). From this point of view, the evaluative considerations that external observers may have with respect to these behaviors are irrelevant: health is simply the normal biological functioning from a frequentist statistical point of view.

This theory advocates an axiologically neutral approach to the notions of health and disease. This does not mean that "disease" is not considered a normative concept, but that this normativity is not based on the values of the observer, rather, it is inferred from the properties observed. This is what James Lennox (1995) called "objective values". On many occasions, this approach is based on the assumption of a sort of "natural normativity" in biological organizations. This natural normativity is sometimes justified by the disposition of the organization of living beings to regulate themselves (Saborido and Moreno 2015; Saborido et al. 2016), or by the action of natural selection to maximize organic designs to improve fitness (Boorse 1976). In any case, the objectivist approach assumes — in a way reminiscent of Aristotle's biological teleology — that the organic design of living beings allows us to infer proper norms for organisms (González de Prado Salas 2018), and that this design can be inferred from the statistical distribution of individuals: the normal in a statistical sense corresponds with the normative.

On the other hand, theorists who argue that it is not possible to objectively define health and disease are usually grouped under the label of "constructivists" or "normativists". According to them, the notions of "healthy" and "diseased" are so plagued with cultural values that it is impossible to disassociate medical categories from their social context. There is nothing like a "natural normativity" because the distinction between "beneficial" and "detrimental" is something that always depends on us. In the medical and the popular discourse, the difference between the healthy and the diseased are

[7] It is worth noting that, if age determines the reference class, it would seem that aging couldn't, in any case, be considered a disease from Boorse's perspective. If any disease is an abnormal behavior within the framework of a reference class that is composed of individuals of the same age, then aging is beyond the focus of the biostatistical approach (cf. Schramme 2013, and see footnote 4).

intimately dependent on our personal and cultural values. Thus, "health" would be the condition that we desire, whereas "disease" would be the condition that we want to avoid. Current theorists such as Lennart Nordenfelt (1987) maintain that at the heart of our medical distinctions are our cultural, and very non-objectifiable, appraisals of what we consider to be beneficial, both in the personal and in the social sphere.

Normativists have been very critical of those who have tried to establish "health" and "disease" as objective scientific categories. The distinction between healthy and diseased, they assert, conceals a political imposition of some people on others, which, on many occasions, has very dishonorable motivations and effects. Normativists often recall examples of conditions that were regarded as diseases in certain historical and cultural contexts and are no longer considered so today, such as homosexuality, ideological dissent or drapetomania (the desire of slaves to escape their masters). In these cases, certain conditions that were socially viewed as undesirable were categorized as diseases and medically treated. Arguably, the field of medicine where the normativist perspective has more radical followers is psychiatry, where there is an influential current, called Antipsychiatry, which defends that "mental illness is a myth" that lacks a solid objectivist grounding and is actually a tool for isolating and dominating those who are different or "socially inconvenient" (cf. Szasz 1974).

This approach emphasizes the undeniable fact that medicine is an applied science and medical theory is practical knowledge, and therefore its most basic categories cannot be separated from the moral criteria of those who use them. However, the main problem with this approach is that it falls into a radical relativism according to which the concept of disease is no longer meaningful. In fact, "disease" becomes synonymous with "undesirable state", which does not seem a fair use of this concept. As Ereshefsky points out:

> If there is general agreement that a state is undesirable, then, according to normativism, there should be general agreement that the state in question is a disease. This problem occurs in a number of cases where there is agreement that a state is undesirable but no agreement on

> whether that state is a disease (…). By tying the term 'disease' to the states we consider undesirable, normativism does a poor job of capturing our use of that term. (Ereshefsky 2009, 224)

Not every undesirable state is a disease. Unemployment and lack of love are not diseases although they are conditions that we do not want. Only some state descriptions, linked to notions such as disability, pain, or suffering are qualified as diseases. Therefore, there seem to be objectivist criteria for determining the frame of reference for the concept of disease.

### 3.2. Beyond the naturalism versus normativism debate: disease as a conceptual tool for medical practice

This debate between naturalists and normativists [8] is at the heart of contemporary philosophy of medicine. However, there are authors who have argued that the definition of disease should not be taken to be so crucial. For instance, Germund Hesslow (1993) argues that the clinical thinking and decision-making in medicine do not need the notion of disease. Hesslow's point is that physicians are able to identify and treat patients without the need for a refined concept of disease. This may be true, but it does not seem to detract from the philosophical task of defining disease. Physicians may have certain intuitions, more or less precise, about what "disease" is, but assessing whether these are correct or not depends largely on whether we are able to judge the validity of their theoretical assumptions. The very work of the philosophy of science is to contribute to the scientific endeavor by rethinking concepts that would otherwise be nothing but the fruits of uncritical intuition or cultural heritage.

In any case, Hesslow points out something worth emphasizing: the concept of disease is a technical notion and it must be evaluated with respect to the way in which this notion acquires meaning only within a theoretical framework and in connection with very specific practices, in this case, those of medicine. This is

[8] In this debate, some hybrid alternatives have also been developed to combine aspects of both strategies in order to come up with a scientifically useful definition of health and disease that is flexible enough to recognize their contextual character (see Reznek 1987; Wakefield 1992). In this article, we will also present a position which seeks to integrate the more positive aspects of naturalism and normativism, but we will adopt a very different perspective to that of these hybrid approaches.

the baseline of some proposals in philosophy of medicine that define "disease" from a perspective that we consider aligned with a "pragmatist" approach. Against the generalized view that our conceptions of "disease" determine medical practice, there are authors who assert that, on the contrary, our conception of "disease" is constructed by what we consider that medicine is able to treat. In this vein, Hofmann argues that it is technology which somehow determines our medical notions:

> All in all it has been argued that technology is constitutive of the concept of disease. Firstly, technology provides the physiological, biochemical, biomolecular and morphological entities that are applied in defining diseases. Secondly, it constitutes the formation of medical knowledge. Technology constitutes the signs, markers and end points that define disease entities and it strongly influences the explanatory models of disease and medical taxonomy. Thirdly, technology establishes how we act towards disease: through diagnosis and treatment technology establishes the actions that constitute disease. Furthermore, the practical capability of technology increases the sensitivity and lowers the treatment threshold, resulting in an increased occurrence of disease (Hofmann 2001, 18).

Technology (i.e., medicine as a technoscience) "invents" diseases, in the sense that it offers us the tools to address them, the knowledge and the concepts to identify and classify them, and the protocols to face them. "Disease" is a technical term that only acquires meaning within the framework of medicine. If there were no medicine (and medical technology), there would be no diseases as such. Scientific concepts, such as "disease", are formulated to answer certain epistemic goals. Thus, the notion of disease that physicians, more or less consciously, assume is determined by the questions that they ask and the way in which they attempt to answer them in medical practice.

Along these lines, Cooper has developed a definition of disease that attempts to cover the whole complex casuistry in which this term is used. Specifically, she claims that "disease is a condition that it is a bad thing to have, that is such that

we consider the afflicted person to have been unlucky, and that can potentially be medically treated" (Cooper 2002, 263).

As can be seen, the first of these conditions (disease is a bad thing to have) picks up the constructivist sensitivity according to which a disease is a state viewed negatively by the affected subjects. The second condition (diseased people are unlucky) is linked to the biostatistical objectivist criterion of Boorse. The third condition introduces the "pragmatic turn". By saying that a disease must be a potentially medically treatable condition, it implies, as Hofmann did, that it is medicine that somehow "invents" diseases. A disease is something that is susceptible to being treated as such by medicine.[9] In Cooper's words:

> For a condition to be disease it must be such that it could potentially be treated by medical science. A cure need not be presently available, but the condition must be such that there is reasonable hope that a medical treatment might become available in the future. This condition is required to distinguish diseases from other types of misfortune—economic problems, social problems and so on. This criterion implies that conditions can come to be thought of as diseases as a result of a treatment for them being discovered. Following the discovery of Paroxetine, social anxiety disorder is a condition that is coming to be thought of as a disease for this reason. Prior to the discovery of the treatment, no-one expected that shyness would prove to be medically treatable, but the discovery of the drug-action proved them wrong (Cooper 2002, 277).

As we will show in the next section, we think that this proposal by Hofmann and Cooper can be aligned with a "pragmatist perspective", such as those postulated by authors such as Philip Kitcher (1978), Ingo Brigandt (2009, 2010), or John Dupré (1993). Generally speaking, we can say that this pragmatist approach is based on the defense that our scientific concepts respond primarily not to metaphysical questions but to epistemological concerns. This approach

[9] Cooper's theory is more demanding than Hofmann's because it requires that a condition be an unfortunate and negatively perceived event in order to be considered a disease. However, by including the condition of being medically treatable, this definition also includes — but is not limited to — a pragmatic approach.

relies on the fact that science is an enterprise in which the values and interests are involved in setting goals for scientists and clinicians to pursue.

## 4. From the pragmatic view to the pragmatist approach

### 4.1. Theoretical terms and conceptual change

Scientific communities implicitly establish the epistemic goals of science. Therefore, the terms are re-defined and uses are changed when science changes. For the new developments of the pragmatist approach in philosophy of science (Kitcher 1978; Brigandt 2009, 2010; Dupré 1993), a philosophical approach to a scientific concept should analyze the fruitfulness of this concept to meet certain scientific goals within the framework of concrete practices.[10] This approach does not interpret theoretical terms, such as the notion of disease, as natural kinds. Rather, they are pragmatically determined. Here, we propose using this pragmatist approach to apply the theoretical concepts developed by Brigandt (2009) to the notion of "aging as a disease". In accordance with Brigandt's theory of concepts, the content of scientific concepts can be divided into three different but interrelated components: 1) the concept's reference, 2) its inferential role, and 3) the epistemic goal pursued by the concept's use. The semantic change of concepts, Brigandt says, is due to changes in one or some of these three components.

Thus, scientists can change the intent of a theoretical concept, i.e. its reference. Many theoretical concepts related to the disease have completely changed their reference or even lost it, such as *phlogiston* or *drapetomania*. In fact, core scientific concepts, such as "matter", "planet", or "disease", have had different references in different times and cultures. The philosophical question at this point concerns explaining how this change in a concept's reference can take place in a rational and justified way and without disrupting the communication that relies it. For Brigandt, a concept can legitimately change its reference if the inferential role of that concept changes as well.

[10] For a description of the philosophical aspects of pragmatism and its historical evolution, see Godfrey-Smith 2015, and Legg and Hookway 2019.

The semantic change that occurs due to changes in the *inferential role* of a concept implies transformations in the beliefs that are meaning-constitutive, and it determines the concept's reference. For example, until the end of the 19th century, when Kitasato Shibasaburō and Alexandre Yersin independently discovered the enterobacterium responsible for plague - which was technically labeled *Yersinia pestis* after the latter - the definition of "plague", a term that referred to a disease unfortunately well-known for quite a long time, did not include that bacillus as its cause. Ever since this discovery, the inferential role of "plague" changed. In other words, discovering that plague was caused by a particular bacterium changed what this term meant for scientific theory and practice. Moreover, and as shown in this case, changes in the concept's inferential role can often be due to good epistemic reasons.

What a good epistemic reason is depends on which epistemic goal is attributed to the use of a given concept. Epistemic goals motivate and justify change in the inferential role and reference of scientific concepts. Moreover, the epistemic goal of a scientific concept is a non-truth-conditional aspect of meaning. On the one hand, the goal of a scientific concept is inferable from the role of that concept in scientific practice. On the other hand, the epistemic goal is related to the desires, interests and values of a scientific community. For example, as Brigandt points out, in classical genetics the epistemic goal pursued by the concept *gene* was the prediction of patterns of inheritance, while the epistemic goal pursued with the use of the molecular gene concept is to explain how genes bring about their molecular products (Brigandt 2009, 91). As scientific knowledge changes, the use of concepts by scientists leads to different epistemic outcomes and contributes to scientific knowledge in different ways. It is in this sense that it is said that the epistemic goals of a concept can change.

**4.2. Disease as a technical concept**

Hofmann's and Cooper's proposals fit very well into this pragmatist approach. They explicitly recognize that medical practices determine, at least partially, the meaning of the concept of disease. Disease is everything that is treated as such by medicine to answer certain epistemic questions of medicine: how our bodies

function, what causes us suffering, what are the social consequences of it, how we can fix it, what can be done to avoid it in the future, etc.[11]

In medicine, the concept of "disease" — as well as concepts that allude to specific diseases — is used by the medical community to achieve certain objectives. In particular, the notion of disease has, at least, the following epistemic goals: to contribute in research purposes (e.g. to determine the etiology and mechanisms underlying a given condition), to serve for scientific inferences (e.g. to detect and predict demographic changes in a particular population due to the health problems), and to help develop new technologies (e.g. to design drugs or treatments through experimentation).

Diseases are conceptual tools that may be more or less useful to address practical problems. It is in this sense that medicine is claimed to "invent" diseases, in Hofmann's words, or that a condition for a state to be a disease is that it is a potentially treatable condition, according to Cooper. It is not simply that medicine treats states that are diseases, but that these states become diseases because they are treated as such by medicine. Of course, this does not mean that everything that medicine treats is a disease. Medicine treats many conditions. For example, physicians provide assistance in pregnancy and childbirth, treatments to improve sport performance, and aesthetic surgery. Our point is not that everything that medicine treats is a disease, but that *everything that medicine conceptualizes as a disease is a disease*.

This does not mean that it is not possible for conditions that were not previously considered diseases to become diseases, or that what is now considered a disease may cease to be a disease due to changes in medicine. As we have stated in the previous section, there are reasons that justify conceptual changes. If the state of the knowledge in medicine in a given context implies a change in the reference, the inferential role or the epistemic goals of a medical concept (such as "disease"), then this concept changes semantically.

[11] Of course, we are not claiming that medicine is the only tool to answer these questions. Here we are simply pointing out that these are epistemic questions to which medicine, often in collaboration with other disciplines, attempts to provide answers.

Diseases are not things that objectively exist in the world and that can be grouped into essentialist natural kinds by virtue of their structural properties. The notion of disease is, in Ereshefsky's terms (2009), a combination of state descriptions and normative claims, and the state descriptions and normative claims of medicine are shaped by the practice of medicine itself. Conceptual changes in medicine are determined by changes in medical practices, and not only the other way around. Our medicine does not make the same state descriptions and normative claims as that of the 19th century or that of Classical Greece because medical science is radically different and treats today what it did not treat back then.

A conceptual change occurs when there is a change in any of the three dimensions of a concept (the concept's reference, its inferential role, or its epistemic goal). From a pragmatist point of view, a conceptual change in the notion of disease would be justified in those cases in which the state of medical knowledge allows us to think that a change in any of these dimensions would help us to achieve the practical goals of medicine. Thus, there are cases in which medical knowledge changes and certain conditions cease to be considered diseases because this categorization proves useless to achieve research purposes, make scientific inferences or aid in the discovery of new medical techniques or tools. For example, drapetomania, left-handedness, and homosexuality are no longer considered diseases. The notion of disease that has been used in medicine for centuries covered these cases but, given the medical changes in in recent decades, the notion of disease has acquired a meaning that does not allow for these conditions to be considered pathological. The reason why certain conditions cease to be considered diseases can be very diverse and should be examined case by case,[12] but it is undeniable that this type of conceptual change has occurred very frequently in the history of medicine.

[12] Conceptual changes in medicine, such as the exclusion of certain conditions from disease classifications, may have quite different justifications. In some cases, these changes are due to a more detailed medical knowledge of body functioning, while in other cases these changes stem from broader social transformations, such as the moral condemnation leading to the end of slavery, secularization, and the LGBT rights movement, for example. Our point here is not that conceptual changes in medicine are due only to advances in medical knowledge, but that these results occur when there are changes in any of the three components that we have discussed in section 4.1 (the concept's reference, its inferential role, and the epistemic goal pursued by the concept's use). As we have already pointed out, these changes may be caused by social or extra-medical factors, such as changes in the cultural values. The pragmatist approach that we endorse here claims that medical practice determines medical concepts, but it cannot be ignored that this medical practice is itself conditioned by its social context. Thanks to an anonymous reviewer for bringing to our attention the importance of explaining this clearly.

Moreover, there are other conditions that did not use to be addressed by medicine and are now understood as diseases. Epilepsy is no longer a sign that the gods have chosen a person as their preferred or condemned one, but rather a neurological pathology, and obesity is no longer a manifestation of opulence but a chronic multifactorial affliction. According to the current conception of disease, these conditions were already diseases, even if they were not initially considered as such. The point here is that they were not considered as such not because the notion of disease was being misinterpreted, but because the very conception of epilepsy and obesity has undergone conceptual changes.

The history of medicine shows many conceptual changes of this type — conditions that cease to be diseases or begin to be interpreted as such — and presumably more conceptual changes will happen in the future because medicine is in constant evolution. New diseases will arise and old diseases will change their meanings in the cases in which such changes prove useful to achieve the goals of medicine. Thus, theoretical terms of medicine, such as those that allude to certain diseases, changed their reference and inferential role when they ceased to serve to pursue the epistemic and practical goals of explaining and fixing that which departed from the social norm or from the culturally acceptable to assume the goal of explaining the biological processes and functions that entail suffering and incapacity. As we will discuss in the next section, we suggest that the recent philosophical interest of some authors in categorizing aging as a disease is perhaps an indicator of a conceptual change in gerontology.

### 4.3. Aging from a pragmatist approach

We think that the pragmatist approach in the philosophy of medicine is very close to the pragmatic proposal by Callahan and Topinkova in the debate on the theoretical definition of aging. Callahan and Topinkova argue that aging should be treated as a disease because medicine can and should do so. At the same time, however, they maintain that aging is not a disease. Callahan and Topinkova remain committed to a definition of disease that they do not explain but believe to be objective and uncontroversial. From our point of view, this

conceptual conservatism underlies an objectivist view which is not justified and is based on an erroneous understanding of how concepts are shaped in science.

We propose to go one step beyond Callahan and Topinkova and take on the pragmatist turn. Medical practice determines what a disease is. Obviously, medicine treats many conditions without considering them to be diseases: cosmetic issues, sport performance, etc. Not everything that is the subject of medical practice is a disease, but everything that medical practice treats as if it were a disease is a disease, because practice determines the meaning of a concept, as well as its possible changes.

The advances in gerontology have greatly increased our understanding of the aging process and have changed the concept of aging accordingly. Thus, aging is no longer simply seen as the passing of time but as a whole set of biological processes that have their origin at the cellular level of organisms and that can be described using the language of biological theory.[13] Present-day experts consider that "aging" is an umbrella term that actually refers to specific cellular phenomena. In particular, they have identified the so-called "nine hallmarks of aging": altered cellular communication, cellular senescence, deregulated nutrient-sensing, epigenetic alterations, genomic instability, loss of proteostasis, mitochondrial dysfunction, stem cell exhaustion, and telomere attrition (López-Otín et al. 2013). As a result, we can see that *the reference of "aging" has changed in gerontology* because *the inferential role of the concept of "aging" has changed as well* with the advancement of knowledge in cell biology. For contemporary biologists, aging is the outcome of concrete cellular mechanisms (i.e. the nine hallmarks).

The current biological knowledge and the advances in biomedical technology have made gerontology adopt the aim to slow down, stop, and even reverse aging (Juengst et al. 2003). In the present, aging is a technical concept that is at

[13] It is also interesting to note that this pragmatist approach to the notion of aging is compatible with a pluralism like that advocated by authors such as Dupré (1993) or Sandra Mitchell (2003) in the philosophy of science. The term "aging" may refer to different concepts, some of which may appeal to a natural state and some of which may appeal to a set of biological processes analogous to those of paradigmatic cellular diseases, such as cancer. Several different conceptions of aging can coexist, both in gerontology and in the ordinary language. The task of philosophers would be to discern and refine the conception of aging that is relevant for each case by taking into account the scientific practices and the epistemic goals with respect to which the term "aging" is used.

the core of certain medical practices. This means that *the epistemic goals of the concept of aging have also changed*: aging is not only a concept that serves to understand what happens to organisms after a certain age, but it is also key to the research and the design of treatments that seek to extend and improve life. One of the epistemic goals of the current concept of aging is to know how it is possible to intervene in this cellular process. This was not an epistemic goal of the traditional concept of aging, which defined it as a natural, universal, and inevitable process.[14] Aging has already come to be treated as a disease by the relevant medical professionals, therefore aging *is* or *has become* a disease. Our claim is that this notion of "aging as a disease" meets the epistemic goals of the notion of disease: to contribute to research, to help to make scientific inferences, and to lead to technical discoveries.

## 5. Conclusions

The notion of aging as understood by gerontology is going through a conceptual change that affects its reference, its inferential role and its epistemic goals. Today's scientific knowledge has modified our deeper understanding of what it means to age. As a result, the notion of aging as a disease has emerged replacing the traditional notion of aging as a non-diseased natural process, and providing a useful technical concept for those who want to understand and treat aging processes. The current state of the biology of aging makes it possible to understand aging as a condition which can be addressed at its very cellular basis. In this sense, aging is not very different from other diseases of cellular origin and there seems to be no good reason not to include it on the medical agenda as a disease.

Of course, this raises many worries about the risks involved in understanding aging as a disease. For example, it could be argued that medicalizing aging could lead to the stigmatization of large sections of the population that, until now, had not been considered diseased. It would also mean a new distribution

[14] Perhaps this explains why some very influential experts on aging, like Medawar (1952), considered unfeasible to treat aging as a disease. Technology in the middle of the last century lacked the potential to effectively treat aging and it was quite difficult to imagine that someday that would be an actual possibility. Consequently, from a pragmatist view, gerontology had not yet "invented" –in Hofmann's terms- the conception of aging as a disease.

of resources dedicated to healthcare systems that would probably involve profound social transformations. An approach to the ethical implications of the notion of aging as a disease must contrast these reasons with those of authors such as Caplan, or Callahan and Topinkova, who argue that treating aging as a disease would bring great benefits.

One of the main advantages of adopting a pragmatist approach to the notion of aging as a disease is that, by assuming that medical practice determines the meaning of the theoretical terms of medicine, the implications of the potential medical treatment for aging are highlighted. When a notion outside the technical vocabulary of medicine, such as aging, becomes a technical concept, this represents a change not only in medical theory, but also in medical practice.

Theoretical concepts are prone to semantic change. Whether adopting the conception of "aging as a disease" is beneficial or not is something that gerontology will decide depending on whether it helps to achieve its epistemic goals. Treating aging as a disease would make it such, but there is still a lot of normative room to discuss whether this is something that we want to do or whether it is more convenient to treat aging as something else.[15]

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