

Carl Zimmer

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Margaret Flinter: Welcome to Conversations on Health Care with Mark Masselli and Margaret Flinter, a show where we speak to the top thought leaders in health innovation, health policy, and the great minds who are shaping the health care of the future. This week, Mark and Margaret speak with Carl Zimmer, multi-award-winning science writer and columnist for The New York Times, whose most recent book was selected by Publishers Weekly as one of the 10 best for 2018, *She Has Her Mother's Laugh: The Powers, Perversions, and Potentials of Heredity*, where he examines a scientific revolution underway with genomics and how to harness this emerging science to not only understand our origins, but also advance, or else.

Lori Robertson also checks in, the managing editor of FactCheck.org, looks at misstatements spoken about health policy in the public domain, separating the fake from the facts.

We end with a bright idea that's improving health and well-being in everyday lives. If you have comments, please email us at chcradio@chc1.com or find us on Facebook, or Twitter, iTunes, or wherever you listen to podcasts. You can also hear us by asking Alexa to play the program, Conversations on Health Care.

Now, stay tuned for our interview with New York Times science writer, Carl Zimmer, here on Conversations on Health Care.

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Mark Masselli: We're speaking today with Carl Zimmer, science columnist and author of numerous books, including his latest, *She Has Her Mother's Laugh: The Powers, Perversions, and Potentials of Heredity*, which has been selected as one of the top 10 books for 2018 by Publishers Weekly. Mr. Zimmer has written on science topics for The New York Times since 2004, including the popular column, *Matter*.

Prior to joining the Times, he was a science writer and senior editor at Discover and has written for numerous other publications, including the National Geographic, Wired, The Atlantic, Time, and STAT. He is an adjunct professor in the School of Biophysics and Biochemistry at Yale. Mr. Zimmer has won numerous awards, including a three-time winner of the American Association for the Advancement of Science Journalism Award and the National Academies of Science Communication Award.

Carl, welcome to Conversations on Health Care.

Carl Zimmer: Thanks for having me.

Mark Masselli: Yeah. You've written extensively about the world of science for a

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couple of decades with a focus on evolutionary science, genomics, and DNA. In your most recent book, *She Has Her Mother's Laugh*, you examine this explosion of knowledge that's under way and our fundamental understanding of the impact of DNA on heredity, and how we're learning so much from the genomics world.

I'm wondering if you could share with our listeners how some of those more recent scientific breakthroughs are revolutionizing our thinking about heredity and why this shift compelled you to write this book.

Carl Zimmer:

Yeah. It's been kind of astonishing to see how much things have changed really, even in just the past few years. When I started out in the 1990s as a journalist, the idea of sequencing one human genome was rare. Now, it's possible to sequence a human genome for maybe \$1,000. You can do what's called genotyping from a place like 23andMe for maybe \$100. All of a sudden, we're just swimming in data about our genes.

Scientists can really look gene by gene, mutation by mutation that exactly how we inherit genes from our ancestors. We're even finding other kinds of heredity. For example, you can inherit your genes from more than one person. Many people are actually [inaudible 00:03:41] where these are made up of a mixture of cells from different individuals that might be a twin and those cells are traded before birth. Mothers can actually absorb a fetal cell, which actually becomes incorporated into their bodies. They don't just have their children in their thoughts. They have their children's cells in their brain. Heredity is just becoming a lot more interesting now.

Margaret Flinter:

Well, you say so clearly that the accessibility of the information with the price of personal genomic testing coming way down, as you said, through entities like Ancestry.com or 23andMe, and others. You also talk about your own experience of having your whole genome sequenced and say that it led to more questions than answers in your case.

Share with us what you learned from that experience, but also what sort of recommendations and cautions you would offer to people who are interested in gaining access to their own genomic profiles.

Carl Zimmer:

When you go to a company like 23andMe or Ancestry, what they do is something called genotyping, where basically they look at about 1000 of the genetic letters in your DNA of the kinds of genetic variants that you have. If you want to really get the full picture, you do something what's called whole genome sequencing. That's not really a consumer product yet. I do various tricks and twists that I talk about in my book with able to actually get hold of my whole genome. One day, a external hard drive with 60 gigabits of data shows up on my front doorstep. I've got it. It's amazing. Of course, if I plug that into my

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computer, what I'm looking at is a gigantic spreadsheet, which means nothing to me.

What I did was then went to different scientists who have different areas of expertise and said, you study genomes. What can you see in my genome? I would say that, I'm not particularly unusual, when it comes to my genome, but it is fascinating to really dig into a big piece of DNA that is yours. Yet there are a lot of questions that you end up asking, maybe more questions than answers.

Mark Masselli:

You've launched a very interesting series of partnerships with the online health publication, STAT. You called it Game of Genomes, catchy title, in which you, as you said to us, take my Petri dish of data and explore it to this whole group of scientists. You shared that process in an award-winning series that help explain more fully your specific genomic traits. Tell us what perhaps the public needs to understand about genetic research and also its implications in their lives.

Carl Zimmer:

It can be an amazing experience, but you have to recognize that the science is very young. It's not like there's like some complete catalog of revealed truth that's just waiting for you. Scientists are just starting to figure this stuff out. A lot of this research takes a huge amount of time. Just going through the 3 billion or so base pairs in one person's DNA is a gigantic labor. For example, I have roughly 1%, 1.5% Neanderthal DNA. I was actually able to look at a complete catalog of my Neanderthal genes.

Then the next thing I'd do is I'd say, okay, well, what does that gene do? Well, nobody knows. If you're curious about what are the Neanderthal genes that are sprinkled throughout your chromosomes, these are programs that these scientists are using on their computers that they wrote themselves, and they're just sort of like hacking together.

There's not some great big computer where all this data comes out of. It turns out that there are a lot of mutations that you can find in your genome where scientists can say, well, if I look at that mutation, I have a pretty good feeling that that is going to actually have a real change to one of your proteins. I don't know if that's harmless. It could be even beneficial. We don't know. There are certain mutations that are very strongly linked to certain diseases and then there's a gigantic twilight zone.

Margaret Flinter:

Well, Carl, one thing that really is fascinating to me is that the more that you've researched this topic, the more you've discovered that nurture seems to have a powerful impact on gene expression and heredity. We've had some guests on the show, Mark, talking about this topic. I remember Dr. Donald Warne at the University of North

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Dakota talking so compellingly about the epigenetic impact of cultural trauma, Native American people, and how that's affected multiple generations.

Then we had Stanford's Dr. Raj Chetty on the show, discussing his research on how one Zip Code impacts health outcomes maybe more than the individual's genetic code. You've been analyzing this nature versus nurture paradox as well. Tell us what insights and conclusions you have about this.

Carl Zimmer:

We've been trying to think about nature and nurture for a long, long time. Actually Shakespeare uses those words in one of his plays. This isn't something that's new. What is new is that we can really tease apart these different contributions. We can say, well, just how much does it matter where you are born geographically in terms of the social conditions that you are experiencing? How much does it depend on particular genes that you inherit? Certainly, like geneticists cannot blind themselves to the power of these social factors. If people are in a very hard, challenging environment growing up, why is it that some people are resilient and some are not?

There may be an answer in the different genes that people carry. There isn't any sort of clean line that you can divide really between nature and nurture because the way your genes work often is controlled by the environment. Likewise, your genes may actually cause you to seek out different environments to shape the environment around you. We can't think about it in sort of an either/or thing.

Mark Masselli:

We're speaking with Carl Zimmer, multiple award-winning science writer and author of numerous books, including his latest, *She Has Her Mother's Laugh: The Powers, Perversions, and Potentials of Heredity*.

Carl, I can't help, but think that if we're having a conversation about genome that we don't want to talk about CRISPR technology and its impact on our sort of general landscape. I'm wondering what your thought is about this type of gene editing process that has a wide variety of applications, including use in some basic biology research tools. How do you think that's going to change or revolutionize how we think about curing diseases and our sort of own mortality?

Carl Zimmer:

Well, what I'm most excited by are some trials that are actually starting literally right now where scientists want to use this technology for editing DNA to treat, maybe even cure, inherited diseases that until now have had no good treatment at all. Sickle cell anemia is a case in point. It's an inherited disease. It's the result of mutations in genes for hemoglobin. There are treatments that people can get that can extend their lives, but still today people are living into

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their 40s and 50s at most on average. These diseases cause a huge amount of pain and suffering along the way.

Mark Masselli: It's a single gene mutation, right, sickle cell?

Carl Zimmer: That's right. If you have a mutation on both copies of this gene, you're going to get this disease. What scientists are exploring now in a clinical trial is using this technology, CRISPR, to create molecules that can go into cells and can cut out a little piece of DNA, to alter that tiny little bit of DNA very precisely. What's going to happen is that these cells are going to be able to start making healthy hemoglobin again because their DNA has been altered.

Now it's a completely up in question whether this is going to work or not, that devil's in the details, and these sorts of things, but these clinical trials are starting lots of experiments on mice with diseases like muscular dystrophy and so on suggested this could work. I think this is a really potentially revolutionary treatment.

Now, what gets people really riled up is not what I just talked about. What gets people riled up is the idea of using this on human embryos because if you do that, then that person who develops from that embryo is going to have that engineering and every one of their cells then will pass that down to future generations. I think that's a separate discussion that we do need to have. I think that what you've seen from a lot of atheists [PH 00:12:56] and scientists have talked about this is we really should not even be talking about this kind of procedure, except for things for which there's no other alternative. It would really only be an incredibly rare set of circumstances where you could medically justify this sort of approach on embryos.

That being said, I'm sure there would be some parents who would love to use it to make their kids taller, to change their appearance, to give them genes that they've been told will make their kids more successful. We really have to withstand that seduction.

Margaret Flinter: Well, Carl, that's in many ways a great segue into the next question, and that is, given this phenomenal world-changing set of tools and soon to be increasingly at our disposal, what's the best way to think about getting ready to teach and prepare the next generation of clinicians in health care, so they're ready to adapt to all of this evolving scientific discovery that's going to lead to better ways to treat and manage, and diagnose maybe, even prevent the onset of disease?

You've written some important textbooks in science education. What do you think about preparing our clinical workforce for the future, which increasingly in our health and health care is going to be moving more towards genomic space personalized medicine?

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Carl Zimmer: I do think that clinicians just really have to practically start over with their education because so much has changed so quickly. The patients are going to be coming to doctors with results they're getting from direct to consumer services as customers, and they're going to say, look, 23andMe says I have this. What are you going to do about it?

Margaret Flinter: Yeah, they already are.

Carl Zimmer: Yeah, exactly. You need to learn how to talk about, for example, risk. What does it mean to have a variant that raises your risk of a disease? There's a big difference between a mutation that guarantees you're going to get Huntington's disease and a mutation that's slightly on average increases the risk of heart disease. Yet it's hard for people to recognize it. If it's there on the report, they think it's all the same. At the same time, I think that clinicians are going to have to really get to understand lots of very common diseases are influenced by hundreds or thousands of different genes. That can sound like a nightmare if you're trying to look at each and every gene.

There are these approaches, known as polygenic risk scores that are going to be coming more and more into practice, where you'll sequence a patient's whole genome and then come up with a score, which then translates to a real different kind of risk depending on what category you're in. Actually with heart disease, this has already been demonstrated pretty effectively in just some recent papers from Harvard Medical School.

What scientists are starting to do is develop a way to look across the entire genome at lots and lots of different variants and figure out how do they add up in each person to a risk for a particular disease. Scientists that are in medical school have been pioneering this with heart disease. Their scores are pretty impressive now. If you divide people up, they have very different risk profiles, and these scores do a good job of predicting how many people in each category are going to get a heart attack or not. This stuff is coming really fast. It's going to be a communication challenge. It's also going to be just a learning challenge.

Mark Masselli: It's interesting. I think your book sort of talks about this hopeful promise, but also this cautionary tale about science and how it could be misused and advance certain agendas. On the other side of the equation, you've got people who are talking about anti-vaxxers, the climate change deniers.

Just sort of a larger question of what is it going to take to bring science back to its proper place in our political discourse? I think you understand the fundamentals of science are important for this in some way should be a settled matter that we have some faith and trust in science. Yet it seems that we have extremes as well. Thoughts

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about that?

Carl Zimmer: Well, certainly within medicine and beyond, pretty much every major improvement in human welfare had something to do with scientific research and discovering things through science. I do think that people do have a great respect still for scientists and for doctors, and so on, but there are these certain areas where people will want to reject the findings of science because it somehow feels like a challenge to how they identify themselves or the way they look at the world. I think we all have to sort of recognize our own biases and to learn how the scientific process actually works, and how science is an ongoing process.

In that way, we can make sure that with genetics, for example, that it doesn't end up being used for justifying racism or other really noxious kinds of ideologies. It's happened in the past. Unfortunately, some scientists themselves have been part of the problem. I think we have to be very clear in terms of education and in our own experiences and conversations to recognize what science really is and the benefits that it can give us.

Margaret Flinter: We've been speaking today with Carl Zimmer, multiple award-winning science writer, longtime columnist for The New York Times, and the author of *She Has Her Mother's Laugh: The Powers, Perversions, and Potentials of Heredity*, which was just selected as one of Publishers Weekly's best 10 books for 2018. You can learn more about his work by going through his website, carlzimmer.com or follow him on twitter @carlzimmer.

Carl, thank you so much for your prolific body of work, for sharing your rich insights, and making it understandable to the general population, and for joining us on Conversations on Health Care today.

Carl Zimmer: Thank you. It's been a pleasure.

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Mark Masselli: At Conversations on Health Care, we want our audience to be truly in the know when it comes to the facts about health care reform and policy. Lori Robertson is an award-winning journalist and managing editor of FactCheck.org, a nonpartisan, nonprofit consumer advocate for voters that aim to reduce the level of deception in U.S. politics.

Lori, what have you got for us this week?

Lori Robertson: In several of his midterm campaign rallies, President Donald Trump has made false and unsupported claims about the right-to-try law he signed on May 30th. He claims that until he signed the law, "we couldn't even come close" to letting terminally ill patients use promising, but unapproved medications. In fact, the FDA for years has

approved applications from patients seeking access to investigational drugs.

Trump also claims there have been tremendous and incredible results already under the months' old federal law, but we could find no evidence that any drug manufacturers have granted access to any medications under the new law. The President made these claims in Texas, Pennsylvania, and Kentucky.

The right-to-try legislation aims to circumvent the FDA and give terminally ill patients access to unapproved drugs more quickly than through the FDA's Expanded Access Program. FDA Commissioner, Dr. Scott Gottlieb, testified to Congress in October 2017 that the FDA had approved 99% of the more than 1,000 annual applications it gets for such access.

Under either the FDA's Expanded Access Program or the new federal right-to-try law, patients along with their physicians can request access to drugs that haven't yet been approved by the FDA directly from manufacturers if there are no comparable treatments. Under right-to-try, which applies only to drugs, there's no FDA or IRB oversight. In both processes, the drug manufacturer decides whether or not it wants to make the drug available.

The right-to-try law is nearly five months old, which isn't a lot of time to see incredible results as the President claims. We asked the FDA, the Goldwater Institute, and an expert on preapproval access to treatments whether any drug companies have granted access to drugs under the new law. They knew of no such instances. We asked the White House Press Office about the President's claim, but did not receive a response.

That's my fact check for this week. I'm Lori Robertson, managing editor of FactCheck.org.

Margaret Flinter: FactCheck.org is committed to factual accuracy from the country's major political players and is a project of the Annenberg Public Policy Center at the University of Pennsylvania. If you have a fact that you'd like checked, email us at chcradio.com. We'll have FactCheck.org's Lori Robertson check it out for you here on Conversations on Health Care.

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Margaret Flinter: Each week, Conversations highlights a bright idea about how to make wellness a part of our communities and everyday lives. Health care providers are forever on the lookout for that magic elixir that can cure a host of chronic ills in one step. In the case of obesity, depression, anxiety, and stress, that elixir could be a number of steps as in taking a hike.

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A large study conducted by several institutions, including the University of Michigan and Edge Hill University in the UK, looked at the medicinal benefits derived from regular group hikes conducted in nature. Researchers evaluated some 2,000 participants in a program, called Walking for Health in England, which sponsors some 3,000 walks per week across the country.

Dr. Sara Warber: This is a national study in the UK. There was investment in these walking groups in training leaders to take people on walks, finding trails that were good for people to do even if they had health problems.

Margaret Flinter: Dr. Sara Warber, professor of family medicine at the University of Michigan, School of Medicine, said this study showed a dramatic improvement in the mental well-being of participants, especially those who had recently experienced something stressful, like the loss of a loved one or a serious illness.

Dr. Sara Warber: Depression was reduced. Perceived stress was reduced. People had, they experienced more positive feelings or positive emotions. There's been a really lovely research that's shown that when we have positive emotions, we actually have better health in the long run. Our control group of people at one time intended to be part of walking groups, but they never took up the practice. We could see how they deferred overtime.

Margaret Flinter: Other studies have shown a link between mood and exercise, but Dr. Warber says this is the first study that revealed the added benefits of group hikes in nature and significant mitigation of depression.

Dr. Sara Warber: Because we're really interested in whether if you are more stressed, would you get some better benefit from being in nature. In fact, that did pan out.

Margaret Flinter: A simple guided group nature hike program, which incentivizes folks suffering from depression and anxiety to step into the fresh air with others, improving their mood, reducing their depression, increasing their overall health at the same time, now that's a bright idea.

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Mark Masselli: You've been listening to Conversations on Health Care. I'm Mark Masselli.

Margaret Flinter: I'm Margaret Flinter.

Mark Masselli: Peace and health.

Margaret Flinter: Conversations on Health Care is recorded at WESU at Wesleyan University, streaming live at chcradio.com, iTunes, or wherever you listen to podcasts. If you have comments, please email us at

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