AGAINST ALL ODDS
EPISODE 12 – "CORRELATION"
TRANSCRIPT

FUNDER CREDITS

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INTRO

Pardis Sabeti
Hi, I'm Pardis Sabeti and this is *Against All Odds*, where we make statistics count.

Three-year-old Kevin and Alan are twins. They're being fitted out with motion detectors for a study of one of the oldest and most controversial questions about what makes us who we are – the genes we were born with or the environment we grew up in. It's a question Kim Saudino is often asked once people know what she does.

> **Kim Saudino**
> They're usually disappointed because they don't usually say, "How much is it?" They say, "Is it genes or environment?" And I say it's both. And that's not the answer they want. They always want to pit one against the other.

Pardis Sabeti
The classic correlation study of genes versus environment was done in the 1980s, with subjects like Jerry Levey and Mark Newman, identical twins separated at birth and raised in different families. They didn't meet until they were in their thirties. Mark recalled his first impression of his twin brother.

> **Mark Newman**
> He's big like me, he's got a big nose like me, glasses like me and he was wearing a baseball cap and when he pulled the baseball cap off, I'm like, oh hell, he's bald like me!

Pardis Sabeti
As well as looking alike the two had a lot of other things in common. Mark installed burglar alarms; Jerry, fire alarms. Both held their beer cans with a pinky at the bottom.

And both were captains in volunteer fire departments – a remarkable coincidence to all but the twins themselves.

> **Jerry Levey**
> I guess I always wanted to be a fireman. And then I find out that my brother's a fireman. It's not strange. He's got to be a fireman. Only because firemen aren't made. Firemen are born!

Pardis Sabeti

Does that mean being a fireman is genetic? Stories like Jerry and Mark's might make you think so. Since they were raised in different families the most likely explanation for their similarity lies in their genes.

Seeing an opportunity to assess the relative roles of environment and heredity, during the 1980s University of Minnesota psychologists studied dozens of identical twins raised apart.

Researcher
Who's going to go first?

Twins
You!

Pardis Sabeti
Like the other twin pairs, these recently reunited sisters underwent a week of intensive testing. The question was how similar they were – in other words how closely correlated were they for certain traits. These included not only physical traits, but also psychological traits – such as how they react to the imminent popping of a balloon. The twins were also given personality and intelligence tests. The same battery of tests was also given to twins raised together.

Thomas Bouchard
In the case of identical twins reared apart, the only reason they ought to be alike is that they share genes in common. So the measure of correlation or similarity between them reflects the effects of genes. The contrast is identical twins who are reared in their own family. There are two major reasons why they should be alike. One of the reasons is common genes, or heredity. The other is common family environment. Consequently you can compare identical twins reared together and identical twins reared apart, and the difference in the size of the correlation tells you the influence of the common family environment.

Pardis Sabeti
So how do you assess the size of the correlation? Well, as we've seen many times already, you can get a pretty good idea simply by looking a picture of the data.

Here we've plotted the heights of pairs of twins raised apart; with the height of one twin, say Twin A, on the *x*-axis and the height of Twin B on the *y*-axis. We can quickly see that the taller one twin of a pair is, the taller the other; there's a positive correlation between the two. Now this isn't too surprising for a physical trait like height, but what about those personality traits the Minnesota Twin Study also measured?

This is a scatterplot of a personality inventory study given to pairs of identical twins reared apart. And while the relationship isn't as clear as it was for height, the points do tend to increase together. Remember, the twins were raised in different families so the fact that a correlation exists at all can only be attributed to their common genes.

We can compare these two scatterplots more objectively with a direct measure of correlation denoted by the letter *r*. Here's the formula for calculating *r*. It's actually not as complicated as it looks, but in practice most people use software or a calculator that finds *r* from keyed in variables of *x* and *y.*

The value of *r* is always a number between -1 and 1, with -1 being a perfect negative correlation and 1 a perfect positive correlation. So let's see what the *r* is for those two scatterplots of twins raised apart. For height, *r* is .92, very close to the perfect correlation of 1, which is what it would be if the heights of the twin pairs were determined solely by their genes. For the personality study, the correlation is .49, not as strong as for height but still suggestive of a strong genetic influence.

Studies like that with Mark and Jerry were only possible back when it was common for identical twins to be separated when placed for adoption.

> **Kim Saudino**
> Nowadays we don't like to separate twins. And so even if they are reared apart we try to have some contact between them. So they're not truly reared apart in the, in the way that they would have been in the Bouchard study.

Pardis Sabeti
So in her study of the role of genes and environment on an important personality trait, Kim Saudino is taking a different tack – comparing fraternal twins, like Kevin and Alan, who share approximately half their genes, and identical twins, like Sam and Ethan, who share all their genes.

The motion sensors on the twins record their level of activity in a variety of play situations. Previous studies have shown that how active a toddler is at the age 2 or 3 is a strong predictor of difficulties in later life.

> **Kim Saudino**
> It's related to behavior problems, aggression, externalizing problems. It's been shown in some studies to be related to academic outcome. It's also correlated with extroversion, so how outgoing they are.

Pardis Sabeti
Here is the scatterplot of the activity level of identical twins as observed in the lab setting from an earlier, similar study – and you can see at a glance that the correlation is pretty good. In fact when Kim Saudino computed *r* it turned out to be .48. Now here is the data from fraternal twins. The picture alone suggests that the correlation between the twin pairs was lower. And the computed value, .26, confirmed that the correlation between the activity levels of fraternal twins is much less than that between identical twins.

Since the environments the toddlers were raised in and studied were the same, the difference in correlations can only be accounted for by the genes they inherited.

Case closed, right? The genes you are born with, much more than the way you are raised, determine how active you'll be as a toddler, and in turn how well you do on important social measures as you grow up. But wait. There's a wrinkle in this story.

In that previous study, the twin pairs also wore the motion sensors for few hours at home. And the scatterplots from those data looked very different from those obtained in the lab setting. The difference between identical and fraternal twins has largely disappeared, with the *r*-value for identical twins now at .87 and for fraternal twins .70.

> **Kim Saudino**
> The fact that we're finding the correlation for fraternal twins in the home that's much higher than one half the identical twin correlation, tells us that—in addition to genetics contributing to familial resemblance – it tells us that the shared or common environment is also contributing to familial resemblance. So things that are common amongst the twins, environments that are common amongst the twins, are making them similar, as well as genes.

Pardis Sabeti
So, for all you still wondering if you were shaped more by your genes than by your environment, remember how Kim Saudino always answers that question: it's both. And it's through correlation studies that she is able to tease apart the contributions of each in different circumstances.

> **Kim Saudino**
> We do now very fancy models; we don't usually compare one correlation with the other. But at the root of these very fancy models are the correlations. They're the basis of it. So, although we do these very fancy statistical analyses, at their very core, it all depends on the correlation.

Pardis Sabeti

I found Kim Saudino's use of statistics to gain insight into the effects of genes on the human condition especially fascinating, because that's something I do in my own research, where I look at how genes can confer resistance to deadly diseases like malaria or Lassa fever.

But that's a topic for another time. Until then, I'm Pardis Sabeti for *Against All Odds*.

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