Chapter 17
A "Longevity Dividend" for All?

New Interventions into Aging and Justice

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17.1 Introduction

Biogerontology, the scientific discipline that explores the biological foundations of aging, has recently achieved important theoretical advances. Two prominent researchers have stated at various congresses, which united more than 20 % of the scientific community, that biological aging is no longer an unresolved problem (Hayflick 2007; Holliday 2006). This means that not only are the general foundations of biogerontology provided by the theory of evolution becoming more and more elaborated, but also the different mechanisms and processes on the molecular, cellular, and organic level are becoming increasingly known (Kirkwood 2008; Arking 2006). Gaining knowledge about these biological mechanisms opens up the prospect of biomedical interventions that might slow down, prevent or even reverse biological aging. Such prospects have already entered bioethical debates, mainly those related to human enhancement. The desirability of 'ageless bodies' and immortality have been the focus of these outlooks on possible long-term achievements (Kass 2003; Kass 2004; Harris 2004, Chap. 13, this volume, Buchanan 2011).

However, this focus might have diverted the attention from the short-term outlook that biogerontologists provide with regard to the possibilities of developing interventions into aging, and the realistic goals these might be able to achieve in the near future. Of particular interest would be the evaluation of these developments in relation to theories concerning just healthcare. This chapter will attempt to develop a general frame of how such an evaluation could be carried out. As claims regularly resurface that age has to be a criterion for the rationing of healthcare in the context of demographic change, a central question would be whether such new interventions into aging should be made widely available, and whether this is possible or not. What kind of impact this type of medicine will have in the context of existing health inequalities will also depend on availability. For detailed and empirically informed answers to these questions and convincing ethical evaluation, an interdisciplinary

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dialogue would be necessary involving biogerontologists, geriatricians, medical ethicists, and health policy experts. This contribution is not an attempt to replace such a dialogue, but serves to outline what might be a convincing choice of subjects to be discussed, and in which steps it might proceed. As a basis regarding the biology of aging, I will use some publications that summarize biogerontological knowledge and one statement in particular by leading experts of the field in which they outline technological achievements close at hand and their potential benefits.

On this basis, I will sketch the reasons for the promise of new interventions into aging and speculate what kind of medicine we can expect on this basis. Secondly, I will tackle the question of who will benefit and argue that limited access to this type of medical interventions is a likely outcome. Third, I will try to answer the question of whether we should worry about this from a perspective of justice. I will provide a couple of arguments why we should not, and then I will develop a justice framework that demonstrates reasons for why we in fact should. Finally, I will discuss some options for what could be done to avoid the undesirable consequence of increasing existing health inequities.

17.2   New Interventions into Aging and Medicine

Why should this issue be a matter of concern? One result of the recent research on the biology of aging is that the biological aging process is flexible and can be manipulated. This has been done in a range of laboratory organisms, such as yeast, nematodes, fruit flies and mice with a variety of different methods such as Caloric Restriction, gene manipulation and using the forces of natural selection (Kenyon 2005; Fontana et al. 2010; Partridge and Gems 2006; Masoro 2005; Rose 2008). Other interventions such as anti-oxidants (Golden et al. 2002; Harman 2009), hormesis or the inducement of light stress by different means (Rattan 2008), stem cell treatments in the context of regenerative medicine (Lafontaine 2009), and hormone treatments are discussed, tested, and sometimes even applied in the context of 'anti-aging' medicine, which is still an unproven and dubious endeavour (Butler et al. 2000; Olshansky et al. 2002). As no intervention into the aging process to date has been proven to be safe and effective in humans, the question must be raised whether the results achieved in laboratory organisms are transferrable to humans at all.

One indication that they are is the finding that mechanisms have been conserved across species barriers. Examples for humans are some particular characteristics of centenarians such as increased insulin sensitivity or lowered risk-factors for CVD in persons opting for a calorie-restriction diet. But, aging in humans is a complex interaction of genetic (estimates range from 15–35 %), environmental, behavioural, social and stochastic components. Stochastic components are random events on a molecular or cellular level such as DNA-damage. As a consequence, individual persons differ in their biological aging rates, which are also influenced by a complex interplay of social factors, the environment in which a person lives and individual health decisions (cf Chap. 2).

Based on the acquisition of further knowledge in the biology of aging, on the successful manipulation of the aging process in laboratory animals, on the conservation of aging mechanisms across species borders and on some common traits of centenarians, which might be used to develop interventions, a group of leading biogerontologists (Jay Olshansky, Daniel Perry, Richard A. Miller, Robert N. Butler in Olshansky et al. 2006, 2007) propagate a major investment in aging research by the National Institute of Health. As a realistic return on such an investment, they have claimed that there will be a "longevity dividend", which will be achieved by a prolonged professional life and a decreased burden of chronic diseases in old age. The proponents of the longevity dividend would like to distance themselves from both more optimistic authors such as Aubrey de Grey, who propagates 'ending aging', and the existing movement of anti-aging medicine, which claims to dispose of effective means to influence aging immediately (de Grey and Rae 2007). Olshansky et al. suggest that a seven-year prolongation of the human lifespan and slower aging for the same period of time is a realistic goal that could be achieved within the next 40–50 years.

What about the medical means to achieve this longevity dividend? Some other authors raise the prospect of simple interventions into aging such as CR-mimetics, also with reference to superior regulatory signalling pathways (e.g. Insulin/IGF-1), which will allegedly downregulate many other age-related processes, if successfully influenced. However, as already mentioned, the genetic, social, behavioural, and stochastic components of human aging will probably limit this outlook. Instead, some experts suggest a type of medicine that is adapted to individual aging. Although Olshansky et al. do not discuss what kind of medicine could result from the basic science to which they are referring, their suggestion on how to invest in aging research provides some insight. They ask for a support of basic research into genomics of aging and into regenerative medicine. Further they, suggest fostering clinical trials that investigate the interaction of drugs and lifestyle interventions. Finally, they also ask for investments in preventive medicine and the influence of social conditions. Together with the understanding of human aging as being different from individual to individual and the result of a multifaceted process with many stochastic components, this suggests that influencing aging will probably not be the result of a simple intervention that acts like some kind of magic bullet. Rather, the type of medicine resulting from the suggested research will be a personalized, complex and regular set of services including check-ups, advice, prevention, and treatment. This could start with a personal genome analysis to determine genetic risk and longevity profiles. From this could result particular recommendations on pharmaceuticals and diets, and individual life styles in general, which could lead to slower and healthier aging. Further regular check-ups on the aging of particular tissues and interventions to address the risks and to act according to the findings of these diagnostic procedures could follow. Finally, treatments with different interventions of regenerative medicines based on stem cells or artificial tissue could be used to restore the functions of organs affected by age-related changes. Obviously, it is only possible at this time to speculate about the type of medicine resulting from biogerontological research, and this would best be done—and should be done—in a dialogue between

biogerontologists, geriatricians and the specialists in the different relevant fields. But, this sketch is at least one possible outcome that could be reasonably expected considering already existing trends (Hamburg 2005; Micans 2005).

The goals of this kind of medicine, which would be achieved by intervening in the basic process of biological aging, are the following: (1) Slower biological aging; (2) Prevention or postponement of age-associated diseases from which would possibly and hopefully result a compression of morbidity; (3) A longer lifespan. Importantly, the target of this type of medicine would be the aging process itself. It may not be possible to identify a particular age-associated disease as a target indication. Also, it may be difficult to predict whether such diseases would be prevented or merely postponed with the result of compressed morbidity.

17.3   Access to this Type of Medicine will be Limited

A first step in evaluating this type of medicine from the perspective of just healthcare is to try to predict who will have access to it. An attempt to do so could be based on its features as a complex, regular and personalized set of services that combines life style recommendations, diagnostic, preventive and therapeutic measures. Further, the goals and the basic way they are pursued could be considered as well. The question of whether access will be widespread could then be answered in two steps. The first will be to see whether a comprehensive set of measures based on influencing biological aging is likely to be covered by public health insurance in industrialized countries. Limits in access in this respect would be structural limits, primarily by legal structures. A different limit could be e.g. limited access to specialist care. The second step would be to look at individual limits in access to this type of medicine.

In many countries, public health insurance or the public healthcare system will probably not be able to finance many of the relevant interventions and services, at least not if the current legal regulations are not changed. In Germany, for example, the respective law requires the public health insurance to cover the costs for medical interventions if they are necessary for the diagnosis or treatment of a disease (§ 27 SGB—social code book—V). However, as indicated above, the main target of the interventions at stake is biological aging, and there may be no clear indication for the treatment of any disease. It is also not clear to what extent these interventions will be considered as necessary for the prevention of age-related diseases. If the onset of these diseases is merely postponed, it may be difficult to convince policy makers to include the respective measures in universal coverage and to decide from which age to start. Some experts even claim that extensive preventive measures should not be a priority of public health insurance, and consequently not be covered.

Further, the law requires sufficiency, cost effectiveness, appropriateness and necessity (§ 12 SGB V). Due to scarce resources and cost constraints that partially result from the demographic change and technological innovation (Bodenheimer 2005, 2005a), there is some likelihood that new expensive medical services and interventions into aging will not be covered by public health insurance. The appropriateness

and necessity of a further lifespan extension might be doubted, as Daniel Callahan has done, in an influential way (Callahan 1977; Stock and Callahan 2004).

Personal limits could hinder access to new interventions into aging as well. If public health insurance will not cover this type of medicine, personal resources for financing access could be insufficient. As stated above, a comprehensive set of medical interventions could be personalized, regular and complex consisting of a combination of repeated diagnostics and therapeutics. If the price of these new technologies fall, as is predicted for whole personal genome scans, it remains that such regular visits and extensive consultations on personal habits and lifestyle choices are time-consuming and therefore also a medical service that could be costly for the less well-off. It is also unlikely the case that everybody will benefit from lifestyle recommendations in the same way. Individual responsibility for bad health choices is limited and also determined by social factors. Social determinants, like living conditions, education, lifestyle, if they remain unaddressed, could prevent some people from benefiting from interventions into aging. Unhealthy diets and their outcomes (e.g. obesity) could present an additional barrier: some risk factors related to obesity could lower the effectiveness of interventions into aging.

In sum, if the assumption is correct that medical interventions into the human biology of aging will be part of a complex and regular medical service, scepticism about whether everybody will benefit from the longevity dividend in the same way or even how widespread such benefits will in fact be seems to be appropriate. Additional barriers might also hinder people from contributing to the longevity dividend, if they lack the job opportunities in their field for a longer working lifetime. Consequently, they may lack the resources for a longer lifespan. Limited access to new interventions into aging and limited potential to contribute to the longevity dividend or enjoy its benefits could increase already existing inequalities in healthy life expectancy. At the same time, the situation of those best off is likely to further improve. A large amount of recent research has provided substantial evidence for a difference in healthy life expectancy according to socio-economic status, e.g. the Marmot report for the UK, and the research by Michael Marmot carried out for the WHO (Marmot 2006). The respective difference in healthy life expectancy in the UK according to the Marmot report is around 18 years; the difference in life expectancy is around 10 years. Due to limited access to medical interventions into aging, this could rise to 25 and 17 years if we use the prediction of Olshansky et al. and if we assume that the worst off are likely not benefiting from the longevity dividend, at least if this is not explicitly addressed by health policy. Compared to the situation of the best off, their position will even worse than it is now.

17.4   Why We Shouldn't Worry

It might seem obvious that this is unjust. In a first step, an analysis of new interventions into aging from a perspective of justice could hold that access to these interventions will create benefits or goods that will be distributed in an unequal way

across society, presumably according to the socio-economic status of its members. At least four arguments could be raised against the possible claim that the distribution of these goods is unjust. The first argument is that the distribution itself is just because it results from a principle of justice, merit. Secondly, it could be argued that the distribution is unjust, but that this is only temporary and will in the long run raise everybody's position including that of the worst off. Regarding the goods and not the distribution itself, a third argument could be that these goods are not relevant from the perspective of justice, as they represent no important gains. Along the same line, a fourth argument could be based on the assumption that these goods could have some relevance, but not a very high priority.

The first argument could be considered to be a libertarian one. Being able to afford these technologies and medical interventions and benefit from them would just be another well-deserved reward and incentive for social and economic success and a rational and disciplined lifestyle. In turn, not being able to benefit from new interventions into aging and a shorter less healthy life-span could also be considered the result of bad health decisions and an unhealthy lifestyle accumulating throughout life considered as a whole. However, serious doubts can be raised as to whether this is based on correct assumptions. Responsibility for bad health choices and outcomes play a major role in this line of argument. But, research on influences that date back to early phases of life and on social determinants of health points to the limitations of personal responsibility in this field. As to the other part of the meritocratic argument that access to new interventions into aging should be simply seen as a reward for social and economic success, it remains to be seen what kind of arguments can be put forward that the equal distribution of the benefits of interventions into aging matters.

The second argument is somewhat related to the first. If the most successful people in society will have access to new interventions into aging, it could be argued that everybody will benefit in the long run. Further, trickle-down effects and increased availability because of wider social acceptance could contribute to a wider distribution. First of all, there could be a social benefit for all if a social elite is able to work longer. The benefit from the longevity dividend could be limited to the most successful members of a society, but this will initially have indirect effects on everybody else because of productivity increases through increased longevity. While the technologies involved will get cheaper with time, such increased productivity will create incentives to make them widely available. Allen Buchanan, who uses this argument for enhancement technologies in general, cites a labour productivity increase of 4 % per year increase in life expectancy in a population (Buchanan 2011). But still, it remains questionable whether this will indeed extend to all members of society or not. In some types of low-skilled and manual labour jobs, increases in productivity by working longer could be smaller and the availability of jobs for older workers may decrease with age, as is the case at the present time.

Both arguments are based on the assumption that an equal distribution is not unjust or does not matter in this case. Two other arguments are related to the relevant benefits or goods. These could be pointless. For instance, it could be argued that the achievement of a happy and fulfilling life does not depend on its length beyond a certain period of time. Seen from this perspective, living past the current average

life expectancy would not be a substantial gain, and therefore it would not matter if some could not afford it. Indeed, Daniel Callahan has used his concept of a "natural lifespan" in this way, which he has put forward against lifespan extension (Callahan 1977). However, this concept poses many problems. First of all, the current average lifespan of humans in industrialized societies is far from being a result of natural evolution. Then, obviously, this argument is a natural fallacy. Even if a certain length of life is natural, this as such has no normative implications. Other assumptions Callahan makes seem to just beg the question. For instance, he argues that after having reached a certain age people have made all experiences that were useful to a certain character. But even if this were true, which is again based on a very doubtful and thin empirical basis, new interventions into aging might also change this alleged aspect of the human life cycle. Finally, contemporary theories of justice do not focus on well-being or fulfilment but rather on the opportunities to achieve them. Ascetic people, such as monks, could forego certain opportunities because they believe they are irrelevant for them. However, what is important is that they have these opportunities in the first place.

Finally, a fourth argument could refer to just healthcare. From this perspective, access to new interventions into aging may be of importance but of less importance than other aspects of healthcare, either for younger ages or for older people. The longevity dividend could possibly be of less significance and may divert resources from more important goals. Such a goal could be end of life care or high quality care for the oldest old, which may still be needed if chronic diseases are just postponed. Not only could the resources for such purposes be missing, we could also run the risk of suppressing the importance of these issues and judgments could become more biased under the impression of extending a vigorous life-time. As could be argued based on Norman Daniels' prudential lifespan account, reasonable priority setting in healthcare would simply ensure that we reach a certain age (Brauer 2009); a prolongation of the average lifespan would not be a priority of just healthcare facing limited resources (Fleck 2010). But also in this case, many questions remain open. First of all: Would all reasonable people really choose in the same way? Many people are willing to make substantial sacrifices to reach a very old age, e.g. undergoing caloric restriction. Secondly, are the goals of reaching a certain age and prolonging the healthy lifespan by means of interventions into old age really competing for resources? This would again depend on the way basic knowledge in biogerontology can be applied to medical interventions, and if and how the longevity dividend can really be achieved.

17.5 The Relevance of New Medical Interventions into Aging from a Perspective of Justice

The arguments that unequal access to medical interventions into aging would not be unjust were either based on assumptions as to what kind of goods this access creates or the principles for their distribution. I will briefly sketch a framework mainly based

on John Rawls' theory of justice regarding these two aspects of distributive justice (Rawls 1971) (other forms of justice such as retributive justice, corrective justice or global justice are beyond the scope of this chapter, although they would be relevant for a comprehensive discussion of this topic). These two aspects are the distributional entities or measures whose distribution is relevant from a justice perspective and the principles according to which they should be distributed.

What kinds of goods are then generated by access to interventions into aging? If agency or positive freedom is considered to be the common denominator of measures for justice, interventions into aging have the potential to produce different categories of such goods or capabilities. There are three basic categories of such goods. The first is improvement of well-being in relation to age-related changes. An example could be macular degeneration such as the cross-linking of crystal proteins in the eye. This might not hinder vision, but can cause discomfort. Thus, it may not be absolutely necessary for agency, but may have a slightly negative impact. The second category is improvement of functional changes affected by age-related decline (cognition, sensual perception, mobility etc.) and improved capabilities as a result. Sarcopenia is a good example. This category would be of obvious importance in the context of agency. Finally, the third category would be life-time. Time as such could be considered a necessary precondition for activities and achievements and thus be a relevant aspect beyond mere physical or mental capabilities or resources.

Considering these categories of goods and capabilities, which result from them age-related interventions are relevant from a justice perspective. This is the case from both a Rawlsian and a capabilities perspective (Nussbaum 1992). It is not necessary to decide here which measure—resourcist or capabilities-oriented—or general approach is more appropriate in this context. The respective interventions would be relevant from the perspective of both. This is not surprising, as the most renowned theories of justice develop a measure on the basis of what they consider to be relevant for agency. In this respect, Rawls puts forward his concept of primary goods, which are preconditions of all kinds of life plans and are necessary for the principle of equality of opportunity. Norman Daniels extends this concept to health insofar as health in the form of 'normal species functioning' is relevant for this equality of opportunity. Furthermore, it is does not matter whether aging is considered as 'normal species functioning' or not—which is denied by some biogerontologists—it certainly is a loss of agency in many respects, and therefore relevant to what Daniels calls an "opportunity range" (Daniels 2008). Interestingly, both Christopher Boorse and Lennart Nordenfelt, two of the most prominent authors of a theory of health and disease, propose that aging could be considered as a condition which should be treated by medicine. Boorse notes that despite the fact that it is not disease, should be retarded or even eliminated if it were possible to do so, and if we decided to do so (Boorse 1997). Nordenfelt writes that prima facie aging could be considered to be a disease, but we do not do so because it is untreatable. Instead he proposes to adapt our vital goals to our age-related capabilities (Nordenfelt 1987). But this could also imply that as soon as aging is treatable, we should indeed try to do so. Tristram Engelhardt points out that age-related changes would obviously have the character of a disease if they were 'premature'. He also stresses that defining aging as a disease

should depend on our ability to postpone it. If it is not postponable it leads only to frustration if defined as disease (Engelhardt 1979). On the other hand, aging can be usefully considered as a disease if postponable. What is 'premature' in the context of aging is also not merely determined by nature, but also influenced by society and also by medical possibilities. The aging process is not programmed, but flexible and depends on the social context, and likely in the future also on medical technology. In the same sense, it is unclear what constitutes a 'normal opportunity range' in relation to age and old age. This may not only depend on the social context and the social status of particular person but also on access to new medical interventions into aging prolonging different aspects of agency such as cognition or mobility. After all, one of the consequences of unequal access to intervention into aging could be that such a thing as a 'normal opportunity range' is no longer there for all members of a society.

Based on this assumption of unequal access leading to an unequal opportunity range, it becomes easier to decide what could be the principle of distribution of the goods generated by interventions into aging. Considering that those who are already the worst off will have a position that is actually worse than those with the best position, access to longevity interventions should be equal or the worst off should have priority. Otherwise, the possible impact on existing inequalities in healthy life expectancy will also lead to an increase in social injustice.

If we apply a fair process to the decision about this principle of distribution, such as deciding behind a veil of ignorance, the participants in such a fair process would presumably opt for principles leading to a prioritarian or egalitarian. Would somebody opt for a society in which the situation of those who already live shorter and less healthy lives should not have priority and those best off should have even longer lives? This is unlikely to be the case. Considering the impact that this would have on the 'opportunity range' of the participants in a fair process, they would not opt for a sufficientarian distribution, which would correspond to the arguments one and two put forward on a libertarian basis or on the basis of trickle-down effects. In opposition to the libertarian argument, one could maintain that people who are not aware of their position in society would not opt for an unequal distribution of goods of such relevance for fair equality of opportunity in old age. Even more so if this 'opportunity range' would not solely depend on their own responsibility and decision. The 'trickle down' argument could include the assumption that the position of the worst off would be better if some people had access to interventions into aging. However, the 'trickle down' effect is far from being certain, and there could be plausible alternatives for the improvement of the situation of the worst off. Finally, in opposition to Callahan's' argument of a 'natural' lifespan, it could be argued that only when the impact on the 'opportunity range' is considered, does it become clear whether people appreciate a greater 'opportunity range'. The question would address the reasons why anybody should stop to value aspects of his or her agency simply because a certain amount of time has passed. Even if some of the opportunities no longer seem relevant at second glance, it is unlikely that most people will consider it as irrelevant not to have them at all.

17.6   Conclusion: Setting Priorities in Research

If, from a perspective of justice, the likely outcome of limited access to interventions into the aging process is considered to be unjust, what consequences should be taken? Three basic alternatives shall be discussed here: Prohibition, enabling general access and setting priorities in research. The first option, prohibition of intervention, may seem like the easiest choice from the outset. As there is the potential of social harm, it could be argued that interventions into aging are not permissible, and that it would be legitimate to forbid them. Two reasons, however, can be raised against this. While there is some potential for harm, it is far from clear how high the actual risk is and what the risk-benefit-ratio will ultimately be. Because there could be substantial social and individual benefits as well, as the authors of the longevity dividend convincingly claim, simply prohibiting the related technologies as a precautionary measure will be morally problematic. The second argument is that a prohibition is also difficult, if not impossible, to implement in an appropriate manner, as there will presumably be strong resistance against it. In order to be effective, it would have to take place on a more or less global scale; furthermore, it is hard to imagine liberal countries, the leaders of which are reluctant to prohibit technologies without evidence of concrete risks, following such a path. Guaranteeing universal access, although this would be desirable from a perspective of justice (see also Farrelly 2007), will probably be too expensive if it includes a comprehensive set of technologies and personalized services, which will be developed without further provision.

The third option may appear more promising. This entails setting priorities on publicly funded research, amended by actions on the social determinants of health. Priorities should be set on the research of interventions, which will be affordable and implementable in the context of the public healthcare system. Such priorities should also address important health problems related to chronic diseases. This should be reflected in interdisciplinary cooperation between biogerontologists, geriatricians and health economists. A recent publication on "Rejuvenating Aging research" by the Academy of Medical Sciences has developed an outline of such research priorities, which also reflects such aspects as the importance of health problems, but it does not explicitly address the aspect of justice or access to possible interventions resulting from this research (Academy of the Medical Sciences 2010). Also, the proponents of the 'longevity dividend' are aware that these issues have to be addressed, as they mention cost-effectiveness and social aspects as parts of their suggested program to fund aging research. This can provide a starting point for the conception of a detailed agenda for priorities in aging research. An example of a medical condition that could be addressed in this way is obesity. Obesity increases the risk of different chronic conditions, and it has been stressed recently that it will lead to severe problems for the healthcare systems in many countries (ten Have et al. 2011). Further, researchers have claimed that it could generate a trend that could reverse the gains in life expectancy achieved up to today (Olshansky et al. 2005). There is also a clear connection between obesity and social determinants. All of this indicates that the problem of obesity threatens the benefit that could be generated

by the longevity dividend, particularly for those who are already among the worst off, and have the lowest healthy life expectancy.

An example of what a strategy for priority setting could look like is the "3D combined matrix approach", which was proposed by the Global Forum for Health Research, an international organization that dedicates itself to demonstrating the importance of the research of health and health equity (Ghaffar 2009). The three dimensions encompass a public health, an institutional, and an equity dimension. With the help of such a tool, a comprehensive approach to a strategy for the research and development of biomedical interventions into aging could be conceived and subsequently implemented in public funding programs such as the framework program of the European Union. In this context, it should be examined whether the criteria for public health insurance or services should be changed and which health policies are successful in tackling the impact of social determinants of health on healthy life expectancy. We should improve the current social context for a fair distribution of the benefits of new interventions into aging and set priorities in research immediately, instead of just waiting to see what kind of impact they will have, if they become available. That way, there might indeed be a 'longevity dividend' for all.

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