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**Virtue Ethics and the Common Good in Business:
An analysis of the direct to consumer genetic analysis company, 23andMe**

Social media, technology, and the environment are changing at unprecedented speeds, racing ahead of both law and ethical analysis. It is unknown whether laws responding to climate change will be enough or on-time to prevent permanent, irreparable damage. Similarly, technology is being developed faster than regulatory processes can analyze personal and collective security risks such as with deepfakes and Artificial Intelligence. Social media provides a globalized forum for creating networks, that has also been noted for its susceptibility to manipulation as was demonstrated in the 2016 United States Presidential elections. Throughout history, the need for ethics, specifically virtue ethics, has been argued philosophically, structurally, and interpersonally. Sharing the objective to align decisions toward the common good, the legal perspective, composed of laws, policies, processes, procedures, and sanctions, works hand in hand with a moral perspective formed by ethics, virtue, character-building, prizes, and processes that reward good behavior and good example.¹

Virtue ethics combines aspects of utilitarianism and deontology to become a holistic and integrate effort focused on the individual. A guiding question within virtue ethics is “what kind of person do I become performing this action?”² Central theorists within virtue ethics include Aristotle, Alasdair MacIntyre, and Catholic Social Teaching.

¹ Ogunyemi, Kemi and J. Brooke Hamilton, III. “Virtues in corporate legal practice.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.141

² Sison, José G., Ignacio Ferrero and Gregorio Guitián. “Virtues and the common good in business.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.2

Aristotle defines that for human life to achieve its purpose of living well and doing well, there must be a flourishing of *eudaimonia*. Next, MacIntyre establishes the need for fulfilling individual and institutional practices that reinforce the common good.³ Moreover, Catholic Social Teaching emphasizes the common good principle that combines the roots of human dignity with a call for social conditions that allow people to reach their fulfillment.⁴ All three theoretical perspectives call on practical wisdom (*phronesis*) as being central to methodologies of decision making applied throughout human industries such as ethics, economics, business, politics, and social relations.⁵ As individuals, companies, and communities move into the legally grey horizon of the future, virtue ethics will grow in importance as a tool for navigating decisions and calling for accountability. Through the analysis of practical wisdom in corporate governance models for future application, a critique of virtue ethics in business may be developed. Specifically, an introduction to the Direct-to-Consumer (DTC) genetic analysis company, 23andMe, will be presented, followed by a virtue ethic analysis through the lens of production. Additional analysis of the effects of the common good effects of production on marketing, law, and corporate governance will be provided in correlation.

Located in the nexus of Silicon Valley, Mountain View, California, 23andMe was co-founded by Anne Wojcicki and Linda Avery in 2006.⁶ The initial objective of 23andMe was to put sophisticated DNA analysis into the hands of consumers. The name of the company highlights this relationship by focusing on the 23 pairs of chromosomes in the normal human cell and, you, the consumer. This analysis provides insight into health, disease, and ancestry with medical research implications. The process of analysis has

³ Sison, José G., Ignacio Ferrero and Gregorio Guitián. "Virtues and the common good in business." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.13

⁴ Sison, José G., Ignacio Ferrero and Gregorio Guitián. "Virtues and the common good in business." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.10

⁵ Sison, José G. and Matthias P. Hühn. "Practical wisdom in corporate governance." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.165

⁶ Hayden, Erika Check. (11 October 2017) "The rise and fall and rise again of 23andMe." *Nature: International weekly journal of science*. Accessed 26 June 2019. Available at: <https://www.nature.com/news/the-rise-and-fall-and-rise-again-of-23andme-1.22801>

been simple from its start. A consumer signs up to be analyzed and is provided a kit to provide a sample of DNA of saliva. The sample is sent to 23andMe, where it is analyzed over several weeks. Results are provided online. At the beginning of the process, consumers choose whether their DNA sample will be stored with the possibilities of being analyzed again in the future as technology develops. Finally, consumers are continually able to participate in research by answering supplementary questions online.⁷ A leader in direct-to-consumer genetic testing, 23andMe is valued at over \$1billion and has a customer base of 10 million people. From 2006 until 2019, 23andMe has become the largest worldwide genetic study to date. In 2013, the Food and Drug Administration demanded that genetic testing be regulated with specific requests that evidence that the produces worked as advertised and did not harm customers be given. Within a year, the first test achieved FDA approval; however concerns remain throughout the industry. Over 100 scientific articles have been published based on consumers' data.⁸ In 2018, the company the pharmaceutical giant, GlaxoSmithKline, acquired a \$300 million stake in 23andMe underlining a four-year deal between the two companies to combine 23andMe's genetic data with drug development.⁹ In 2019, the objective of 23andMe is clear, in large bold text it states, "[t]he promise of genetics for health and wellness." Below, in a smaller font, the original objective remains, "[h]elping people access, understand and benefit from the human genome." A three-pronged approach to achieve these objectives are presented: Direct-to-consumer genetics, research services, and drug discovery.¹⁰ While it is clear that the drive and resources for genetics-driven drug research are in place, there have not yet been any reported breakthroughs.

⁷ 23andMe. "How it Works." 23andMe. Accessed 26 June 2019. Available at:<https://medical.23andme.com/how-it-works/>

⁸ Geggel, Laura. (28 July 2018) "23andMe is sharing genetic data with drug giant." *Scientific American*. Accessed 26 June 2019. Available at: <https://www.scientificamerican.com/article/23andme-is-sharing-genetic-data-with-drug-giant/>

⁹ Brodwin, Erin. (25 July 2018) "DNA-testing company 23andMe has signed a 300 million deal with a drug giant. Here is how to delete your data if that freaks you out." *Business Insider*. Accessed 26 June 2019. Available at: <https://www.businessinsider.es/dna-testing-delete-your-data-23andme-ancestry-2018-7?r=US&IR=T>

¹⁰ 23andMe. "Home." 23andMe." Accessed 26 June 2019. Available at: <https://medical.23andme.com>

Production is an intentional process to meet human need.¹¹ Aristotle argues that for human beings to be virtuous, they must pursue human excellence, which leads to both happiness and flourishing, (*eudaimonia*).¹² The integrity of the whole object, agent's end intention and resulting circumstances all inform the moral quality of decisions. Within production, these values translate into an awareness of the end results and the means of creation being within control.¹³ Aristotle states that "human production can only be understood as a rational and ethical action if it provides useful things for the good life" further distinguishing that money is not an end, but a means and that the accumulation of wealth as a goal should be condemned.¹⁴ 23andMe presents an ethical question of production that is becoming more common in the technological age. An individual pays to participate in a service. This service generates data that is of value to the individual. The individual cannot monetize this data in any meaningful way for themselves.¹⁵ However, when this data is collected en masse, it produces a new product of significant financial benefit to the holder. In the case of 23andMe, the individual produces a DNA sample, and the company produces an analysis. Initially, it is thought that the value of the company analysis is of the highest value. However, as the database grows, the collection of individual DNA samples become the actual production.

Do the original production of a DNA sample, the companies presentation of sample results, or the collection of an extensive DNA database support human

¹¹ Scalzo, Germán. "Virtues and the common good in production." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.83

¹² Sison, José G., Ignacio Ferrero and Gregorio Guitián. "Virtues and the common good in business." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.2-3

¹³ Scalzo, Germán. "Virtues and the common good in production." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.84

¹⁴ Scalzo, Germán. "Virtues and the common good in production." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.85

¹⁵ Barber, Gregory. (17 Dec 2018) "I sold my data for crypto. Here's how much I made." *Wired*. Accessed 26 June 2019. Available at: <https://www.wired.com/story/i-sold-my-data-for-crypto/>

excellence? The production of the original DNA sample involves spitting in a tube and paying \$99 to \$199. This process appears to be straightforward, however concerns about equity and diversity have presented.¹⁶ Essentially, the database is going to be biased toward middle and upper-income individuals who have the economic resources to spend on at-home genetic research and preventative health care. In this regard, those who produce DNA are entering into space where human excellence is pre-selected. Secondly, the presentation of sample results may be divided into ancestry, family connections, and health and trait results. The FDA called for regulations in 2013, as the company was providing potentially life-altering information, such as risk rates for Alzheimer's, mental illness, and breast cancer, without appropriate approval. The company argued that the information was not diagnostic but informative and educational. However, the FDA disagreed and called for health information to be curtailed.¹⁷ A continued critique of 23andMe is that consumers do not understand, or misinterpret, results as they are based not on diagnosis but probability.¹⁸ Other services, such as ancestry and traits, are of interest and appeal to American genealogists. However, family connections have also raised response as it is a way to learn more about family genetics, but also serves as a sophisticated paternity test.¹⁹ Leading to the conclusion that the product of DNA comes with risks that the company does not mediate. Thirdly, though individual genetic material is used within the collective, the terms of service explicitly state that "you acquire no rights in any research or commercial products that may be developed by 23andMe or its partners."²⁰ Though the

¹⁶ Park, Alice. (21 Oct 2015) "Genetic testing company 23andMe returns to market." *Time*. Accessed 26 June 2019. Available at: <https://time.com/4080583/23andme-dna-genetic-testing/>

¹⁷ Park, Alice. (21 Oct 2015) "Genetic testing company 23andMe returns to market." *Time*. Accessed 26 June 2019. Available at: <https://time.com/4080583/23andme-dna-genetic-testing/>

¹⁸ Vlasits, Anna. (4 Aug 2017) "How 23andMe won back the right to foretell your diseases." *Wired*. Accessed 26 June 2019. Available at; <https://www.wired.com/2017/04/23andme-won-back-right-foretell-diseases/>

¹⁹ Doe, George. (9 Sep 2014) "With genetic testing, I gave my parents the gift of divorce." *Vox*. Accessed 26 June 2019. Available at: <https://www.vox.com/2014/9/9/5975653/with-genetic-testing-i-gave-my-parents-the-gift-of-divorce-23andme>

²⁰ 23andMe. "Terms of Service." 23andMe. Accessed 26 June 2019. Available at: <https://www.23andme.com/about/tos/>

individual is the essential ingredient, the human component has been removed from the final product. There are several critical areas where 23andMe fails to live up to its potential in promoting human flourishing. Specifically, its failure to promote a more diverse database and serve a more equitable community, its user-beware approach to the presentation of individual DNA results, and, finally, its failure to acknowledge the source of DNA production as it embarks on highly influential and potentially lucrative partnerships with pharmaceutical companies. As the company is valued at over \$1billion, it is hard to not interpret these decisions as being created with intention with the end result being the generation of profit. One way to redirect the purpose of the company toward human flourishing could be to acknowledge the human element within the process by refunding the initial analysis fee now that the value of the product has changed from producing individual results to fueling pharmaceutical research. Additionally, profits could be utilized to create a more equitable database.

The marketing of 23andMe plays a central role within production as it helps define what is being sold, what is being consented to by users, and what is ultimately being produced. 23andMe markets itself as selling information about health. This information should support the common good and be virtuous as it may be used to improve a person's well-being and lead to critical genetic research opportunities. However, the lines between what is sold to consumers, consent, and the final product become murky. "Marketing aims to create value for a) customers, b) firms, and c) society through the design, production, distribution, and sale of goods and services."²¹ Marketing also demonstrates the importance of MacIntyre's fundamental ethical principle, practice, by merging technical and moral skills in a continual relationship.²² Specifically, in marketing, he distinguishes between goods that are internal and external to practice. Internal goods create value for customers, partners, and society through the exchange of products and services. Fame, money, and power are the external goods

²¹ Ruiz, P. García and C. Rodríguez Llusma. "Virtues and the common good in marketing." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.107

²² Ruiz, P. García and C. Rodríguez Llusma. "Virtues and the common good in marketing." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.106

that reward practice. The moral challenge is expressed when the external goods are no longer rewards of a healthy internal good practice leading to the sacrifice the ethics.²³

For example, the internal goods of 23andMe appear to be first providing consumers direct access to health information that may have a positive impact on the quality and longevity of their lives, and secondly creating a database from DNA participants to inform research. Initially, the business plan appears to be internally good, and worthy of reward. What is ethically questionable is that 23andMe is engaged in a two-sided business platform. On one side, it is conducting business with the consumer. The consumer provides a saliva sample, self-reported information, web behavior information, financial transaction, signs a contract, and provides informed (research) consent to receive genetic information including a health report and ancestry report. On the other side, 23andMe is marketing the self-reported information, genetic information, and web behavior information to businesses, such as private or public research laboratories. These agencies may be, but are not limited to, producing scientific publications, financial transactions, commercial patents and operating licenses based off the genetic testing, data banking, and biobanking that 23andMe has accumulated.²⁴ The internal good becomes less clear as the more ambiguous motivations of the other business to business market are revealed. Consumers consent to the original business agreement paying to have their personal DNA analyzed and included in research based on evaluating whether the system is internally good. However, as layers of data accumulate to include not only genetic testing but data banking and biobanking with an open market of buyers and unknown ends, moral confidence begins to erode. Specifically, the existence of a dual marketing plan that identifies different value objectives is a critical ethical red flag in the exchange. Virtue ethics practices the integrative alignment of shared values with the customer, firms, and society, so that all levels may flourish; it does not segregate leaving sectors to stagnate.

²³ Ruiz, P. García and C. Rodríguez Llusma. "Virtues and the common good in marketing." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.106-107

²⁴ Stoeklé, Henri-Corto, Marie-France Mamzer-Bruneel, Guillaume Vogt, and Christian Hervé. (31 March 2016) "23andMe: a new two-sided data-banking market model." *BMC Med Ethics*. Accessed 26 June 2019. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4826522/>

One of the main challenges with new technologies is that they move fast, accruing consequences more rapidly than laws can anticipate or respond to risk. The marketing plan of 23andMe has revealed a divergence of production, which is also reflected in legal risk assessment. Aristotle states the legal ideal as being that “societies and firms create laws to balance the common good with the good of individuals in order to achieve *eudaimonia*, human flourishing or fulfillment.”²⁵ Catholic Social Teaching provides a practical component by advocating for an alignment between external and internal goods with an emphasis on human dignity and an attitude of stewardship.²⁶ Increased security risks of having a database of genetic material have been identified. 23andMe states that DNA material and private information is stored separately; however risks of hacking exist and are of increasing concern globally.²⁷

Additionally, as data is provided to second and third parties concerns for privacy escalate. Genetic information is sensitive data and may cause immediate impact and irreparable harm to an individual’s health insurance, relationships, and ability to obtain work. Additionally, law enforcement can request access to DNA databases. In its terms of service, 23andMe states that it will consent and provides a transparency report. Even if someone has elected not to join the database, issues of consent have been raised as the participation of even one family member jeopardizes anonymity. An extreme example of this scenario is the Golden State Killer who was identified by a DNA sample taken from a crime scene that was then matched to relatives within the data search. It is estimated that currently, 60% of white Americans can be identified through DNA, or DNA

²⁵ Ogunyemi, Kemi and J. Brooke Hamilton, III. “Virtues in corporate legal practice.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.143

²⁶ Ogunyemi, Kemi and J. Brooke Hamilton, III. “Virtues in corporate legal practice.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.149

²⁷ Rosenbaum, Eric. (16 June 2018) “5 biggest risks of sharing your DNA with consumer genetic-testing companies.” *CNBC*. Accessed 26 June 2019. Available at: <https://www.cnbc.com/2018/06/16/5-biggest-risks-of-sharing-dna-with-consumer-genetic-testing-companies.html>

proxy.²⁸ The law is intended to provide security, “it protects everyone’s freedom by curtailing each one’s freedom.”²⁹ While some of the unintended effects of a DNA database could be considered positive, such as identifying criminals, others are dangerous, opening society to threats of too much control. The lack of control from start to end along with the dismissal of secondary legal consequences does not embody stewardship of the social community. Likewise, the genuine and severe risk of data falling into unscrupulous hands is a legal crime and works against human dignity.

Just as 23andMe is a two-sided business with dual market objectives, so is it morally divided. There is little doubt that it has and will continue to achieve its stated goals of provided direct to consumer access to genetic information and also using that information for research. This objective curates internal good by providing human data for research to innumerable studies and creating personal awareness of health risks. However, the external goods of profit associated with an alliance with pharmaceutical partnerships call the motives of the company into doubt. If medical breakthroughs are achieved, it is unclear if access to them will be affordable and equitable. The failure to acknowledge the human element fueling the business is concerning, as well as the lack of equity and diversity. The unintended secondary legal effects have far-reaching individual and social security consequences and are not being mediated with the common good in mind. For Aristotle, practical wisdom in corporate governance demonstrates “doing the right thing the right way.”³⁰ While 23andMe might have been founded on the internal principles of doing the right thing, it is no longer clear if it is acting for the common good or financial reward. Is the company producing a product to benefit society, or to increase fame, money, and power? There are several steps that 23andMe may take to be more aligned with the common good. A practice of virtue

²⁸ Kaiser, Jocelyn. (11 Oct 2018) “We will find you: DNA search used to name Golden State Killer can home in on about 60% of white Americans.” *Science Mag*. Accessed 26 June 2019. Available at: <https://www.sciencemag.org/news/2018/10/we-will-find-you-dna-search-used-nab-golden-state-killer-can-home-about-60-white>

²⁹ Ogunyemi, Kemi and J. Brooke Hamilton, III. “Virtues in corporate legal practice.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.141

³⁰ Sison, José G. and Matthias P. Hühn. “Practical wisdom in corporate governance.” *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.168

ethics must be integrated into the company's production method. As consumers are part of the company, respect to their human element must continually be given, and concern for equity and diversity addressed. Additionally, a unified marketing plan aligning virtues with internal and external goods is essential. Finally, the presence of unintended legal impacts implies a failure of choice—in both method and end. Practical wisdom finds growth, not limitations, in the practices of moral virtue, normatively beyond mere rule-following, inclusiveness, and accountability.³¹ A cornerstone question for individuals, communities, society, and 23andMe being: Are the people we become through these actions, who we want to be?

³¹ Sison, José G. and Matthias P. Hühn. "Practical wisdom in corporate governance." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.166-167

Work Cited

23andMe. "Home." 23andMe." Accessed 26 June 2019. Available at: <https://medical.23andme.com>

23andMe. "How it Works." 23andMe. Accessed 26 June 2019. Available at: <https://medical.23andme.com/how-it-works/>

23andMe. "Terms of Service." 23andMe. Accessed 26 June 2019. Available at: <https://www.23andme.com/about/tos/>

Barber, Gregory. (17 Dec 2018) "I sold my data for crypto. Here's how much I made." *Wired*. Accessed 26 June 2019. Available at: <https://www.wired.com/story/i-sold-my-data-for-crypto/>

Brodwin, Erin. (25 July 2018) "DNA-testing company 23andMe has signed a 300 million deal with a drug giant. Here is how to delete your data if that freaks you out." *Business Insider*. Accessed 26 June 2019. Available at: <https://www.businessinsider.es/dna-testing-delete-your-data-23andme-ancestry-2018-7?r=US&IR=T>

Doe, George. (9 Sep 2014) "With genetic testing, I gave my parents the gift of divorce." *Vox*. Accessed 26 June 2019. Available at: <https://www.vox.com/2014/9/9/5975653/with-genetic-testing-i-gave-my-parents-the-gift-of-divorce-23andme>

Hayden, Erika Check. (11 October 2017) "The rise and fall and rise again of 23andMe." *Nature: International weekly journal of science*. Accessed 26 June 2019. Available at: <https://www.nature.com/news/the-rise-and-fall-and-rise-again-of-23andme-1.22801>

Kaiser, Jocelyn. (11 Oct 2018) "We will find you: DNA search used to name Golden State Killer can home in on about 60% of white Americans." *Science Mag*. Accessed 26 June 2019. Available at: <https://www.sciencemag.org/news/2018/10/we-will-find-you-dna-search-used-nab-golden-state-killer-can-home-about-60-white>

Ogunyemi, Kemi and J. Brooke Hamilton, III. "Virtues in corporate legal practice." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.141

Park, Alice. (21 Oct 2015) "Genetic testing company 23andMe returns to market." *Time*. Accessed 26 June 2019. Available at: <https://time.com/4080583/23andme-dna-genetic-testing/>

Rosenbaum, Eric. (16 June 2018) "5 biggest risks of sharing your DNA with consumer genetic-testing companies." *CNBC*. Accessed 26 June 2019. Available at: <https://www.cnbc.com/2018/06/16/5-biggest-risks-of-sharing-dna-with-consumer-genetic-testing-companies.html>

Ruiz, P. García and C. Rodríguez Llusma. "Virtues and the common good in marketing." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.107

Scalzo, Germán. "Virtues and the common good in production." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.83

Sison, José G., Ignacio Ferrero and Gregorio Guitián. " Virtues and the common good in business." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.2

Sison, José G. and Matthias P. Hühn. " Practical wisdom in corporate governance." *Business Ethics: A Virtue Ethics and Common Good Approach*. Edited by José G. Sison, Ignacio Ferrero and Gregorio Guitián. Routledge: New York, 2018. p.165

Stoeklé, Henri-Corto, Marie-France Mamzer-Bruneel, Guillaume Vogt, and Christian Hervé. (31 March 2016) "23andMe: a new two-sided data-banking market model." *BMC Med Ethics*. Accessed 26 June 2019. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4826522/>

Vlasits, Anna. (4 Aug 2017) "How 23andMe won back the right to foretell your diseases." *Wired*. Accessed 26 June 2019. Available at; <https://www.wired.com/2017/04/23andme-won-back-right-foretell-diseases/>