Science AMA Series: We are Gonçalo Abecasis and Scott Vrieze, researchers leading Genes for Good, a large scale study of genes, health and behavior taking place on Facebook. Ask us and our team anything!

$Genes_{f}or_{G}ood^{1}andr/ScienceAMAs^{1}$

[1]Affiliation not available

April 17, 2023

Abstract

Hello, Reddit! We are: Gonçalo Abecasis, professor of Biostatistics at the University of Michigan's Center for Statistical Genetics (UM / CSG) Scott Vrieze, professor of Psychology & Neuroscience at the University of Colorado's Institute for Behavioral Genetics Chris Clark and Kevin Wei Li, web application programmers at UM / CSG Gregory Zajac and Katharine Brieger, graduate student research assistants at UM / CSG Ellen Schmidt and Anita Pandit, research area specialists at UM / CSG We use genetics to understand human health and disease and spend our lives analyzing genomic data and developing tools to make these analyses more informative. Tackling some of the big challenges in human genetics and genomics requires engaging 100,000s of volunteers and collecting rich information about their health, behavior and environment. Last year, we launched Genes for Good, a study of genes, health and behavior through a Facebook app. Volunteers complete health history surveys, daily health tracking surveys, and behavioral tasks. After providing a base level of information, we ship a free spit kit to participants to collect a DNA sample. Results, including summaries of survey results, raw genotypes and ancestry information, are freely shared with participants. To date, over 12,000 people have used our Facebook app, completing over 500,000 health history surveys and trackers. Data stripped of information such as names and addresses are shared with other scientists to ensure the information is used to the greatest extent possible to understand links between genes and health. Believe it or not, this is actually a relatively new way of approaching medical research! You can read more about the study on the Genes for Good informational website or join the study here. It's free and all you need is a Facebook account! We're here from at least 1pm-3pm EDT (10 am PST, 6 pm UTC) to answer questions about the study and about the future of genomic research in general! Ask us anything!

the WINNOWER

REDDIT

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GENES_FOR_GOOD R/SCIENCE

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Hi and thank you for doing this AMA. Two questions for you:

1. Can you expand on what information you provide to your study participants who submit DNA samples. It looks like you give ancestry information (pretty straightforward) and raw genotypes (what does this mean). Hypothetically, if someone was a carrier for a BRCA1 allele that is associate with breast cancer or a PSEN1 allele associated with Alzheimer's disease - would you alert them to this risk factor? Why or why not? It seems to me like there would be a moral imperative to do so.

2. What sort of liability do researchers face in the event that their encryption processes fail, and hackers steal information from the study? I'm not a particularly malevolent person (I don't think), but I can imagine a number of ways in which study participants could be hurt by such a data breach.

Genes_for_Good , r/Science , Science AMA Series: We are Gonçalo Abecasis and Scott Vrieze, researchers leading Genes for Good, a large scale study of genes, health and behavior taking place on Facebook. Ask us and our team anything!, *The Winnower* 3:e146737.73852 , 2016 , DOI: 10.15200/winn.146737.73852

SirT6

Hi,

These are good questions!

Let me tackle the second one first. ... I think the answer has two parts. When you share information with a research study, or anybody else, there are some risk -- particularly, it is possible that the information could leak and that hackers and other bad actors would try to get it. We can't guarantee that won't happen, but think that the benefits of helping science and humankind outweigh the risks. That said, when you participate in research and sign a consent form, you don't waive any legal rights. If researchers are actively reckless or do things that go against the consent with your data, you should hold them accountable.

In terms of return of information, your question is very common. Basically, we return the raw genetic information and ancestry. If we know about your BRCA1 or PSEN1 genotypes, the data would be there. There is a case to be made that we should flag observations that might be especially relevant or to which you should pay further attention, but -- in the current US regulatory framework -- it is not clear that research studies are allowed to this. In fact, just soon after we launched, we had a lengthy conversation with the FDA ... but that is for another day.

Hi Team! Thanks so much for doing an AMA! I have two questions:

How reliable are self reported health histories via social media? Do you have to deal much with trolls/lying/misremembering?

One advantage of facebook is all the family history information that people delineate- is that something you are able to capture to build genealogies/pedigrees and even family health histories?

p1percub

Reliability and validity of self-report is certainly important, and something we've evaluated carefully. The short answer is that we've really been pleasantly surprised with the quality of the self-report data we've collected. We can check this because some of the questionnaires have built-in reliability checks. For example, we expect certain patterns of responses to the personality survey -- in psychometric speak, we expect a factor analysis to return a five factor solution consistent with the Big Five model of personality. And this is exactly what we get. We also see expected population-level relationships between measures. For example, we see the expected relationship between BMI and type 2 diabetes consistent with large-scale representative studies. There are other checks we use to make sure any individual participant's responses look good. Of course, we can't perfectly ensure that everyone is responding honestly but, given the wide variety of checks we've run so far, the data generally look good, which we see as a testament to the participants!

While Facebook can't see what you do in the Genes for Good app (they don't have any access to information one provides or sees in the app), it turns out that one benefit of using them to present our app is that Facebook already works really hard to ensure that Facebook users are real people. Since one must be a Facebook user in order to participate in Genes for Good, this means that most prospective participants are also real people!

At this time we do not request that participants provide any Facebook-related information to our app other than what Facebook requires of all apps (e.g., public profile). In the future, and of course with the consent of each participant, we may ask that they provide the study more Facebook-related information such as family members and friends. Of course, this would be totally voluntary and we would present participants with the risks and benefits of doing so.

Hope that clarifies, and thanks again for the question!

I saw a documentary that a lab in China was doing the same thing, but with kids, to research if the level of IQ has anything to do with genetics. They were trying to use those genes to "create" more intelligent humans.

Can you eli5 what could this bring to the table for health research scientists?

le0nicolas

Hi,

I didn't see the documentary. But, a lot of the reasons people do genetics of different attributes and behaviors is not necessarily out of a desire to modify those attributes and behaviors.

Genetics provides a general tool to connect things we observe at the level of organisms (e.g. obesity, blood pressure, blindness in the elderly) to detailed molecular mechanisms (e.g. molecular messengers in the brain, sodium channels, immune defense mechanisms).

In the context of our study, each survey is completely optional and participants get influence what happens with their data by deciding which ones to answer or not.

Thanks!

PS. I had to look up what eli5 means. New to reddit!!

Can you talk about the ethical implications of trying to find correlations between genetics and behavior? I haven't looked up what behaviors you're testing for, but clearly there are some racial stereotypes out there that are at least a touchy subject.

For example let's say you find a gene for being thrifty and that gene is found to be abundant in some population- would this open the door to justify making more negative sweeping assumptions about some groups of people?

puntloos

Whoa! This is a big and very important question! Thanks for asking it.

Issues of behavior, race, and genes are a controversial subject, to say the least. One problem in our view is that some research on these issues, or interpretation of such research, is highly simplistic and prone to misinterpretation. In fact, studying racial differences is extremely complex because genetic variation (or the DNA differences between people) is different between different races, but so are myriad other factors, such as socioeconomic status, for example. But it doesn't break out perfectly by race, by any stretch of the imagination, which has led geneticists to use concepts like "genetic ancestry" (incidentally, ancestry information is something we provide to our participants who provide DNA samples!), which is related to but different from socially constructed concepts of race. To give a concrete example, in the United States African American is considered (by the US Census at least!) as a racial category. But as population geneticists know, there is more genetic variation among sub-Saharan African individuals than there is in the rest of the world *combined!* So having a single category of "African-American" kind of doesn't make much sense from a genetics perspective.

Second, genetic ancestry (or race, for that matter), at least in the U.S. is related to differences in genetic variation, but also to differences in social/educational/occupational opportunity, nutrition, healthcare, justice system, etc., often in ways that are discriminatory. So any study of group differences

between two races (or ancestries) is totally confounded between genetic and environmental influences on behavior. Parsing which of these effects is important, or most important, is extremely difficult (hence, some of the poor research mentioned above!) This is why genetic research is often done within a particular ancestry (e.g., conduct a study only on East Asians, or only on Europeans).

Third, it is very important--crucial, in fact--to understand that the individual effect on behavior of any particular gene, or genetic variant, is tiny. So small that you can't even detect that it results in behavioral differences among individuals unless you have sample sizes of hundreds of thousands of individuals. What does that mean? It means that even if there were a genetic variant discovered that is associated with "thriftyness" (to use your example), it would only make an individual, maybe, .002% more thrifty... hardly a major influence!

-Scott

Epidemiologist here,

How has your experience been with using Facebook to recruit participants? I've done some work looking at case control recruitment and I see/believe that with the basic demographic data on Facebook and it's widespread use, it could be a viable vehicle for future control selection.

Your thoughts as well about sharing the individual level data with the participants. I know many times with generic studies these results are not shared for various reasons, some of which other comments have touched upon.

syuusuke42

Hi,

We have had a really good experience engaging people on Facebook. We have been able to engage participants across all US states and volunteers seem to be a rather diverse bunch (certainly much more diverse than we'd be able to engage if we recruited only locally in Ann Arbor, Michigan!).

The data we collect generally seems high-quality -- we can reproduce expected epidemiological trends (say, the link between obesity and diabetes, smoking versus heart disease, etc) and also genetic association signals. So we think that our volunteers are providing really good data (if you are one and are reading, thanks!!)

We think it is really important to share data with participants. They were kind enough to volunteer and they have been superhelpful with suggestions on research directions, data wrinkles, and the like.

Do you charge academic researchers to access the information obtained from your study? What about pharmaceutical companies?

It looks like your study uses some version of open consent. But isn't it a bit difficult to ask participants to consent to all future uses that may emerge for this data? How do you screen requests to access the data?

QueenofDrogo

Hi,

We don't charge academic researchers to access the information we are obtaining. That is the general standard in our genetics committee -- most of the best studies out there share data, and there is lots of value that comes from combining and remixing data across studies.

It's true that we are asking for consent to use the information participants provide in quite general ways -- basically, to help advance knowledge of genetics and health. On the other hand, compared to other research studies, the risks are relatively limited. For example, the risks associated with data sharing are quite different from those in serving as a test case for a new medicine or clinical intervention.

One other important point is that each survey is optional. If there is some data that a participant is not comfortable sharing, they can choose other surveys or parts of the study to engage.

Thanks for the questions!

Thanks for the AMA! This study could serve as a model for broader-reaching studies targeting larger geographical areas and more samples at low cost. Very interesting model!

I'm curious about the process for creating surveys. It seems like once you have genetic data for a participant you might as well collect as many phenotypes as possible. How do you decide what to target? And how are you going about validating the survey answers?

foodisfood

Hi,

We have been basing surveys on validated instruments out there and sometimes taken suggestions from other scientists or other researchers.

Validation of the instruments is a big question. As a starting point, we have been trying to see if we can reproduce previously reported genetic and epidemiological relationships. We have been pretty happy so far.

Thanks!

Have you received much feedback about what people have done with the returned genetic data? Does it seem like people have a reasonable understanding of what the information they're getting back means?

StupidName2010

This is a great question!

We feel strongly that participants deserve to have their own data given back to them, but certainly with data as large and complex as genetic data files, we know that not everyone is able to use and interpret the results easily. One of the things we hope is that people who join the study will be excited about the idea of learning how to interact with genetic data to a greater degree. While we can't give any interpretation of disease risk, it is certainly possible for people with the technical know-how to look at specific sites to see which variant they have. We are still working on developing new tools that would make it easier to visualize certain parts of the genome for people who want to be able to go in looking for particular sites. This is a topic we talk a lot about and are curious to hear more from our participants about what they do with their returned results.

Hello,

Thanks for doing this AMA. I've got two questions for you all.

1. From your website, it seems like you will be using an exome chip to genotype everyone. A good

number of these exome variants are population specific. How applicable will this analysis be for people of different backgrounds that you will reach through a global social network like Facebook?

2. What is your process for getting informed consent? How do you make sure that people really understand what they are signing up for and not just clicking accept?

Thanks!

cantgrowaneckbeard

Hi,

The exome chip, like most other genetic instruments, has a bit of a blind spot in non-European ancestry individuals. That is because the vast majority of currently available genetic data is from European ancestry individuals.

We have been working to improve the analysis that are possible in non-European samples (for example, some of us helped organize the 1000 genomes consortium, which studied individuals across the world). Also, if funding allows, we would love to go back and analyze each DNA sample in greater detail.

We are using a HumanCoreExome chip that contains rare exome variants like you described, but the array also contains tagging variants that are shared between populations. These variants in particular are designed to be informative of underlying haplotypes and also help us to impute variants that are not on the array. This allows us to study genetic associations in the whole genome, which will help capture the global extend of genetic diversity better.

For consent, we have an initial consent that we tried to make really readable and easy to follow. We have a follow-up more intrusive discussion of risks and benefits that we ask participants to work through before receiving genetic data.

Goncalo

Are there specific traits that you are hoping to study? Some things would be pretty easy to measure like height and weight, I bet, while others would be hard to get from a general health history. Are you going to study the genetics of social behaviors on facebook? For example I've read that you can tell people are more or less depressed based on the way they interact with the site?

timeforathrowawayact

We want to do the genetics of everything!

But, honestly, one of the more exciting things that a platform like Facebook enables is the ability to interact with participants regularly and collect information about diet, sleep, exercise and other regularly changing behaviors. In traditional studies, it is very hard to collect this sort of information in a single interaction with participants.

We keep current lists of all our health history and health tracking surveys on our website.

To what extent is geography of participants considered? If none, consider coarsening the data to ensure privacy and perhaps work with a GIS scientist, like me. ;)

chucksutherland

We have relatively coarse on information on geography, but we do have participants from all over the

US.

Here is a summary from the day we reached 5,000 participants... Participant Map

We obviously would be very happy to hear about how GIS scientists like you might use the data to help us understand genetics, health and disease!

What type of "health and behavior" questions you ask the participants?

How much trust are you placing in the participants to be truthful?

Any mechanisms in place to decrease the percentage of people that hides information?

And how do you expect this can skew your data analysis? (pvalues for example)

brolios

We keep current lists of all our health history and health tracking surveys on our website.

We have run some statistical analyses for inconsistent responses and found them to be very few and not likely to influence genetic association results. We also have the option of excluding these individuals from analysis. We have also checked if genetic association results with various traits like BMI, hair color and eye color match previously reported findings and they have.

Obviously, we would love if everyone would answer every question to every survey, but this never occurs with any real survey. Thankfully, since we are primarily interested in finding relationships in our variables this sampling bias that results from nonresponse does not influence our results as much as if we had been trying to estimate the population averages of these traits using our data. The p-values will be higher, but only because there are fewer observations than there otherwise would be if everyone had answered.

Do you attempt to track differences in exposure to environmental toxins based on address, such as lead exposure in Flint, Michigan, or natural/supplemented fluoride levels in water? I would think that differences in lead uptake would correlate strongly with intelligence, and fluoride with dental issues. But it would be fun to look at all the other correlations... just in case.

Wikiwnt

Yes -- we would love to figure out how to do that well. We probably would need help from the other redditor who was an expert in GIS or from others like them.

I just recently got my results back from Genes for Good! What site do you recommend using to read the raw data? I have a rare disease and am very interested in reading the results. Thank you!!

bdecked

Hi,

This is one of the most common questions and one of the trickiest to answer because of the current US regulatory framework. The advice we have gotten is that, for now, we should refrain from providing interpretations of the data that could be construed as medical advice (and that we also shouldn't point to third party sites that would provide these).

We hope to get to a better place, but want to do so in a manner that is ethical, compliant with the law,

and helps participants satisfy their curiosity.

We are really encouraged that the US Precision Medicine Initiative has also been advocating for the principle that participants should have access to their data, including interpretation that is relevant to them. Hopefully, their clout will help get us all to a better place in terms of research data sharing with participants.

For the rare few of us without facebook accounts, can you suggest any alternative ways that we can contribute DNA samples and health/behavioural info for these types of studies?

IceBean

Currently the app is built to work only for Facebook users. While Facebook doesn't obtain any information a Genes for Good participant provides we use Facebook primarily as a platform for distributing the app as well as an authentication layer for logging into the app

Some folks we know (including a parent of one of the investigators in Genes for Good!) created a Facebook account that they use for no other reason than to participate in Genes for Good. Ultimately we would like to support other authentication mechanisms to expand the app beyond Facebook, but that's not currently a very high priority.

how is facebook obtaining genetic information?

Herxheim

Facebook actually receives no information about participants other than the fact that they've "installed" the Facebook app. Facebook is essentially only used as an authentication layer and a platform for notifications and "shares" of the app.

Once logged into the app, all information submitted by participants is done so directly to the Genes for Good servers owned and operated by the University of Michigan, *not* through Facebook. In addition to that, genotyping is done in the University of Michigan Sequencing Core and that raw data is delivered to us for processing through the University's intranet. When distributing processed genotype data to participants we do so through Box a HIPAA-compliant file sharing platform.

So, throughout the process, participant health and genotype data never go to Facebook servers.

By making your app completely voluntary and providing no incentive to participate how will your team get data on 'hundreds of thousands' of people?

It seems like any data you do receive will be strictly limited to the scientifically/health conscious folks. Even then they'll probably stop participating and forget very soon after they start.

Most data collection services (facebook, google) provide a useful service in exchange for data. You guys are straight up just hoping to collect data while providing nothing in return?

macadamian

We feel that feel that this is unique opportunity for people to contribute to research while also obtaining free ancestry and genetic information. We're one of only a few groups currently providing raw genotype data and ancestry to participants free of charge.

We hope that providing ancestry information and raw genetic data is a valuable and interesting

incentive for individuals who choose to participate in Genes for Good. We also provide visualizations of survey data to help participants tracking their daily habits and compare their health information to other participants in the study. Our hope is that this interactive environment encourages participants to be more involved in the study and learn more about themselves in the process.

Why is so difficult and expensive for individuals to obtain specific genetic testing for rare diseases?

Specifically, for example, searching for tests of genetic markers for Hereditary Spastic Paraplegia - almost all companies with the ability to test for it require a physician intermediary and up to $2500 for a serum panel. Why, if you and your group can send anyone on Facebook a spit test and full results for free, can I not send in a blood sample for one specific test privately and without the exorbitant cost?

Obviously private firms will need funding that doesn't come from grants, but is that markup/cost actually justifiable? And why would I need a doctor to order a test I am capable of requesting?

RissaWasTaken

These are really tricky questions, with lots of components to answer.

In terms of genetic testing, it is true that -- currently -- most DNA analyses in a research setting are much cheaper than analogous clinical analyses. Some of the answers are as you might expect: there are much higher stakes with clinical testing, and so one needs additional checks and balances. Some others are more complicated: for example, researchers often are quicker to adopt newer, more scalable technologies and testing labs can be quite conservative and slow to change.

Finally, your genome and DNA is a big place -- not every test measures everything. In Genes for Good, we use a relatively affordable genotyping array -- this is great for a first pass look at DNA in the context of a research study, but will miss many details, especially any genetic variants that are unique to an individual and are not shared with many others.

It seems like this type of program, while useful for accumulating reasonably large volumes of raw data, would also be vulnerable to selection bias -- i.e., you will only ever get the health history and genetic information of people who wish to participate in such a program, which may not be representative of the general population. Do you have a plan for dealing with this? How do you expect it to impact the results produced by studies using your data?

FromPhysicsWithLove

Selection bias is a common problem in many types of genetic studies, especially because the strategies that allow one to collect unbiased epidemiological samples are often hard to scale to large numbers.

One important point, when studying the genetic causes of disease, is that most of these selection biases will not lead to false associations between genotype and outcome, once you control for ancestry. Thus, even biased samples, can be extremely effective at uncovering causal relationships between genetic variation and human health and disease.

This has been shown repeatedly; one of the most notable (and at the time controversial!) examples was the Welcome Trust Case Control Consortium.

That said, we do see some obvious selection biases in our sample. For example, our volunteers are typically about 10 years younger than the average US adult and 65% are women.

Hello and Go Blue!

As your study seems to suggest, recording rich information in addition to DNA sampling is important in increasing our understanding of physical traits. Your study seems to have succeeded in collecting sufficient information to infer meaningful results.

Do you think there is a benefit in applying similar data collection practices on a larger scale? For example, would it be helpful for medical centers to systematically collect and use the same type of data collected in your study? If so, how do you think such a system should function (on the data collection, storage, and distribution scale)?

CrockpotFan

Funny that you would ask! We think that using the health information in a medical record is also a great (and complementary) idea. You can see some of the things some of us are doing with that here: www.michigangenomics.org

We think the information we collect is actually very complementary to what you can get from medical records (which tend to focus on big illnesses, but miss important things like behavior and environment).

As a preface, I love your research and I think this area is one of the most promising. Having said that; historically one of the most dangerous things you can be is born with the wrong heritage. These sorts of studies always make me just a little nervous. Even in our own lifetime we've seen large scale genocide. Does it ever worry you that your research, while altruistic, has the potential be used as part of a very dangerous roadmap. In the wrong hands a catalogue of what people are made of and where those bits came from is one of the most dangerous catalogs there can be.

ArrowInTheMyst

We think the potential for benefit and for helping the common good is much greater than the potential for harm. Genetic data is already helping us understand many different diseases better at a molecular level, and the benefits are starting to translate into better medicines in many cases.

Also, in our view, genetic studies have mostly emphasized how similar we are to each other -- rather than how different. If your genome was a new fangled Mac retina display, and you collected all the differences between you and the next person you come across today in a corner of the screen, they would not add up to much more than a smudge the size of a house fly, I think.

Isn't most genetic research just crunching numbers and lots of statistics? What conclusions can you draw from this data, or what is the purpose of the study other than compiling genetic data? What are the useful applications of this study?

maltwin11

One of the things we are most excited about is that, because we can reconnect with participants on Facebook, we may be able to recontact participants with a really interesting genetic make-up and invite them for follow-up analyses.

This is one of the most exciting ideas in current human genetics, because it would enable us to replace many studies of animal models (e.g. studies of mice where a gene has been removed) with studies of interesting people (e.g. studies of people where the same gene is naturally missing).

First of all, let me say a huge THANK YOU for this project. With a big enough sample (which I hope you get!) you could be starting something as major as the human genome project; I'd say that's brilliant, but it would be an understatement. What I wanted to ask is if any of you are aware of similar projects taking place in Europe, or accepting participants from Europe. I'd love to be a part of this but since I'm not in the US it's not possible. Also greater significance would be achieved by joining data from peoples all over the world.

I'll be following your progress closely and please do another AMA when the study is finished, I'm sure millions of new questions will arise!

Lizzie7493

We agree with you -- it would be really important for these projects to take place not just in the US but elsewhere. Each genome has a little bit of insight to contribute about human biology, and we can learn a lot more by studying diverse genomes from many populations rather than just from a few.

Any progress or info on specific non life threatening diseases? Specifically Vitiligo? Thanks.

killabee444

There is some nice data out there on the genetics of vitiligo. In fact, it is often easier to do genetics on conditions that are not life threatening - because, as you can imagine, it is hard to recruit people who have already died.

Here is one example: [http://www.ncbi.nlm.nih.gov/pubmed/22561518]

My fiance is bipolar. She is obviously worried that if we have a child that the child will be Bipolar as well. What are the chances of this happening? Seems here concerns are valid.

JDG00

Many serious psychiatric disorders have a genetic (and heritable) component. Fortunately, these are also rare events.

As a thought experiment, imagine that the children of a bipolar parent might have 10-fold higher risk of a serious psychiatric illness (most estimates out there are a little lower than that!). That might imply that 1% of the population, but 10% of the children of a bipolar parent have disease. That would still mean that the vast majority of children of a bipolar parent would healthy, from a psychiatric perspective.

With Genes for Good and other genetic studies, we are hoping to understand better why someone like your fiance is sick -- and hope that, in the future, this knowledge will lead to better treatments.

Good luck to you and your fiancee!! I hear that having these big issue conversations (children!) before marriage is a great predictor of future happiness. We will have to see if our data validates that one day.

Thank you guys for doing this AMA!

Sorry I don't have a question about behavior, but I am interested in hearing your opinion.This study indicates that there may be genes that are more resistant to cancer. Is there any way we can use this knowledge to increase resistance to cancer in the future?

Mr_Shav

Scientists like us have great hope that, with better understanding of what makes some people prone to cancer and others less so, we will be able to come up with better ways to treat and prevent cancer!

I do the DNA purification of the GFG samples at the UMich-DNA Sequencing Lab. Thanks for the QIASymphony! :o)

derdody

Thank you for your hard work!!

With many studies of human health it is useful to have twins participate in the research. Is this true with the study you are conducting? What kind of comparisons are available to geneticists using the self reported information that would be valid? How do you account for the people who lie in their self reports?

Dudge

We have tried some statistical methods that detect outliers and don't think cheating on surveys is a major concern. Happily, when we have tried to reproduce expected association signals (between genotypes and health data or between different health variables), we have gotten expected and sensible results.

That said, it is almost impossible to guarantee that no one is cheating. Some cheating strategies (like random clicking) are easy to catch, whereas others are extremely difficult (instead of answering by random clicking, try to answer as your best friend would -- resulting in a very plausible looking set of answers).

I'm starting my studies as a biology major this fall as a freshman at Case Western Reserve University, and I hope to one day become a geneticist or genetic engineer. Do any of you have any advice for someone wanting to pursue their life's passions and join the biology field?

AGreatMassOfDeath

First, biology is a great field to study! Congratulations!!

In terms of advice, I like to give some general and some personal advice.

In general terms, biology is becoming more and more quantitative. If you have a chance to pick up some statistics, computer science, or other geeky skills, do so. They will probably came in handy!

Personally, you will do best if you find a portion of biology that matches your passion. There is tons of good research happening at Case Western. Try to join a research lab and help out with whatever is going on there. Then join a different lab in the summer or next year. And stick with whatever really grabs you or where you feel you really are making a difference.

What advantages have you seen with doing research using this method? Disadvantages?

Favorite type of soup?

ryan4588

Two really nice advantages are the ability to collect diverse samples from across the United States and

to maintain a connection with participants, which (hopefully) will allow us to collect additional data over time.

An obvious disadvantage, as many have alluded to, is that the sort of person who volunteers to share their health and genetic information with us on Facebook can be very different than the typical US adult. Most obviously, they are typically younger.

PS. We like all types of soups -- but vegetable soups are especially popular among the group.

This is so cool! I'm definitely going to sign up! When you guys get the spit kit, what do you do with it? Does everyone get their whole genome sequenced? Is there a target number of people you are hoping to enroll in your study?

DoShitGardener

We currently genotype ~500,000 genetic markers and use that data to impute (guess!) the rest of your genome.

We'd love to get to 50,000 people or so. But then we would probably decide we would need even more!

Do you ever see gene editing for genetic diseases etc in children as common an occurrence as IVF?

Do you also ever believe "designer babies" (as in choosing non health related things such as hair colour) would be commonplace?

LtSlow

These are really new ideas and a little outside our area of expertise. There are lots of ideas about how gene editing might help children and adults get permanent solutions to chronic conditions.

We need to decide what we think of designer babies as a society. Personally, seems like a terrible idea that I hope never comes to pass.

Hey there, thank you for doing this! How do you consider the chances of companies like google´s Calico to actually succeed in slowing, stopping or even reversing the aging process?

Nightauditor1981

We surely hope they will succeed before it is our turn to grow old :) but we are too busy to think about it too much for the moment.

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We would be flabbergasted if that finding held up. But the best way to figure those sorts of things out is with data and analysis.