DNA (Forensic Science part two):

Midnight Facts for Insomniacs

Podcast Transcript

(Note: transcript consists of episode outline)

So this is an unusual situation, Duncan, because we are both on equal footing. You know what this episode is about. Normally you are in the dark, but not today, because this is part two of the previous episode, and so you got to know the topic ahead of time. And…I don't like it, I prefer a power discrepancy. I like to be privy to the insider info and hold it over your head. I'm very petty, we've established this.

So as you unfortunately already know, which I hate—have I mentioned that?—this is the second episode in our forensic science series, and we may have to do another one at some point. There is just so much to cover, and DNA is too big of a topic to shoehorn into a multi-subject episode, so we really had no choice but to do a deep dive. Plus we've actually discussed other elements of forensic science already in older episodes; for instance, we covered bite marks in one episode, and just to recap: trash. Junk science. Not real. If you've ever seen a bite

mark from a crime scene, it usually just looks like a big discolored bruise, because that's what it is. it's a blob. Remember the iodine fuming fingerprint from last episode? Similar. Useless. From an innocence project article, "Bite mark "experts" cannot even agree on the answer to the most basic of questions: Was this injury caused by teeth?...[in 2014, researchers carried out a study which asked ABFO-certified dentists to use a "decision tree" to analyze sets of bite marks — some from their own case files. Among other basic questions, they were asked to determine whether they were looking at a "bite mark," something "suggestive of a bite mark," something that was "not a bite mark," or whether they had insufficient information to make a determination. In all but a few cases, participants could not agree on whether or not they were looking at a bite mark." Awkward. You know how they quiz somaliers on which vintage and varietal they're tasting... well it would be like if a bunch of somaliers couldn't figure out if they were drinking wine. "This is definitely either a 1787 Chateau Lafite Bordeaux, or...sprite."

But today's subject, DNA profiling, is a lot closer to the kind of CSI forensic magic that we all want to believe in. It kind of IS magical; DNA can solve decades-old cold cases and deliver justice to rapists and murderers who otherwise would have gone free. And the way that DNA sequencing works is both conceptually simple...and functionally confounding. It's a lot. As

often happens on this show, I feel like I'm walking a fine line, because it is very tempting to try to sound smarter than I am by geeking out on the science of DNA, with in-depth explanations of Phosphodiester linkages, single-ringed pyrimidines and double-ringed purines...you get the idea. I don't even know if I pronounced any of those words correctly, that's how smart I'm not, and how bad of an idea it would be to try to go full professor. Which is why we're not going to go too far down the scientific rabbit hole. But of course, we can't *ignore* the science, either. Here is what I'm shooting for: When I think of DNA I personally can't help but picture the little talking double helix snippet from the Jurassic Park amusement ride video. "Dino-sours." I want to be as entertaining and lovable as that little wisp of anthropomorphic DNA. Just a little genetic scamp.

So let's start at the beginning. Most of you have heard the cliché: DNA is the "blueprint for life." Deoxyribonucleic Acid is a microscopic paint by numbers with instructions for creating an entire human. Or rat or fish or tree, and even some viruses. Not Covid, though. That's a lowly RNA virus, only a single strand structure. Covid is kind of a little bitch, I like to insult Covid, it makes me feel better. Take that, stealer of years. Now DNA on the other hand is a double helix and contains a complex set of genetic instructions, although interestingly, almost all of our DNA is completely the same. Duncan, you and

I share 99.9% of our DNA. it's amazing to think that only a measly .1% difference makes me infinitely more awesome. Nature is remarkable. As is my DNA. Remarkably superior to yours. And it's not just humans that share the bulk of our DNA with each other. We also share 96% of our DNA with chimpanzees, 80% with a mouse, 60% with chickens, 60% with fruit flies, and bizarrely, about 50% with bananas. We are almost as closely related to bananas as we are to chickens.
It's not just bananas, we share about 50% of our DNA with *most* plants, but for some reason the Internet is obsessed with how much DNA the average person shares with a banana in particular. Probably because bananas are inherently funny. They're shaped like yellow dicks and they're slippery AF. They're slippery dicks, isn't that an alcoholic beverage? Of course those percentages are a little bit misleading. Much of our DNA is just junk, the remnants of discarded evolutionary trash, and in fact genes, the important parts of the DNA that actually encode for stuff that matters, make up only about 2% of your total DNA. We share 50% of that, so the actual amount that we share with a banana is only about one percent of our DNA. Still kind of weird that half of our important genetic stuff is shared with slippery penis-fruit.

Digging a bit deeper into the science and structure, DNA is technically a polymer. Other polymers include various plastics, like polystyrene.

Packing peanuts: structurally similar to DNA. On a very basic level. A polymer is made up of sequences of large molecules, and those sequences repeat. When it comes to DNA they're arranged in subunits called nucleotides.

This is where it gets a little complicated. So imagine a ladder. The steps are made up of two nucleotides each, side-by-side, connected by hydrogen bonds. Each of those individual nucleotides is either adenine, cytosine, thymine, or guanine, commonly shortened to A, C, T, or G. So the steps of the ladder can each be one of 24 combinations: AC, TG, AG, CG, etc. The supporting frame of the ladder is composed of sugar phosphates. Now imagine you took that ladder and made it like a bazillion miles long and then twisted it into the familiar helix shape, and then crumpled it up into a jumbled mess the size of a basketball, and then shrunk that basketball down infinitesimally. Your imagination is doing some heavy lifting here, but hopefully you get the idea.
So how do we know what DNA looks like?
I'm sure you've heard the names James Watson and Francis Crick, because they both became internationally famous after publishing an article about DNA in the magazine "nature" in 1953. And I wonder how many times James asked his partner a question and Francis used the opportunity to respond "elementary, my dear watson." This would be a daily

occurrence, for me. The partnership would have been short-lived. It would get old very fast, but I would never stop.

Watson and Crick get all the glory, but they built on an established foundation. we owe the bulk of our gratitude for the discovery of DNA to Swiss physician Friederick Miescher. Around a century before Francis Crick presumably annoyed the shit out of his partner with incessant Sherlock Holmes references, Johanne Friederick Miescher first detected DNA while he was studying pus from discarded surgical bandages that he had scavenged from a local hospital in 1869. I don't see any problem with here, who hasn't spent a summer happily pus-scavenging from the local medical facility. We Don't kink shame. Meischer is notable today for having two prominent modern laboratories named after him, and also for being a creepy freak who spent his time staring at pus and salmon sperm. Now even though he deserves the credit for discovering DNA, to be fair he didn't actually know what he had discovered, he simply made note of the fact that he had detected an unexpected structure in pus. I find it disturbing that he was familiar enough with pus to be like, "that's not supposed to be there. This isn't the pus I know." he gave this unknown pus-structure the name nuclein. It wouldn't be until about a decade later that German biochemist Albrecht Kossel would finally isolate the mystery structure, getting so far as to identify all of the nucleobases we

covered: adenine, guanine, thymine, and cytosine.
The first steps toward imaging the structure of DNA took place in 1937, when English molecular biologist William Astbury was able to capture the basic outline via a technique called xray diffraction. 15 years later in 1952, a graduate student named Raymond gosling, working under the direction of chemist **Rosalind Elsie Franklin**, would capture a vastly improved image via the same basic technique. It became known as photo 51. It revealed the double helix structure, the nucleotides, and microscopic alien autopsies. (Area 51? Anything? Buehler? OK.) What really happened was that the photo made its way to a couple of British researchers you might recall from around 90 seconds ago: American bacteriologist James Watson and his research partner British physicist and Sherlock-Holmes-quoting smartass Francis Crick. The prevailing theory up until this point had been that the phosphate backbones of DNA—the rails of the ladder—were on the inside and the nitrogenous bases—the steps of the DNA ladder—were pointing to the outside. but photo 51, along with input from Rosalind Franklin, allowed Watson and crick to refine their model to reflect a rudimentary version of the double helix that we all recognize today. on February 28, 1953, Watson and Crick barged into the Eagle pub in Cambridge, and Crick disrupted everyone's lunchtime drinking to announce that he and his colleague had "discovered the secret of life.

“ Seems kind of rude, honestly. Like, congratulations, I guess? Kind of randomly rubbing in your success… we’re all drinking at noon, things aren’t going great over here. Also there’s a football game on TV…Maybe you could discover the secret to shutting the fuck up. I guess it’s better than him getting naked and shouting Eureka. Still seems annoying, though. However, I could be wrong, because the Eagle pub was located near Cavendish laboratory where the duo worked, and so it hosted many of Watson and Crick’s fellow researchers and scientists who presumably would have cared about the discovery and for whom this announcement would’ve been relevant. The Eagle pub today sports a circular blue plaque commemorating the incident. The original plaque notably omitted the contribution of Rosalind Franklin, and that did not sit well with at least one local, who in 2017 scrawled “plus Franklin” and a heart emoji on the bottom of the sign. That’s some very polite British vandalism. You don’t see a lot of heart emojis in your typical American graffiti. Mostly penises. Just last year, the plaque was replaced with a new one and the owners sort of clumsily added the following line: “the breakthrough relied on data from Rosalind Franklin, Maurice Wilkins, and other scientists.” I mean cool, but pretty much every breakthrough relied on data from other scientists.

There would be no E equals MC squared if previous scientists hadn’t already defined energy, mass, and the

speed of light. And of course the *existence* of light waves, and basic math. Imagine if Einstein had to start from scratch, he would have been too busy figuring out that 2+2 = 4 to be mucking around with spacetime. But it's a nice sentiment.

I mentioned that the scientific journal *nature* broke the news of DNA's structure having being finally determined, it was a single issue of the magazine but the announcement was given appropriate fanfare: five individual articles in that one issue. The magazine editors knew they had a scoop here.

Watson and Crick would receive the Nobel prize in 1962, and they would share it with the previously referenced Maurice Wilkins, another DNA pioneer who was also the guy who passed along photo 51 to the duo. Rosalind Franklin was snubbed yet again, but not because of her gender, probably more because she had died tragically at age 37 from cancer and Nobel prizes are only awarded to living recipients. still, not a great look to ice out the only female scientist who was prominently involved in the discovery.

So where does DNA come from, how did it evolve and originate? I almost don't want to mention this because it can lead down some outlandish rabbit holes and it's like throwing red meat to the conspiracy theorists, but there is serious speculation that the building blocks of DNA may have come from outer space. The chemical reactions occurring out in the cosmos Among

the clouds of gas and dust between stars produce nucleobases—the adenine, thymine etc. that make up the steps of the DNA ladder. It's possible that in the distant past, comets or asteroids bearing genetic material could have plowed into earth and distributed their life-giving payloads. That sounds incredibly sexual. The universe is a horny place.

So scientists understood the basics of DNA by the early 1950s, but it would take decades to unravel the details of any creature's complex individual genetic code. DNA sequencing, which is the process of mapping all of those nucleotide steps in the double helix, traces its origins to 1955 when British biochemist Frederick Sanger mapped out the entire sequence of the amino acids of insulin, a tiny protein with which we are all familiar from its role in diabetes. A couple decades later, in the 1970s, researchers at Cornell University achieved some very complicated breakthroughs which I'm not going to detail here because I don't understand them, but I'm told that those techniques greatly advanced sequencing technology, allowing Frederick Sanger to build on their work and publish his groundbreaking treatise "DNA sequencing with chain terminating inhibitors" in 1977. It's a gripping read; suspenseful, romantic, a real page-turner. I'm guessing. How could it not be, it was extremely popular, among a very small demographic.
In that same year, 1977, Sanger

completed the first full genome sequencing, it was of a virus that infects bacteria. the DNA of bacteriaphage phi X 174. (That is the Greek symbol for Phi, like you would see on a fraternity house, and then the letter X and then 174. I actually typed into Google: "why are phages Identified with a Greek symbol," before realizing I don't care. I don't want to go that deep. Suffice to say that not all of them are, but some of them are, for some reason, and I await your emails. 12 years later, researchers were able to sequence the entire Epstein-Barr virus and determine that it contained exactly 172,282 nucleotides. So, now you know, down to the individual nucleotide. Do with that what you will. We're not called midnight interesting facts, or midnight useful facts. Just the facts, ma'am. Except the ones that I choose to omit. This is a dictatorship. The first semi automated DNA sequencing machine was revealed in 1986 by the California Institute of technology, and was quickly eclipsed a year later by the first fully automated sequencing machine in 1987, the ABI 370 by a Massachusetts company called Applied Biosystems. Dammit, Massachusetts. Got to steal California's glory. I guess I should blame California scientist who could only muster partial automation. Losers. With the subsequent development of the "whole genome shotgun sequencing method," by the institute for genomic research, geneticist Hamilton Smith and colleagues were able to map the first complete genome

of a free-living organism, Haemophilus Influenzae. Also known as “hamster flu.” No, it’s not even a flu but rather is a bacterial microorganism that was initially misnamed as a virus, and is responsible for some upper respiratory tract infections. In hamsters. No. In case you’re wondering it contained 1,830,137 bases. Midnight fact.

The next massive breakthrough in sequencing technology was the NGS method, which stands for next generation sequencing. We mentioned this before, scientists, not very creative. NGS allows scientists to sequence an entire genome at once by sampling fragments of the genome simultaneously via an automated technique called “massively parallel” sequencing. Not just a little bit parallel, massively parallel. I didn’t realize there were degrees of parallel-ness. There are so many methods for sequencing that we’re just going to skip forward, we’re not going to cover DNA nano ball sequencing and Heliscope single molecule sequencing and microfluidic systems sequencing and Illumina sequencing and the ion torrent semiconductor method and 454 Pyrosequencing, which I’m guessing involves a flamethrower.

Suffice to say that the Illumina method dominates the market with about 80% marketshare as of 2023.

All of this brings us to the human genome project, which sounds dystopian as hell but was an international effort that involved scientists from all over the world cooperating to identify, map, and

sequence all of the genes in the human genome. The project began in 1990 and took 13 years, it was completed in 2003. Sort of. It still stands as the largest collaborative biological project in world history. Spearheaded by us. the United States, not me and you, the royal us, the big U-S, I like to take credit for all things that my government does that are good. Which is very few things. Usually I'm hiding my face when I travel internationally, being American is not always something to be proud of. So The United States government adopted the initiative in 1984 and when it was completed in 2003 it included about 92% of the genome. Which...ok. I don't really know what to say about that, I kind of thought scientist were better at math. The "level complete genome was achieved only three years ago in 2021 and still wasn't complete. .3% of the bases were still not fully mapped. The final assembly was completed in January 2022." so it actually took 32 years, but whatever, people were getting impatient, and it's hard to throw a big media party when you announce that you're "92% complete. " Much of the funding for the human genome project was provided by the NIH in America (the national institutes of health) and the sequencing was performed simultaneously in the United States, Japan, China, Germany, and England at a total of 20 universities and research labs. There are more than 3 billion nucleotides in the human genome, so it was going to take a while. luckily, as we mentioned,

the vast majority of the human genome is identical, and when they say they've sequenced the human genome, they mean the parts that we all share. They didn't map the genome of one specific person, it wasn't Kevin's genome. There are a multitude of benefits that come from a varietymostly complete map of the human genome. Figuring out the mutations that lead to cancer, for instance. And of course spawning a multi billion dollar industry that exists solely to tell you how much Native American you have in your bloodline and whether grandma might have been too friendly with the milkman. It is an industry I look at with some suspicion after a friend used one of those 23 and me services and has since received regular updates revising the percentage of specific ethnicities in her make up. This is apparently normal. CBC news recounts the experience of a woman named Katy Jean whose results initially came back as 75% Great Britain, 12% Iberian peninsula, and surprisingly, one percent central Asian. But she was even more surprised when ancestry.com sent her a revised version months later, "Iberian Peninsula and Central Asia disappeared." that means 13% of her initial result was completely wrong. The website claimed that this frequently happens due to an increase in sample sizes. As more people submit their DNA, the website is able to more accurately provide results. Again indicating that the results they provide are not accurate. I'm so confused, if you pay a website to determine your

genetic makeup and the genetic makeup that they determine is incorrect by their own metrics, and could change at any time, what are you paying for? And this very problematic discrepancy among Katy's multiple results hints at some of the issues were going to talk about today, because the area that we are most interested in per the episode topic is forensic science. you might have forgotten that, because I never stay on topic.

When DNA is used in forensics we typically refer to it as DNA profiling, or sometimes DNA fingerprinting or genetic fingerprinting, and despite the concerns we're going to raise, there's no denying that when it comes to catching criminals, DNA is the best tool we've got.

The use of DNA for individual identification was pioneered in the 1980s; in fact the first patent ever filed for a forensic application of DNA was in 1983 by American biologist Jeffrey Glassberg based on work he had done at Rockefeller University. Judging by the patent details, it's a fairly simple process: "the identification is based upon an analysis of DNA length polymorphisms generated by the action of restriction endonucleases." Glassberg btw also founded the North American butterfly Association, a conservation group dedicated to engaging in public outreach, habitat creation, and restoration. What's the relevance you ask? Fair question.

Moving on.
Around the same time, across the pond, a British geneticist named Alec Jeffries was also working on his own technique for DNA profiling at the University of Leicester, and it would be his work in 1985 that led to the first application of DNA profiling to a criminal case and the conviction of a serial rapist and murderer. Of the discovery Jeffries says, “it was an absolute eureka moment.“ Again, when people use that phrase I don’t think they understand its origin. “In five golden minutes my research career went whizzing off in a completely new direction. The last thing that had been on my mind was anything to do with identification or paternity suits. However I would’ve been a complete idiot not to spot the applications.“ So this guy essentially created Maury Povich, but I think we can forgive him for that because he also helped solved a whole crap load of murders, starting with the previously referenced first ever forensic DNA success. July 31, 1986. The parents of 15-year-old Dawn Ashworth from Enderby England became concerned when Dawn was late returning from the home of a friend. At 9pm they called the police, who eventually initiated a search; Her body would be found two days later near a wooded footpath called 10 pound lane. Dawn had been raped, beaten, and strangled to death. The crime seemed to match a pattern of similar assaults and murders over the last few years in the area. Semen samples taken from the second victim

in 1983 were compared to over 5000 local men who voluntarily submitted to DNA testing, but no matches were initially discovered.

With the first instance of Alec Jeffries's forensic DNA tests seemingly having failed (I hate pluralizing names that end with S: Jefferies's) suspicion turned to a 17-year-old with mild mental deficiencies named Richard Buckland and under questioning (read: interrogation) he initially confessed to the murder. However, on August 1, 1987, a man named Ian Kelly admitted to the police that he had taken the blood test while posing as a guy named Colin pitchfork, a coworker who had begged him to do it under the justification that some prior convictions would have biased to the police against him.

Pitchfork was arrested on September 19, 1987 and his DNA matched the samples from multiple crime scenes. Pitchfork would later spill all his beans —ew— providing investigators with an exhaustive account detailing his life of twisted debauchery. He claimed that his criminal career began with flashing, he had exposed himself to more than 1000 women beginning in his early teens. That sounds almost impossible, that is an incredible amount of flashing. He was single-handedly keeping the trenchcoat market alive in the UK. How many women even lived in his town? Some of them must've seen it a few times. To be fair, and I don't want to give him any kind of credit or let him off The hook here (and I realize that's a bad way to start a statement

about a flasher and rapist and murderer) but this was before the era of dick pics. There are lots of dudes these days who have shown their junk to more than 1000 women nonconsensuau. It's just so much easier to do it now and get away with it. Eventually Pitchfork confessed to the sexual assaults and murders as well, though he "lied about the level in nature of the violence he had inflict in his victims." the hell you say. We were dismayed to discover that this murdering rapist was not being 100% forthright. Uncouth.

Pitchfork would plead guilty to two of the rapes and murders and the sexual assault of two other girls, and receive a sentence of life imprisonment, but in 2021 was granted "release on conditional license." Jesus Christ. He was recalled to prison two months later for "breaching his license conditions by approaching young women." In June of last year it was announced that pitchfork would be released again on parole, but the Lord Chancellor of England intervened and Pitchfork remains in prison. Apparently there was one reasonable human being in the British legal system. Even a guy wearing a white powdered wig was like, nah. This is silly. And I know silly. Pitchfork could still potentially be released, though, so that's great.

Alright, so how does DNA profiling work? Well as we mentioned 99.9% of human DNA is the same, but there are unique sequences of repetitions. Unique repetitions sounds kind of like an oxymoron, but there you have it.

They are the same, but uniquely. the acronym VNTR stands for variable number tandem repeats, Meaning that the repeated pairs of nucleotides vary in number, and by applying various chemical processes researchers can view particular bands of repeats that make identification possible. However there are a plethora of different chemical methods that can reveal those bands. One of the earliest was Restriction fragment length polymorphism, in which the white and red blood cells would be separated with a centrifuge, and then the white blood cells would be bathed in hot water, salted, and placed back into the centrifuge, and then baked at 300 degrees until golden brown. The hot water and salting is true. then the DNA would be fragmented using a so-called restriction enzyme, and then the cells would be hit with electricity... There's more. A lot, actually, which is why we're going to skip it. Eventually you end up with an image on x-ray film with those distinctive bands that reveal the unique DNA profile. this technique has largely fallen out of favor because it requires a significant sample of DNA, as many as 25 hairs or a drop of bodily fluid that is at least nickel sized, and it also takes a while. You might have to wait up to a month to obtain results via RFLP. This method is also prone to human error...pretty much a bad idea all around.

Today, there's a more streamlined method. DNA profiles are typically created by starting with a polymerase chain reaction. This involves adding to

the sample a heat-stable DNA polymerase; this is an enzyme that binds to the DNA, allowing it to replicate. Then you heat up the DNA sample to 93°C or 200°F and this separates the threads, then you reheat it to Trigger duplication, doubling the number of copies, and you do this about 30 times to expand the sample. Rather than analyzing variable number tandem repeats, in this technique researchers typically compare short tandem repeats, which are tinier portions of those VNTRs and this results in more accurate matches. I'm told. Once again, I understand none of this. there is also a method called amplified fragment length polymorphism, and we're just not going to go there.

DNA evidence has led to some amazing successes. Throughout the 1980s and 1990s, around 70 teenage girls and women, many of them runaways or sex workers, were targeted by a serial killer in the Seattle and Tacoma area of Washington state. The bodies of the first five victims were found in the green River, south of interstate 90, and as a result the green River killer became a fixture in the media. Many of the victims had been sexually violated repeatedly after death, the killer would return to the scene of the crime and engage in acts of necrophilia, leaving a trove of DNA evidence that at the time was utterly useless. In 2001 investigators were able to use advances in DNA profiling

to match DNA those samples to married father Gary Ridgeway, a hard-core Christian who read the Bible to his coworkers out loud, and traveled door-to-door preaching the word of God when he wasn't murdering hookers. Killing sex workers was an activity that he would later refer to as his "career. " ridgeway somehow escaped the death penalty and is now 74 years old in Washington state Penitentiary in Walla Walla Washington. whimsical name for a town that hosts one of the worst humans to ever have existed on this planet. He should be executed.

Yet another huge win for DNA forensics, and one that hits very close to home: the Golden State killer operated all across California throughout the 1970s and 80s, raping and murdering women from Sacramento in the north to Santa Barbara in the south. He also terrorized the public with horrible poetry. In 1977 the Sacramento Bee received a communication from someone claiming to be the man who at the time was known as the east area rapist. The poem was titled "excitements crave," and we're already off to a bad start. i'm not going to torture you with it in its entirety, but the poem ended with a request for more publicity:

"Jesse James" has been seen by all
And "Son of Sam" has an author.
Others now feel temptation's call
Sacramento should make an offer.
To make a movie of my life

That will pay for my planned exile
Just now I'd like to add the wife
Of a mafia Lord to my file
Your east area rapist
And deserving pest
See you in the press or on TV.

Bad poetry is not a crime, but it probably should be. He should've gotten a few extra years for that. Just on principle alone. So around the time of the poem, the perpetrator also made several phone calls to the police, mocking their attempts to catch him, and it's just amazing to even remember that there was a time when you could drive to some remote location and hop on a payphone and make completely untraceable calls for a shiny quarter. I feel old and also the idea of talking on a public phone makes me shudder with germ phobia. So gross.

Interestingly, the method for catching the Golden State killer has proven a bit controversial. Detectives uploaded the killer's DNA profile to a website called GED match, a personal genomics site. The site returned 10 to 20 matches for potential relatives, indicating that those people and the killer shared a distant ancestor, so the detectives got to work building a huge family tree. They were able to narrow down the suspects to two people, one of whom was ruled out by a relative's DNA test. On April 18, 2018, detectives were able to surreptitiously collect a DNA sample from the door of the suspect's car and later from a tissue in the man's outdoor garbage can. Authorities subsequently

arrested and successfully convicted 72-year-old former police officer Joseph James D'Angelo Junior, who was found to have committed at least 13 murders, 51 rapes, and 120 burglaries during a crime spree that began in 1974 and lasted 12 years, ending in 1986.

This is an undeniably happy ending to a tragic saga, but the methods used to identify D'Angelo have been met with understandable wariness. As more and more people voluntarily submit their DNA to public companies for genetic diagnoses and genealogical tracing, more and more people are swept up in these giant digital family trees that can be searched by the authorities and used to identify dissidents, anyone opposing a problematic regime, and other "undesirables."
And of course, Governments around the globe are eager to gather and catalog genetic information in giant databases. In America, DNA that is recovered from a criminal investigation is automatically entered into the CODIS: the combined data index system. This is a database maintained by the FBI containing more than 5 million profiles. Within the CODIS are a few different indexes: the offender index contains the profiles of people who have actually been convicted of crimes., while the arrest index contains profiles of people arrested for committing violent felonies. There's also the forensic index, which is made up of profiles culled from blood, saliva, semen and tissue recovered at a crime

scene, whether or not those profiles represent people who were actually convicted. That's a little disturbing. So if you were in a 7-Eleven buying a case of beer, and you had a nosebleed, and after you left someone robbed the place and shot the clerk, your blood might have been collected and your DNA is now in the FBI's database. You could even be included in the database as the result of a crime scene you never visited. DNA profiling methods have changed over the years; investigators no longer need puddles of blood to run tests; these days so-called "touch DNA can be extracted from a crime scene based on even casual contact with an object." As few as seven or eight cells from the epidermis (or top layer of human skin) can be enough to get what is now considered an acceptable result. So let's say you shook hands with a guy who then shot someone 20 minutes later. Your DNA could actually end up on the gun, and this happens more easily than you might expect. "...a project by graduate students Cynthia Cale and Madison Earll...looked at secondary DNA– whether it can be transferred to objects from someone who never touched the smoking gun. During this study, subjects shook hands for two minutes then handled test knives. The results were shocking after they swabbed the object for DNA. "In 85 percent of the samples in this particular study we detected DNA on the object from individuals who did not have direct contact with the object. Their DNA was transferred to the

object by the person they had direct contact with." Pretty scary, although a two minute handshake is a little aggressive. It's more like arm wrestling.

But think about it, if the 'touch-DNA technique" is so sensitive that anyone simply brushing up against an object can leave enough DNA to be extracted, imagine how vulnerable a crime scene becomes. If the scene is not immediately locked down at the moment of the crime, bystanders or witnesses or anyone trying to help—including first responders and investigators—could be leaving their own DNA all over the place. A Crime scene is like a teenage boy's bedroom. DNA everywhere. Nowadays investigators have to show up to the crime scene wearing paper oversuits and overshoes and gloves, with their hair covered, they have to be careful even when they talk so as not to allow stray spittle to contaminate the scene. Because if their DNA mixes with a potential suspect, the result will be hopelessly muddled and possibly implicate either of them or neither of them. In 1997 a murder victim in London was found with biological material under her fingernails, presumed to be skin cells belonging to her attacker, the result of scratches and gouging during a struggle. However, when DNA analysis was performed the tissue matched a woman who had also been murdered three weeks prior. There was no possible connection between these two victims. It turned out that at the

mortuary, an employee used the same pair of scissors to trim the nails of the two murder victims. Similarly, in 2007, the DNA of an unknown female was found associated with 40 separate crime scenes, and it eventually turned out that investigators had been using cotton swabs to collect samples and those swabs had been contaminated by a woman who was working at the cotton swab factory. Then there was Adam Scott, who in 2011 matched with a sperm sample from a rape victim in Manchester England despite the fact that 20-year-old Scott lived more than 200 miles away and had never visited Manchester in his entire life. It turned out that the false match was the result of cross contamination at LGC forensic laboratory; one of the technicians reused an evidence tray that had contained a sample of Adam's saliva from a previous "spitting incident." The fact that Adam was out there hocking loogies on randos is not a great look, but, while distasteful and unsanitary, spitting is not exactly the equivalent of rape. It does involve forcing your DNA on someone, but these are different levels of violation. Scott had been out on bail for the saliva fracas when he was erroneously picked up for sexual assault and spent three months in jail, which is technically a miscarriage of justice but as I read it I feel like maybe three months is the right amount of jail time for spitting on a stranger. Scott was actually sentenced to a year for so-called affray, basically fighting, so I'm guessing there was more damage just than spitting involved. Scott told a

local newspaper that the mixup made him feel angry and disgusted, sentiments shared no doubt by his spitting victim. Pretty gross, dude. Keep your DNA to yourself.

So I really want to get excited about DNA evidence, and to an extent I am, but the cynic in me still has major trust issues. Because the problems with DNA profiling don't always come down to cross contamination These days we are basing many prosecutions on *partial* DNA matches. incomplete DNA samples from those "touch DNA tests" obviously match with many more people than a full sample, so a partial sample could implicate multiple suspects in an area, especially areas where there has been interbreeding among family members. If one member of the Royal family is ever implicated by partial DNA evidence, the crime will be impossible to solve, because any of those inbred motherfuckers could have been the perp. Actual motherfuckers in many cases....I'm assuming. And as you've probably guessed , trials in which the conviction was based on partial DNA evidence have led to some pretty egregious miscarriages of justice. Like the man with Parkinson's disease who was convicted of a burglary despite being unable to walk more than a few feet without help. Oops. If it hadn't been for his lawyer demanding multiple DNA tests, he would still be rotting in jail.

Interesting sidenote: once your DNA is in the CODIS database, the only way to

get it removed is via court order. So let's say your DNA was collected and you were charged with a crime but later found innocent or exonerated, there's no automated procedure to take you out of the database. You have to ask nicely. Use the magic word. "How badly do you want to not have your personal genetic information catalogued in a government database? Say please, with sugar on top."

So to round out the indexes from the CODIS, there is finally a "missing persons index" that includes DNA results from unidentified bodies, and it also includes samples from the relatives of missing people, and these two indexes are frequently compared to each other to figure out if a new unidentified body can be matched to any of those grieving relatives.
And once again, there have been many notable successes...and there have also been successes when it comes to overturning particularly egregious travesties of justice. More than 200 convicted criminals have been released since 1989 as a result of DNA testing that proved their innocence. In over 80 of those cases, the actual perpetrator was also able to be identified and convicted via DNA evidence. Winning. Tiger blood scenario, if the tiger was a piece of shit murderer.

And that's where I'm going to end, uncharacteristically; it's not consistent with our MO, but I think it's appropriate this time because I really do want to

emphasize that DNA, while not by any means perfect, is absolutely the best forensic tool we've got. You and talk sometimes in terms of net positives or net negatives... DNA profiling is a net positive for the world. it's a chaotic good, just like you.

We have a new maniac!

New $10.00 member! 🎉 Meet Robert

Robert just became a $10.00 member!

Robert
robertisaac1991@yahoo.com

And we have a new minion, ace Adams. Sounds like a 1940s fighter pilot.

New $3.00 member! 🎉 Meet Ace Adams

Ace Adams just became a $3.00 member!

Ace Adams
aa.c.e.h.a.r.d.w.a.r.ee@gmail.com

We have returning patron

New A$5.00 member! 🎉 Meet Sydney Sam

Sydney Sam just became a A$5.00 member!

Sydney Sam
samtakacs@hotmail.com

https://www.genome.gov/genetics-glossary/Deoxyribonucleic-Acid#:~:text=Deoxyribonucleic%20acid%20(abbreviated%20DNA)%20is,known%20as%20a%20doubley%20helix.

https://www.cambridge-news.co.uk/news/history/the-eagle-discovery-dna-announced-22149817

https://www.itv.com/news/anglia/2023-09-03/forgotten-female-scientist-behind-dna-breakthrough-recognised-on-pub-plaque

https://www.cambridge-news.co.uk/news/history/the-eagle-discovery-dna-announced-22149817

https://science.howstuffworks.com/dna-profiling.htm

https://www.pbs.org/newshour/health/

the-pub-where-the-secret-of-life-was-first-announced

https://fox59.com/news/newspoint/new-study-says-your-dna-can-show-up-at-a-crime-scene-even-if-you-were-never-there/

Anger of 19-year-old from Cornwall who was wrongly accused of rape in Manchester after DNA blunder - Manchester Evening News

The strange case of the 'time travel' murder - BBC News

https://www.pfizer.com/news/articles/how_genetically_related_are_we_-_to_bananas

https://www.cbc.ca/amp/1.4826831

https://innocenceproject.org/why-bite-mark-evidence-should-never-be-used-in-criminal-trials/