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On Biotechnology, Theology, and the Human Sciences

Jonathan Jong

Abstract

There may be very good Christian theological reasons to oppose human biotechnological enhancement. It is, however, difficult to discern what they are. Much of the specifically Christian response to transhumanist biotechnological enhancement has revolved around the metaphysics of human persons; this is hardly surprising, given that similar themes appear in other bioethical themes, such as over in vitro fertilisation, abortion, and euthanasia. The main aim of this paper is to clarify the theological requirements for such responses, particularly those that are mistakenly delegated to scientists. In particular, the paper will focus on the need for a Christian theological account of human nature that does not unduly rely on biological accounts of the same.

[Keywords]

ethics; metaphysics; enhancement; transhumanism; human nature; natural law; species concepts

It will not have escaped the attentions of readers of this journal that conversation between “science” and “religion” is typically asymmetrical, such that theologians are often reacting to the empirical and theoretical deliverances of the sciences broadly construed. We are eager to elucidate the theological implications of this or that scientific discovery, sometimes keen to ward off so-called debunking arguments and other times keen to build on findings we consider germane to our theological commitments. In this eagerness, we may have ceded too much ground to the scientist, delegating metaphysical work to her. Meanwhile, the positivistic dismissal of philosophical and theological metaphysics is alive and well among public-facing scientists¹. So, the metaphysical *work* has largely been left undone, but this is not to say that we are not—in our scientific, philosophical, and theological construction—nevertheless guided by metaphysical presuppositions: quite to the contrary, we have just uncritically adopted scientific ontologies in our philosophizing and theologizing. The disastrous effects of this move are widespread, not least in the field’s decades long and surprisingly expensive preoccupation with the discovery of causal joints between God and nature, as if both occupy the same secondary efficient causal space. More to the point on this occasion, however, is the way in which theological objections against biotechnological enhancement are undermined by our own reticence to do Christian theological metaphysics.

None of this is to deny the importance of attending to empirical facts. Indeed, our situation is exacerbated when we simultaneously delegate our metaphysical work to scientists while also predicating our technological dystopianism on speculative ignorance on scientific and historical matters. For exam-

ple, no sensible discussion about biotechnological enhancement can be had without the honest recognition that we are all already beneficiaries of enhancement technologies. Let us begin here, then, with the flogging of a dead Luddite.

How humans have changed

Cognitive abilities are changing. The “Flynn Effect” refers to the observation that IQ scores have been rising over time, since the 1930s, when standardized intelligence testing was first widely administered around the industrialized world. A recent meta-analysis found an average increase of 2.31 standardized IQ points per decade. The effect was robust across different samples, performance levels, and methods of measurement.² The effect has also been documented in developing countries, where the IQ gains over time are now more rapid than they are in industrialized countries.³ We can have debates over whether standardized intelligence tests like Stanford-Binet, Weschler, or Ravens tests really measure intelligence until we are blue in the face, but if these changes over time are not merely statistical artifacts or the result of test-taking practice, then there is some sense in which cognitive abilities have changed over recent generations: my generation’s average IQ is nearly one standard deviation higher than that of my grandparents’. Given that it is vanishingly unlikely that these IQ gains are the result of evolution by natural selection over the past century or so, changes in our social, economic, and cultural environments are probably responsible for this enhancement.

Longevity is changing. There is little evidence for changes in the *maximum* human lifespan, but this limit applies to so few individuals that it is more distracting than meaningful. Average life expectancy from birth has certainly increased markedly over time, but this too is an uninformative metric, telling us more about infant mortality than we might want to know. More importantly, not only has infant mortality declined, but those of us who survive childhood do live longer now than our ancestors did, though this journey towards longevity has been bumpy. Most of the pre-modern data available are of wealthy or otherwise privileged men; no surprises there. For example, J. D. Montagu mined the *Oxford Classical Dictionary* for birth and death dates of prominent ancient Greek and Latin male figures (philosophers, poets, and politicians; excluding those who died violent deaths), and estimated that those born before 100 BCE enjoyed a median lifespan of 72 years; those born after 100 BCE had an estimated median lifespan of 66 years.⁴ Skipping forward a millennium or so, Maria Carrieri and Diego Seraino turned their attention to popes and artists between the 13th and 19th centuries. Between 1200 and 1599, the median lifespan of a pope was 66 years and 63 for an artist. Lifespans then increased: between 1600 and 1900, it was 77 years for a pope and 70 for an artist.⁵ Today, the average British resident lives considerably longer than all these privileged men. According to 2004-2016 figures from the UK Office of National Statistics, a newborn boy can expect to live 79.2 years while a newborn girl can expect to live 82.9. Among those who survive to age 65 years, men can expect to live a little over 83 years and women can expect to live to 86 years. C. D. Mathers et al.’s recent multi-country study found

that this increase in lifespan among older adults is happening across high income countries—usually due to improvements in healthcare and healthy behaviours—but not low income countries.⁶ Longevity may no longer just be for popes and philosophers, but it is still not equitably distributed.

Now for a more trivial example; this time one of human anatomical change. Between the 1870s and the 1970s, the average height of Western European adults increased by an average of 1cm per decade according to data from 15 countries.⁷ This too is a global trend: for example, South Korean women gained 20.2cm and Iranian men gained 16.5cm between 1896 and 1996.⁸ Again, these gains are unlikely to be due to genetic changes so much as to changes in sanitation and diet.⁹ Like changes in lifespan, these increases in height have not been linear: average adult height has fluctuated over time. For example, the English got taller under Roman occupation between the 3rd and 5th centuries BCE, and then shorter again from the 7th century, and then taller again after the Norman Conquest, and then shorter again in the 1200s and 1300s when there were great famines, and then taller again after the Black Death, and then shorter again during the harsh working conditions of the Industrial Revolution.¹⁰ You get the picture.

Moral unease over *biotechnological* human enhancement

And you get the point. Human cognitive ability, lifespan, and physiology have all changed over time: and if higher IQ scores, longer lives, and taller builds are improvements, then what we have experienced is enhancement. Indeed, even if the distinction between therapeutic treatment and enhancement could be sensibly made, it is implausible to consider the increase of IQ scores, adult lifespan, or height to be examples of the former. We may be cleverer than our grandparents, but this does not entail that they suffered from cognitive deficits. We may live longer now than they did, but this does not entail that they died prematurely. We may be taller now than they were, but this does not entail that they were physically disabled. So, if we find these changes acceptable, then there can be no objection to human enhancement *per se*.

Furthermore, these changes are attributable to human activities and accomplishments: improvements in education and cognitive stimulation, and in sanitation and diet and healthcare. In other words, these were technology-driven enhancements. So, again, if we find them acceptable, there can be no general objection to technology-driven enhancement. Nor is it plausible to object to *deliberate attempts* at human enhancement, while permitting in accidental enhancements. The population changes I described above may well have been happy accidents of various social and economic changes, but we now do regularly try to improve ourselves and each other via means not unlike those mentioned above, including improvements in diet, cognitive environment enrichment, education, and sanitation. Unless those too

are morally problematic, then we have no silver bullet against the use of technology to enhance our longevity, cognitive ability, and physiological adaptedness.

So far, so obvious: but then, how we might distinguish between acceptable and unacceptable forms of technology-driven enhancement? Well, if it is neither the *enhancement* nor the *technological* that is the problem, perhaps it is the *bio-* aspect of biotechnological enhancement that raises moral alarm bells. 'Twas ever thus. Moral queasiness about biomedical intervention is hardly new. Consider the historical and current uneasiness over contraceptive and fertility treatments¹¹, and ergogenic and nootropic substances, and even vaccines.¹² There are obvious differences between these interventions and the means of enhancement discussed in the previous section: medical and more specifically biotechnological techniques involve direct manipulations of human bodies and brains. Relatedly, they are directly targeted at individuals now and not society at large over generations.

Recent psychological research might shed some light on why these bother us, both the direct and the biological aspects of biotechnological intervention. Work on the Trolley Problem, for example, has shown that people find the direct infliction of harm (*viz.*, pushing someone onto railway tracks to be hit by a train) less morally acceptable than the indirect infliction of harm (*viz.*, redirecting a train to hit someone) even if the consequence of both actions leads to the same positive outcomes (*viz.*, saving the lives of five people whom the train would otherwise have killed).¹³ Stock criticisms of research on the Trolley Problem aside, the general idea that we are more averse to *causing* harm than *allowing* it should be uncontroversial. Indeed, this is how many theologians and philosophers of religion let God get away with the suffering we see (or ignore) around us. Biomedical—and more specifically, modern biotechnological—interventions are not paradigmatic cases of harm, but they are perceived as direct intrusions into the body envelope, and *ex hypothesi* close enough to be psychologically governed by our normative intuitions about harm.

From another theoretical angle—that of Moral Foundations Theory¹⁴—attempts at body modification are likely to trigger feelings of disgust associated with violations of purity or sanctity, which are in turn emphasized especially by religious people: our opposition to biotechnological interventions may therefore be the psychological result of weighting our concerns about purity over our concerns about the potential positive health benefits of such interventions (plausibly covered under MFT's care/harm domain).¹⁵ Of course, to explain our moral intuitions in terms of our affective responses is not to repudiate them: indeed, some philosophers have argued that our reactions of disgust or repugnance are good moral guides.¹⁶ However, arguments from repugnance generally assume the universality of the disgust response toward the behavior in question: this assumption fails to enjoy empirical support. Therefore, unless proponents of these arguments are willing to supplement them with claims that their

opponents are affectively or morally defective, the arguments will prove unsound on the basis of false premises even if they can be made to be formally valid.¹⁷

There is a further sociological observation that may be offered, which comes closer to the central concern of this paper. As a culture, we have become enamoured with the *gene* as a unit of analysis: this gene-centrism manifests itself not only in debates within evolutionary theory over the units of selection, but also in political and otherwise political debates about such diverse topics as pathology, ethnicity, gender, and sexuality. In particular, there is widespread equivocation between the “genetic” and the “natural” or even the “real”. Thus, for a disease like attention deficit and hyperactivity disorder to be real requires it to have a genetic basis; and for homosexual orientation to be natural, it needs to be genetically caused; and distinctions between subpopulations of human beings are based on genetic differences. This privileging of the gene—and its alignment with the natural—also gives it moral purchase, such that genetic modifications are seen as morally problematic on the grounds that they are modifications to our nature. But even setting aside issues concerning the alignment of the natural with the good, there are many problems with this way of thinking about genes.

Phrases like “genetic basis” and “genetically caused” are often uncritically bandied about, but they do not hold up to scrutiny. It is a truism that all human attributes are genetically based, in the universally accepted sense that all biological attributes are products of gene-environment interactions: even the most stubborn of genetic determinists admit both “nature” (note the equivocation again) and “nurture” in their causal vocabulary. The upshot of this is that traits cannot be categorized between those that have “genetic bases” and those that do not. The obvious next step is to try to plot traits on a continuum of naturalness based on the “genetic contributions” to their development. This will not do either, as direct inferences from analyses of variance to conclusions about causation are invalid: biological causality cannot be apportioned in the way that, for example, physical causality might be¹⁸. The statistical technique is simply inappropriate for this metaphysical job. But if the specialness of genes lies not in the quantity of their causal contributions, perhaps it lies in certain qualitative differences between genetic and other developmental resources. However, close comparisons of genes against other developmental factors—epigenetic as well as physical and cultural environmental variables—reveal that posited asymmetries are *theoretical choices* rather than empirical findings: if genes are considered “signal” (or “blueprint”, to use a more common metaphor) against environmental “noise” (or “building material”), it is not because the facts of biological development and evolution make them so¹⁹.

Now, well-informed readers might notice that the claims in this section are debatable: they are accepted by developmental systems theorists and by those sympathetic to the recent extended evolutionary synthesis, but disputed by others more closely aligned with the 20th century version of the modern evolutionary synthesis. Guilty as charged, but this only goes to reveal the perils of delegating metaphysical questions—in this case, questions about centrality of genetics to philosophies of human na-

ture—to biologists. To be sure, it is of academic interest to elucidate the theological and ethical ramifications of contested or even falsified biological theories, but we should at least know that that is what we are doing.

Appeals to nature

Neo-Darwinism is often said to have rung the death knells of Aristotelian essentialistic teleology, but there are vestiges left of the old metaphysics in our moral thinking, both religious and secular. Talk of “playing God” is bandied around at least as flippantly and uncritically as talk about genes, but for religious and nonreligious people alike, the objection seems to have something to do with the violation of human nature.²⁰ Of course, it is the tradition of natural law reasoning that formally and rigorously defends this link between the nature of a thing and its goodness. The basic metaphysical presupposition of natural law reasoning is that things have natures that are given (by God, if we want to get theological) and are therefore prior to us as individuals. A thing’s nature determines its proper end, the direction towards which is what it means to be good. Natural law theories therefore fly in the face of the post-Enlightenment concern to cleave facts from values, and the concomitant ban from deriving an “ought” from an “is”. Then again, so do naturalistic consequentialist theories, in their moves from pleasure to goodness, pain to badness, or whatever. In any case, this presupposition provides a general method for assessing the moral valence of actions: actions are morally good insofar as they contribute to the fulfillment and flourishing of humans *qua* humans, and morally bad insofar as they pervert or damage our humanity.

The devil is, of course, in the details. Just as utilitarians face difficulties in justifying their views on what counts as the utility to be maximized, so natural law theorists face difficulties in justifying their view on which aspects of human nature count among those to be protected and promoted. In other words, before they can enumerate biotechnological oughts, natural law theorists need an account of what human nature is. As it happens, religious natural law theorists pride themselves in their naturalism, even while insisting that “the very idea of natural law demands ontological support of the kind provided by theism”²¹: the upshot of this naturalism is that, quite unlike the divine command theorist, the natural law theorist is confident in his or her ability to discern the natures of things and reason about them to make moral inferences. This confidence is, in my judgement, misplaced.

We have already considered the empirical and conceptual difficulties with equating the natural with the genetic: and even if we had good reasons for giving genes the requisite metaphysical weight to make them morally relevant, and even if we knew how to apportion causality to specific genes relative to other developmental resources, we would be left with the task of determining which genetic polymorphisms were normative and which were aberrant. One option is to conflate the normative with the normal, but natural law theorists are generally quick to resist this tyranny of the statistical average, and for good reason: the goal of any individual life is not to be at the centre of the normal distribution of

any given trait. Another option is to bring in the resources of evolutionary theorizing, and to consider normative the traits (and underlying genes) that have been selected for: but this move too has been resisted, as there might be many evolutionarily adaptive traits—sexual promiscuity, proneness to violent aggression, distrust of outgroup members, to list a few possibilities—that natural law theorists tend not to want to embrace.

There is a further, thornier problem. Before we can determine the traits that are natural to humans, such that attempting to modify them is a violation of human nature, we need some account of what a *human* is, whose nature it is we are investigating. There seem to be two strategies taken: to delegate the definitional responsibility to biologists and accept that humans beings are whatever *Homo sapiens* are, or to assert that natures are self-evident and that “we recognize it when we see it”, even if we cannot list necessary and sufficient criteria.²² To tackle the second strategy first: it is not at all obvious that membership in the category “human being” is self-evident. Our deplorable history of slavery and genocide makes that point resoundingly well. Less melodramatically and as conservative natural law theorists can sympathize with, our current debates over abortion, stem cell research, and treatment decisions for patients in permanent vegetative states all show that questions about what (or who) counts as a human being are not straightforwardly and uncontroversially answered.

Nor is it obvious that we should delegate our definitional—and metaphysical—work to biologists. The desire to do so seems to be predicated on a misunderstanding of how scientific taxonomies work. Consider, for example, the fact that we have multiple definitions of “life” and “death”, each of which are fit for the purposes they serve whether it is the delimiting of a field of scientific enquiry or the choice of treatment options. For some purposes, life begins at fertilization; for others, at embryonic implantation; for others, at birth. For some purposes, life ends when the heart stops; for others, when breathing does; for others still, when brain functions cease. Questions about when life *really* begins and ends are poorly posed when posed to the biomedical scientist: the correct answers depends on the context of the question.²³ Similarly, there is no biological answer to the question of how to distinguish between the sexes, or even how many sexes there are. There are plausible multiple criteria that are not perfectly correlated with one another, including chromosomal, internal sex organs, external sex organs, hormonal levels, and hormonal reception (e.g., androgen sensitivity). For some purposes, it is reasonable to say that there are two sexes; for other purposes, it is reasonable to say that there are more; for still other purposes, it is reasonable to say that sex lies on a biological spectrum.²⁴

What is true of life and death and sex is true also of species. There are multiple definitions of species—that is, multiple systems of biological taxonomy—some of which apply better to some taxa than others and for some purposes than others. Morphological species concepts rely on similarities and differences in form; biological species concepts rely on interbreeding and reproductive isolation; phylogenetic species concepts rely on evolutionary divergence. Each species concept has its benefits and limitations that are more or less salient in different contexts of scientific application; none are designed for

theological and moral reflection. Species concepts are tools constructed for biological research; the assumption that they are fit for purpose for religious and moral use cannot be taken for granted. Indeed, taxonomical pluralism presents a significant challenge to natural law theorists insofar as they expect biology to help them distinguish between natural kinds. Consider, for example, a moral objection against genetic hybridization based on the idea that we ought not act to violate species boundaries. This objection assumes that there are objective species boundaries, such that there can be a fact about the matter of whether we have crossed them. But if there are such objective boundaries, they are not given to us by biological science, whose taxonomical concepts are theory-driven constructions.²⁵ If natural law theorists want to have objective boundaries between species so as to forbid interventions that inter-mingle them, they have some metaphysical work to do.

The challenges ahead

Biology does not supply on a silver platter an answer to questions such as “What is a human being?” or “What is human nature?” The best that the biological sciences can do is provide a variety of options for our perusal.²⁶ The rest is up to us. We must decide upon our metaphysical commitments and infer from them our moral norms. But we seem reticent to do the job. And no wonder, for it is a difficult job. It is a job made both more difficult and more pressing by biotechnological advances and goals. Even if it were obvious to us how to draw lines between humans and nonhumans now, this task will be increasingly difficult when—for example—we modify nonhuman animals to be more like us or to be able to interbreed with us. Perhaps we could object to such activities on the grounds that it will make our philosophical tasks more difficult, but this is unlikely to be persuasive. Besides, even if we just oppose all biotechnological activities that problematize species membership further, it is important to recognize that such technologies are not responsible for our conceptual confusion in the first place.

We have fared much better at constructing *normative* accounts of human nature than we have been at defining and describing it, if by that we mean that there are plenty of available options. Natural law theorists among theists have catalogues of basic goods ready at hand, which they infer from what they identify as natural human desires and inclinations. Both of these strategies and the goods they identify owe themselves largely, unsurprisingly, to Thomas Aquinas.²⁷ Protestant theologians have been less ready to align themselves with neo-Aristotelianism, but they too are prone to turning to nature, asking questions not only about universal human traits but also *uniquely* human traits: the intuition here, hardly foreign to neo-Aristotelians, is that both the universal and the unique are good indicators of human nature.²⁸ This general method relies on the careful study of human desires and inclinations, as well as of the factors that encourage or diminish human flourishing. In so doing, it suggests a potentially

fruitful relationship between theology and the human sciences, whose goal is precisely to conduct such studies.

This relationship is not to be one-sided, of course. Being as affected by its *Zeitgeist* as any other disciplines, the preoccupations and methods of the social and psychological sciences are what you might expect in late capitalism in the individualistic West. The theoretical assumptions and methodological tools of these sciences are therefore ripe for theological critique. Are, for example, current measures like gross domestic product or the Happiness Index²⁹ or the Satisfaction with Life Scale³⁰ fit for the purpose of answering our questions about the conditions of human flourishing? Are the basic human needs posited by Abraham Maslow and psychologists ever since a reflection of their own projected desires, or accurate descriptions of human beings in general? Should we adopt the assumed goals of political, economic, and evolutionary processes—power, wealth, reproductive success—as the goals given to our human nature by God? But if theological critique of the social and psychological sciences is possible, this must mean that natural law theorizing has its own theoretical and methodological assumptions for the human sciences. Now, it will not do just to complain *after* scientists and popularizers of science come up with narratives of human nature that seem to us too reductive or mechanistic or crass or amoral. They—*we*, if I may speak from the laboratory bench here at the end—need theologians and philosophers to help us ask the right questions if there is to be any hope for useful interaction between the sciences and their queen. The ritual of philosophical and theologizing about scientific discoveries from our armchairs has proved inefficacious: if there is to be any hope of fruitful interaction between theology and the natural and social sciences, collaboration has to begin earlier than the publication and (worse still) popular dissemination stage. I am aware that these demands seem unfair on theologians: not only am I suggesting that theologians should do theological metaphysics and ethics, but I am expecting them to help scientists do science. And it is unfair, I suppose, but whoever said that this was meant to be easy?

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- ¹ Stephen Hawking and Leonard Mlodinow. *The grand design* (New York, NY: Bantam Books, 2010); Lawrence Krauss, *A universe from nothing* (New York, NY: Free Press, 2012).
- ² L. H. Trahan, K.K. Stuebing, J.M Fletcher, and M. Hiscock, "The Flynn Effect: A Meta-Analysis," *Psychological Bulletin*, 140:5 (2014): 1332-1360.
- ³ James R. Flynn, *Are We Getting Smarter? Rising IQ in the Twenty-First Century* (Cambridge: Cambridge University Press, 2012).
- ⁴ J. D. Montagu, "Length of Life in the Ancient World: A Controlled Study," *Journal of the Royal Society of Medicine* 87:1 (1994): 25-26.
- ⁵ Maria Patrizia Carrieri and Diego Serraino, "Longevity of Popes and Artists Between the 13th and the 19th Century," *International Journal of Epidemiology* 34:6 (2005): 1435-1436.
- ⁶ C. D. Mathers et al., "Causes of International Increases in Older Age Life Expectancy," *The Lancet* 385:9967 (2015): 540-548.
- ⁷ T. J. Hatton and B. E. Bray, "Long Run Trends in the Heights of European Men, 19th-20th Centuries," *Economics and Human Biology* 8:3 (2010): 405-413.
- ⁸ NCD Risk Factor Collaboration. "A Century of Trends in Adult Human Height," *eLife* 5: e1341.
- ⁹ T. J. Hatton, "How Have Europeans Grown So Tall?" *Oxford Economic Papers* 66:2 (2014): 349-372.
- ¹⁰ Gregori Galofré-Vilà, Andrew Hinde, and Aravinda Guntupalli, "Heights Across the Last 2000 Years in England," *Discussion Papers in Economic and Social History*, 151 (2017).
- ¹¹ Incidentally, the claim still commonly made that there were religious objections against the use of anaesthesia during childbirth seems much exaggerated though not entirely fabricated:
A. D. Farr, "Religious Opposition to Obstetric Anaesthesia: A Myth?" *Annals of Science* 40:2 (1983): 159-177; A. G. McKenzie, "Another Look at Religious Objections to Obstetric Anaesthesia," *International Journal of Obstetric Anaesthesia* 27 (2016): 62-65.

The claim is found, for example in: Charles Foster, *Human Dignity in Bioethics and Law* (Oxford: Hart, 2011); Paul Badham, "A Theological Examination of the Case for Euthanasia," in *Facing Death*.

An Interdisciplinary Approach, eds. Paul Badham and Paul Ballard (Cardiff: University of Wales Press, 1996), 101-116.

¹² Badham, "A Theological Examination" also repeats the accusation that Pope Leo XII opposed vaccination; there is no evidence for this accusation: D. J. Keefe, "Tracking a Footnote," *Fellowship of Catholic Scholars* 9:4 (1986): 6-7.

¹³ Philippa Foot, "The Problem of Abortion and the Doctrine of Double Effect," *Oxford Review* 5 (1967): 5-15; J. D. Greene et al., "Pushing Moral Buttons: The Interaction Between Personal Force and Intention in Moral Judgement," *Cognition* 111:3 (2009): 364-371.

¹⁴ Jesse Graham et al., "Mapping the Moral Domain," *Journal of Personality and Social Psychology* 101:2 (2011): 366-385.

¹⁵ Joseph Bulbulia, Danny Osborne, and Chris G. Sibley, "Moral Foundations Predict Religious Orientations in New Zealand," *PLoS one* 8:12 (2013): e80224; Jesse Graham and Jonathan Haidt, "Beyond Beliefs: Religions Bind Individuals into Moral Communities," *Personality and Social Psychology Review* 14:1 (2010): 140-150.

¹⁶ See for example Leon Kass, "The Wisdom of Repugnance," *The New Republic* 216:22 (1997), 17-26; William I. Miller, *The Anatomy of Disgust* (Cambridge, MA: Harvard University Press, 1997).

¹⁷ Joshua May, "Emotional reactions to human reproductive cloning," *Journal of Medical Ethics* 42:1 (2015): 26-30.

¹⁸ See for example Elliott Sober, "Apportioning causal responsibility," *The Journal of Philosophy* 85:6 (1988): 303-318; Richard C. Lewontin, "The analysis of variance and the analysis of causes," *American Journal of Human Genetics* 26:3 (1974): 400-411; Peter Taylor, "The analysis of variance is an

analysis of causes (of a very circumscribed kind),” *International Journal of Epidemiology* 35:3 (2006): 527-531.

¹⁹ Susan Oyama, “Causal democracy and causal contributions in developmental systems theory,” *Philosophy of Science* 67 (2000): S332-S347; Paul E. Giffiths and Russell D. Gray, “Developmental systems and evolutionary explanation,” *The Journal of Philosophy* 91:6 (1994): 277-304.

²⁰ C. A. J. Coady, “Playing God,” in *Human Enhancement*, eds. Julian Savulescu and Nick Bostrom (Oxford: Oxford University Press, 2009), 155-180.

²¹ David Oderberg, “Towards a Natural Law Critique of Genetic Engineering,” in *Philosophical Reflections on Medical Ethics*, ed. Nafsika Athanassoulis (Basingstoke, UK: Palgrave Macmillan, 2005), p. 113

²² David Oderberg, *Real Essentialism* (Abingdon, UK: Routledge, 2007).

²³ See John P. Lizza, *Persons, Humanity, and the Definition of Death* (Baltimore, MD: The Johns Hopkins University, 2006).

²⁴ See Claire Ainsworth, “Sex Redefined,” *Nature* 518:7539 (2015): 288-291.

²⁵ Jonathan Jong, “What are human beings (that you are mindful of them)?: Notes from neo-Darwinism and neo-Aristotelianism,” in *Issues in Science and Theology: Are We Special? Human Uniqueness in Science and Theology*, eds. Michael Fuller, Dirk Evers, Anne Runehov, and Knut-Willy Sæther, (Cham, CH: Springer, 2017), 79-97.

²⁶ See also Travis Dumsday, “Transhumanism, Theological Anthropology, and Modern Biological Taxonomy,” *Zygon* 52:3 (2017): 601-622; Jonathan Jong and Aku Visala, “Evolutionarily Debunking Arguments Against Theism, Reconsidered,” *International Journal for Philosophy of Religion* 76 (2014): 243-258;

²⁷ E.g., T. D. J. Chappell, *Understanding Human Goods: A Theory of Ethics* (Edinburgh: Edinburgh University Press, 1995); John Finnis, *Natural Law and Natural Rights* (Oxford: Oxford University Press, 1980); Alfonso Gomez-Lobo, *Morality and the Human Goods: An Introduction to Natural Law Ethics* (Washington, DC: Georgetown University Press, 2002); Mark C. Murphy, *Natural Law and Practical Rationality* (Cambridge: Cambridge University Press, 2001).

²⁸ Gerald McKenny, “Biotechnology and the Normative Significance of Human Nature: A Contribution from Theological Anthropology,” *Studies in Christian Ethics* 26:1 (2013): 18-36.

²⁹ John Helliwell, Richard Layard, Jeffrey D. Sachs, eds., *World Happiness Report 2018* (New York: Sustainable Solutions Network, 2018).

³⁰ Ed Diener et al., “The Satisfaction With Life Scale,” *Journal of Personality Assessment* 49:1 (1985): 71-75.