



# CODE OF A KILLER

A new two-part drama for ITV

Press Release.....	Pages 2-3
Foreword by Writer, Michael Crompton.....	Pages 4-5
Character Biographies .....	Pages 6-9
David Threlfall is DCS David Baker .....	Pages 10-13
John Simm is Dr Alec Jeffreys .....	Pages 14-17
DCS David Baker .....	Pages 18-22
Professor Sir Alec Jeffreys .....	Pages 23-28
Executive Producer, Simon Heath.....	Pages 29-33
Synopses.....	Pages 34-35
A Beginners Guide To DNA Fingerprinting .....	Pages 36-39
Cast and Production Credits.....	Page 40



## CODE OF A KILLER

*“Professor Alec Jeffreys’ DNA fingerprinting revolutionised the way police investigate crime. It is arguably the most important contribution to criminal investigation ever made.”*

Two of the UK’s most renowned actors, David Threlfall and John Simm, join forces in new ITV drama *Code of a Killer*, produced by World Productions.

*Code of a Killer* is based on the extraordinary true story of Alec Jeffreys’ discovery of DNA fingerprinting and its first use by Detective Chief Superintendent David Baker in catching a double murderer.

The drama focuses on how Jeffreys’ science and Baker’s investigative vision created the single biggest leap in the history of criminal investigation.

David Threlfall takes the role of David Baker who between 1983 and 1987 headed up the investigation into the brutal murders of two Leicestershire schoolgirls, Lynda Mann and Dawn Ashworth.

Only a few miles away, Dr Alec Jeffreys, played by John Simm, was a scientist at Leicester University who, on 10 September 1984, invented a remarkable technique to read each individual's unique DNA fingerprint.

When a local teenager admitted to one of the murders but not the other, Baker asked Jeffreys to analyse the DNA evidence left at the crime scenes. Both men were shocked to discover that the teenager was innocent, his confession false. DCS Baker then took the extraordinarily brave step to launch the world’s first ever DNA manhunt, testing over five thousand local men to track down the killer.

Made by *Line of Duty* producers World Productions, *Code of a Killer* has been written by Michael Crompton (*Kidnap & Ransom*) with the full knowledge and input of retired Professor Sir Alec Jeffreys and former Detective Chief Superintendent David Baker.

The drama also features Lorcan Cranitch (*Penny Dreadful*), Robert Glenister (*Spooks*), Siobhan Redmond (*Between The Lines*), Anna Madeley (*Sense & Sensibility*), Dorothy Atkinson (*Call The Midwife*), Andrew Tiernan (*The Great Fire, The Driver*), Jaz Deol (*Restless Dust*), Hannah Walters (*Whitechapel*), Lydia Rose Bewley (*The Inbetweeners*) and Ged Simons (*Downton Abbey*).

Code Of A Killer is directed by James Strong (*Broadchurch, United*), produced by Priscilla Parish (*Line of Duty*) and executive produced by Simon Heath (*Line of Duty, The Great Train Robbery*).

Commented Simon Heath: “Code of a Killer is a testament to the pioneering science of Alec Jeffreys and the foresight and determination of David Baker. Together they brought justice for two grieving families and changed the course of criminal investigation forever.”

Members of the families of both Lynda Mann and Dawn Ashworth have been consulted about the drama.

# **Foreword**

## **By**

### **Michael Crompton**

A few years ago James Strong told me about the tragic events that happened in the villages of Narborough, Littlethorpe and Enderby in 1983 and 1986. He had made a documentary some ten years earlier and had always thought that the story had all the ingredients for a compelling drama. We took the idea to ITV and later to World Productions and they agreed - this story had to be seen.

The violent murders of two fifteen year old girls, Lynda Mann and Dawn Ashworth occurred in a cluster of small villages in Leicestershire not far from Leicester University where a young genetic scientist, Alec Jeffreys, was working on how DNA could help understand inherited diseases. It's here that he made the monumental discovery that showed, in the form of a simple bar code, that everyone was a combination of their parent's DNA and that combination was unique to them. He called it genetic fingerprinting.

DCS David Baker, the man leading the murder investigations, was something of a pioneer himself. He was one of the first to use tape recorders in police interviews and use computers to help collate information. When he heard about Alec Jeffreys' invention - first used in immigration cases - he thought it would help determine the guilt of a young man who had confessed to one the murders. And so something we all now take for granted and is used all over the world was first tried out as part of a criminal investigation in Leicestershire to prove the innocence of a young man. This, in turn, led to the instigation of a massive blood screening that would eventually, after thousands of samples had been taken, force the killer's hand.

I first met and spoke with both Alec and David and they have helped enormously to put the details into these incredible and sometimes unbelievable sequence of events. In the process of writing a three-hour drama based on real lives there is always a tension between what really happened and how to show this in a coherent and dramatic way. My aim has been to create a film that best represents how extraordinary this story is.

And then I got in touch with the mothers of Lynda and Dawn. And my experience of the story fundamentally changed. This was no longer purely an exciting crime drama. This was real. This happened. And for both mothers the cruel legacy of their daughter's murders is still being experienced.

When I first met Dawn Ashworth's mother, Barbara, she shared with me her memories of Dawn, her experiences after her murder and how she has tried to cope ever since. It was through Barbara that I managed to contact Kath – the mother of Lynda Mann. I promised them both that they would be able to read the scripts and that my intention was to portray what had happened to them and their daughters as truthfully and as faithfully as possible.

It has been quite a journey developing, writing and watching this drama come to life. One of the most moving moments I've ever had as a writer was when I got Kath and Barbara's reaction to the scripts. There were some historical inaccuracies they asked me to put right - which of course I did - but above all they were deeply moved by how their experiences had been portrayed.

This is the tale of two mothers and their families still mourning the loss of their daughters Lynda and Dawn. It is also an extraordinary tale of scientific invention and police endeavour that ultimately led to the capture and imprisonment of a very dangerous serial killer. It has changed lives and given the world the most important contribution to criminal investigation work since the fingerprint.

## **BIOGRAPHIES**



### **DETECTIVE CHIEF SUPERINTENDENT DAVID BAKER**

David Baker was born in Leicestershire in 1935. Before joining the Leicestershire police force he worked at the post office for two years and served in the Air Force for three years. In 1960, after three years of working in the police force, Baker joined the CID, climbing the ranks to Detective Chief Superintendent.

A few months before Lynda Mann's murder in 1983, David Baker led an investigation into the killing of a five-year-old girl whose body had been found in Leicestershire. The child had been abducted from funfair in Edinburgh and the two police forces of Edinburgh and Leicestershire worked together using computers. Baker realised the great advantages this new technology offered over traditional methods. Making the most of technological developments set DCS Baker apart. He joined the police national computer committee and the police national tape recording committee.

In 1986 a second 15 year-old girl called Dawn Ashworth was killed in similar circumstances to Lynda. Almost immediately a teenage suspect came to the attention of the police and, after questioning, he was charged with the murder of Dawn. However the police had nothing to link the teenager to the death of Lynda Mann. Baker contacted Dr Alec Jeffreys having read about Jeffreys' discovery of DNA fingerprinting in a local newspaper. Baker was looking for scientific proof that the suspect was indeed guilty of both murders. Jeffreys' test proved, in fact, that the suspect was innocent and his admissions false. The teenager was cleared of the crimes and released.

On top of clearing an innocent man, the test also confirmed that both murders were committed by the same person, as Baker suspected.

Baker believed the killer lived locally and, determined to catch him, he took what Professor Sir Alec Jeffreys described as the 'extraordinarily brave step' of leading the world's first ever DNA manhunt. Men between the ages of 18 and 34 living in the area were asked to volunteer their blood so that it could be compared to the DNA of the killer; testing began in January 1987.

David Baker retired from the police force on Christmas Eve 1995 at the age of 60. He has five children and he still lives happily in Leicestershire with his wife.



### **PROFESSOR SIR ALEC JEFFREYS**

Professor Sir Alec Jeffreys was born in 1950. It didn't take him long to discover his passion for science; he was only eight when he was given a chemistry set, with which he not only blew up his aunt's apple tree but caused scars to his chin that he disguises with a beard to this day. He reacted to later presents of a microscope and dissecting kit with just as much enthusiasm. Brought up in Oxford and Luton, he attended Luton Grammar School and Luton Sixth Form College, where he met his wife, Sue, before taking a four-year biochemistry degree at Merton College, Oxford, followed by a PhD in genetics.

He began working at Leicester University in 1977. Thirty-one years ago, on 10 September 1984, he had a "eureka" moment, inventing a method for distinguishing each individual's DNA. He and his team quickly realised that the implications of this discovery would be far-reaching, relating to issues of paternity, disputed identity, immigration and crime.

Within a few months it had been used to save a young boy from deportation by being able to scientifically prove the boy's biological relationship with his mother in an immigration tribunal, and soon people were queuing up to solve questions of identity through the new method of genetic fingerprinting.

By 1985, Jeffreys and his team had developed genetic fingerprinting into genetic profiling for forensic use. This was the method used to clear a young man accused of raping and killing two girls in the Enderby area of Leicestershire and to convict the real killer.

Since then it has been used to solve criminal and other cases all over the world, including clearing innocent men on death row, identifying the body of the Nazi war criminal Josef Mengele and investigating the impact of the nuclear accident at Chernobyl on the DNA of future generations.

Jeffreys was elected to the Royal Society in 1986, became a professor of genetics in 1987, and an honorary freeman of the City of Leicester in 1992. In 1994, Jeffreys was awarded a knighthood. He retired in 2012 but remains a member of the University of Leicester and holds an emeritus professor position.

## DAVID THRELFALL IS DCS DAVID BAKER



### **Q: Code of a Killer depicts the world's first DNA manhunt for a murderer?**

"Sadly when these things happen they have a way of staying in the public consciousness. So I had a trace memory of both murders. But probably like anybody else, if you say, 'When was DNA first used in a criminal case to prove somebody was guilty?' you would start thinking about the 1950s or 40s. 1986, 1987 probably wouldn't feature."

### **Q: What was your initial reaction when you first read the scripts?**

My initial reaction was, 'Is it going to be OK with the families?' That was my first question to the director James Strong. He assured me they were OK with it, because obviously your first human response is they will have to recall events. Although, I would imagine, it's something that's going to stay with the families for the rest of their days. So if it's to re-focus people on what horrendous crimes this man committed, then perhaps you're doing something worthwhile."

### **Q: What was your take on David Baker when you both researched him and met him?**

"I went up to Leicester to meet him and visited all the places that I wanted to. So when I was talking about Ten Pound Lane or the Black Pad or Narborough or Enderby, I knew in my sense memory what the pictures were."

"When I spent time with David he was tremendously open and simple and clear about what his job was. Generally as well as specifically on the murders."

**Q: Did you take anything in particular from what he said in terms of playing the role?**

“The obvious thing is the accent. I have to find the Leicester accent. It’s a mindset. I played a policeman a couple of years ago, having never really played that role before. The word David used to describe interviewing and making progress is ‘persistence’. There’s a certain quiet persistence in his approach to policing. So I got that from him. And obviously a little bit about his own background, just to help me become David Baker.

“Obviously this is a drama not a documentary. James Strong, the director, having made a documentary about what had happened felt there was a drama to be filmed. So we do things - David said the police picked the phone up to Alec Jeffreys to say, ‘there’s this thing in a paper about what you’re doing with DNA and paternity and immigration. Do you think you can apply it to a murder inquiry?’ We physicalise that.”

**Q: The murders had a big impact on these three close-knit villages?**

“Absolutely. When you go there it becomes crystal clear how much of an impact it must have had both in 1983 at the time of the first murder and then - ‘Oh my God it’s happened again’ - in 1986.”

**Q: Did you get a sense of the dogged determination the police force had, even though officers worked for a number of years without a result?**

“Particularly David, yes. He said it was always there. You start with, say, a group of 40 officers doing house to house inquiries, interviews, the forensics, the pathology. Various people attached to different aspects of the case. Then when results were not forthcoming it gradually dwindles because then other unconnected murders happened elsewhere over the next three years and also had to be investigated. But there was always a team of people trying to pursue this killer. Certainly David - it never left him. It’s that word ‘persistence’ again.”

**Q: Working with John Simm again for the first time since Men Of The World in the mid-1990s?**

“John Simm is an old friend. We’ve known each other a long time. That was just a real bonus. I love working with John. We had talked every so often over the years, ‘Wouldn’t it be nice if..?’ And then this came up and it was a nice collision of an opportunity for us to work again. Sometimes with people it’s, ‘Oh it feels a bit like last week.’ We’ve not been in and out of each other’s pockets over the last 20 years but we meet socially. It was always my desire to work with John again. He is one of our finest actors.”

**Q: What was the relationship like between David Baker and Alec Jeffreys?**

“Professional in terms of getting the job done and in that process they got to know each other. We all went out for dinner during filming in Leicester. David and Alec are delightful company.”

**Q: As an actor who has played many roles, can you imagine doing the job David did?**

“I think there are similarities. David talked to me about that when we met. There is a certain forensic approach to trying to get under the skin of playing somebody. Because what interests me is pretending to be somebody else. ‘I do this but they do that. I wouldn’t say that, but they say that.’ It’s being rigorous and thorough about finding something where somebody’s metabolism is different from yours - quicker, slower, more erratic. And just practising that to a level where it becomes a running condition you feel inside you - that somebody else who is not quite you. That’s just more interesting, partly because I get a little bored with being me.”

**Q: Your thoughts on Alec Jeffreys and that ‘Eureka Moment’ that has made such a huge global difference in policing and many other areas?**

“We’re just getting on with filming but occasionally you stand back and go, ‘You actually did this.’ That’s what Leicestershire should be proud of. The fact these two men were literally in the vicinity. Alec doing his work and then David is forward thinking ahead of his time. Musing on how he can get a result on a case that is proving very, very difficult to find the perpetrator. Reading about Alec in a paper and thinking, ‘Maybe he could apply that technique to this?’

“If they weren’t together within the radius of Leicester, would it have ever happened? I like to think it would. But the fact it came out then and in such a dramatic way to convince several thousand men to come forward and volunteer to donate blood.

“Because this new thing was like a supermarket barcode. A genetic fingerprint that is completely unique. It’s getting the fact that was such a new idea. It’s such a part of our society now. But to be in at that ‘Eureka Moment’ - when you stand back, you think, ‘Wow. That’s quite a thing. A worldwide thing.’”

**Q: Policing was very different in the 1980s, before national computers and tape recording of interviews - using DNA was a real leap of imagination by David Baker?**

“Absolutely. David also took the leap to use computers, to use tapes in interviews. There was all sorts of new stuff as well as the introduction of DNA fingerprinting. The use of computers was new. The use of recording equipment to ensure not only what the person being interviewed was saying was correct but that the police were correct. And they weren’t culpable of oppressing a suspect.”

**Q: As well as leading to countless convictions, DNA has also cleared many innocent people, including some on Death Row in America who would be dead now. They are alive and free today because of DNA testing?**

“That happened in this first investigation. DNA evidence cleared the teenager who was arrested for the Dawn Ashworth killing. He turned out to be innocent.”

**Q: An important story to be told in a TV drama?**

“ITV are commissioning some very interesting dramas and they obviously feel this is an important moment. DNA is used all over the world now. And back in Leicester they used DNA to confirm the fact it was the remains of King Richard III in the car park.”

**Q: DNA testing has also been used to finally identify unknown soldiers in World War One Graves?**

“With DNA, if you do find remains you can confirm identity and give families closure.”

**Q: Have you ever had a ‘Eureka Moment’ of your own?**

“When Sergio Aguero scored the goal for Manchester City to win the Premiership in 2012.”

## JOHN SIMM IS DR ALEC JEFFREYS



### **Q: Code of a Killer brings an extraordinary story to a wider audience?**

"I didn't know anything about it until I read the script. It's an extraordinary and amazing story. Alec Jeffreys is an incredible man who made one of the most important scientific discoveries ever. It changed the way the police find criminals. What a story to tell. I think it will amaze people who don't know about it. And, of course, it's a true story."

### **Q: You met Alec Jeffreys during filming?**

"We met at a dinner in Leicester while filming scenes at the university and sat next to each other. Alec regaled us with scientific tales and wonderful stories. If anything, my admiration for him went up after meeting him. He's a really lovely man."

"There were certain details I wanted to know. For example, what he did at the 'Eureka Moment'. Did he jump up and down? How excited did he get? We had already filmed that scene and I think I got it fairly close to what he described. We discussed things in the script and how he first became interested in science."

### **Q: You visited the actual laboratory at Leicester University where he discovered DNA fingerprinting?**

"Alec showed me exactly where it happened on that Monday morning back in September 1984. It's quite something to be there. You do get a real feeling of wonder standing there."

**Q: And used some of his own period scientific equipment in the drama?**

"I did. I found out half way through using all this equipment that the pipettes and everything had Alec's name on them. I thought the art department must have done that for the production. But most of it was the actual equipment, machines and material he used in his laboratory at the time. And I play with them trying to look as if I know what I'm doing. That felt really special."

**Q: You grew a beard for the role to capture Alec's look in the 1980s?**

"I had enough time to grow it before we started filming. It was dyed as well - I had dyed hair and a dyed beard. I shaved it off when I got back at the end of filming."

**Q: Did you do your own research on Alec?**

"I watched him on YouTube and they sent me quite a lot of footage of him. I was interested in how he spoke then and how he moved around the lab. There was quite a bit of film of him being interviewed. I didn't want to do an impression of him. I just had to get an essence.

"He is quite a character and he speaks differently to me. I studied his voice and taped snippets of it and put it on my phone as voice memos. So I'd have that on me all day and every so often I'd play him talking. Just to get the feel of him. His physicality and his manner.

"Although I, of course, wanted to meet him, I was glad that didn't happen until we'd started filming because I didn't want to copy him, especially now as an older man where he might have changed a little."

**Q: Were you good at science at school?**

"Not really. It's one of the best things about this job. You get to pretend to be all sorts of different people. And it was a real honour to play Alec Jeffreys. The reason I took the job was because I realised the importance of what he did. To be able to play a real life genius, a legend of the science world, was the thrill for me.

"Like most people, unless you're into science and know about it, I was pretty ignorant about the details before this. So it was great to go over it and learn. To discover what he actually did.

"The good thing about the script is the story of the DNA discovery is very clear and easily understood. And it's quite amazing that it happened by accident. Then it just so happened a police detective called David Baker was looking for this killer in the same area, read the article about DNA, took a chance and was very brave.

"They are both incredible characters. Real life heroes. Hopefully the brilliance and bravery of these two men will be recognised by a wider audience."

**Q: How would you sum up the relationship between Alec Jeffreys and David Baker?**

“A lot of it has been dramatised to tell the Code of a Killer story. David was a visionary in terms of policing. He had the imagination to see how this might help them catch the killer at a time when they were running out of leads. It initially led to a young man who had confessed to one of the murders being released because the DNA test proved he was not involved and that he had given a false confession. David was a very brave man to stand by this new discovery and to trust Alec’s science.”

**Q: The drama is obviously very sensitive to the fact that at the centre of this story is the murder of two teenage girls?**

“It was done with the full knowledge and support of the families and, of course, you have to be very careful. These are real people and real lives.”

**Q: Alec had concerns at the time about his personal safety?**

“There was some concern the killer would know where he lived and Alec was the man who gave police the means to identify him. There were also people turning up outside his house after the DNA discovery. He was inundated with people asking for his help in immigration and paternity cases.”

**Q: It’s mind-boggling when you think how this discovery is now used around the world in so many ways?**

“The ripples of the discovery he made continue to get bigger and bigger. It becomes more and more important as the world turns. I wasn’t into science before this but it seems since we’ve filmed this that DNA is in the paper every single day. Every time I look, DNA has done something else.”

**Q: Have you ever had anything approaching a ‘Eureka Moment’ yourself?**

“Perhaps when I first tried acting. My first ever drama class when I was coaxed into going. It was Billy Liar. As soon as I started it and everybody went, ‘Oh, well that was pretty good,’ I thought, ‘Maybe I could do this?’ And every time I hear The Beatles.”

**Q: You’re reunited on screen with David Threlfall for the first time since you played Kendle Bains and Lenny Smart in the mid-90s’ BBC1 comedy Men Of The World?**

“That sitcom wasn’t a big success but I thought it was quite funny at the time. David and I also sang the theme tune. I remember how much fun we had recording it. We’ve been good friends ever since.

“We can’t quite believe it’s taken this long to work together again. We’ve always been meaning to do something on stage and it almost nearly happened. It wasn’t the reason I took the job but it was a big factor. I thought, ‘Well, I’d love to work with David again.’

“He was one of my heroes when I was younger. I saw him play Smike in Nicholas Nickleby and he blew my mind in that. I’ve always been a huge fan of his. He is one of the greatest screen and stage actors this country has to offer and has been for a long time. David Threlfall is another genius.”

**Q: The use of DNA testing is so commonplace today but it is amazing to think this discovery was only made in 1984?**

“It is quite incredible. You think it’s always been around. It’s closer to the Life On Mars era, really. Then making use of new computer data bases. All of that was in its infancy.

“It was a real privilege to dip into that world which was just incredibly fascinating. And to get the chance to meet Alec and spend an evening chatting with him is something I will never forget. He’s one of the most incredible men I’ve ever met in my life.”

## **DETECTIVE CHIEF SUPERINTENDENT DAVID BAKER**



**Q: What was your role within Leicestershire Constabulary when the investigation into Lynda Mann's rape and murder began in November 1983?**

"I was a Detective Chief Superintendent and Head of CID. So I was in charge of all the crime investigation in the county."

**Q: Can you tell us about Lynda Mann and the circumstances of her death?**

"Lynda Mann was a 15-year-old girl who left her home in the early evening to visit a friend in Enderby. She lived in the next village, Narborough, but never reached her friend's house.

"She was reported missing from home at about 11 'o clock that night when her parents returned from the local pub. We mounted a search, as much as we could at that time of night. But we had no idea where she had gone or where she was.

"It wasn't until the early hours of the next morning when an ambulance driver is cycling along Black Pad Lane to work at the ambulance station that he saw the girl's body lying in a small wood. A full scale murder inquiry ensued. We had house to house inquiries in the villages of Narborough, Enderby and Littlethorpe and a full search.

"But there were no actual sightings of the girl from when she left her home until the body was found. We did a full forensic search of the wood where the body was found and a major incident room was set up."

**Q: Why were police convinced from the start the killer must be a local to these three close-knit villages of Narborough, Enderby and Littlethorpe near the M1?**

“It was the remoteness of the footpath where Lynda was subsequently found and there were no other incidents in the area. So it looked very much like it was local. As though somebody must have known Lynda and intercepted her before she was killed.”

**Q: The rape and murder of Lynda Mann had a huge impact on those local communities?**

“There was a great apprehension in the villages, bearing in mind Lynda’s age and the fact that a lot of children of the same age would be out and about in the villages at around the same time that Lynda was. So parents were most concerned. A lot of people went to the same school as Lynda and knew her.”

**Q: Police officers are professionals but also human beings. What was the reaction of you and your colleagues to Lynda’s murder?**

“We were all concerned - her age and the brutal way in which she met her death. It caused a great deal of concern, not only amongst the public but, of course, amongst officers that dealt with the inquiry and the family.”

**Q: Fears the killer would strike again proved correct. Can you tell us about Dawn Ashworth?**

“In 1986 there was another girl missing in similar circumstances. This was Dawn Ashworth. She had gone to visit a friend in Narborough. The friend was out and so Dawn was walking home. We believed she was walking in a wooded footpath area to and from her home and where her friend lived.

“A search of the area failed to reveal the body initially and a full scale search was then conducted. Because it was adjacent to the motorway, we were also looking on the motorway embankments and we conducted a search of the fields. A dog handler on the Saturday morning after she was reported missing found her leather jacket first and then her body hidden in a hay field, covered with grass and nettles. An attempt had been made to fully conceal the body.”

**Q: Police assumed from the start the same killer was responsible?**

“Yes. There were a lot of indications in view of the location where the body was, the circumstances in which she went missing and although the time of year was different and the time of day was different, there were that many facets of it, including the way she had met her death, that we felt the two were connected. And we proceeded on that premise.”

**Q: A local 17-year-old was subsequently arrested?**

“This person came to our notice. His motorbike was seen in the vicinity, unattended. He couldn’t account for it. He had spoken of where the body was likely to be found, to associates of his, so he was arrested and interviewed. During the interview he made certain admissions in respect of the death of Dawn Ashworth which resulted in us charging him with her murder. He was remanded in custody.

“We were firmly convinced the two murders were connected but he denied all knowledge of the murder of Lynda Mann and there was nothing to connect him with it, except, loosely, a blood sample which we took from him, which actually connected to both girls. But, again, that was only a percentage of the population.

“We needed to progress this further. There was no other forensic evidence available to us and it was at that point that I’d heard of Dr Alec Jeffreys’ work at Leicester University in respect of DNA. And the fact he’d used it on paternity cases and he was able from the DNA test to identify an individual, as opposed to a person who was a percentage of a blood group. So we contacted the university and asked if he would be able to do a DNA test for us in respect of this person and the Lynda Mann samples.”

**Q: The result was unexpected, in at least one respect?**

“The result that came back was unexpected because it eliminated him from any connection with Lynda Mann. So in consequence of that, both in fairness to him and to ourselves, we organised a further test on the samples from Dawn Ashworth. And that then came back completely negative and established firmly that he was not responsible for the death of either girl. But there was an individual whose DNA matched and was responsible for the murder of both girls. So we had to start from scratch.”

**Q: In one sense it was a blow to the inquiry but it also confirmed your belief that the same man was responsible for both murders?**

“It did, yes. It also clearly established this person’s innocence and, of course, he was released from prison straight away.”

**Q: What were your thoughts in deciding mass DNA screening was the way forward - quite a leap at that time with this new technology?**

“We’d been through two murders. We’d knocked on pretty much every door in the three villages, asking questions of where people were at the material times. And we had got absolutely nowhere with it. We’d also carried out inquiries on people that worked in the area, that used the area for schools and pleasure and what have you. So we had to get another ingredient into the mix to establish the veracity of what people were telling us.

“Mass screening was not new. I was aware that we had done actual fingerprint testing of a community under the old ink method many years ago. So we now had the DNA technology and there was a strong possibility we could match the DNA with an individual. There was a chance for blood screening to succeed.”

**Q: Was there resistance to the idea and any scepticism?**

“Yes. There was some scepticism as to how we would succeed with it. Another element was the actual cost. But with the co-operation of the Forensic Science Laboratory we were able to eliminate some of the costs by just normal blood count screening before we went on to DNA testing. We’d got to do it.”

**Q: How did men in the local community respond to your appeal to be DNA tested?**

“We had 100 per cent co-operation from the local community. We mounted a pretty comprehensive publicity campaign using all aspects of the media and we set up the sampling centres. I think of all the samples we asked for, only two people refused. And they were eliminated on other grounds.”

**Q: You realised from the outset the killer would try to avoid what was the world’s first DNA manhunt and attempt to beat the system?**

“That’s right. We were aware of what the possibilities were and the fact somebody might endeavour to bypass the system and get someone else to take the test for him. So we built in one or two checks with the blood sampling. And, of course, that’s exactly what happened.

**Q: While this DNA testing was taking place, there was a real fear the killer might claim a third victim?**

“Undoubtedly. We had taken advice and there was every possibility the murderer could strike a third time. That’s what encouraged the local population to co-operate and give us the samples we required.”

**Q: It was a massive and lengthy process. Did you ever have any doubts during those months that it might not succeed?**

“Yes. You’d be remiss if you didn’t have that apprehension. But we trusted in the system and it came up trumps.”

**Q: Detectives tend to believe they make their own luck?**

“I think so, yes. You do. You take risks at certain stages of your career and this was one of them.”

**Q: What was the reaction of you and your colleagues when the killer was finally arrested and confessed?**

“There was a great deal of satisfaction of a job well done. But it was quite an anti-climax, really, Three, four years’ work was over in a matter of minutes.”

**Q: The local - and wider - community must have felt a huge sense of relief?**

“I’m sure the local community were very relieved that we had given them an answer.”

**Q: Do you think the killer would have been caught without DNA testing?**

“It’s a difficult question. On the basis of the evidence we had available to us at that time, there is a doubt. But, of course, if he had continued in his course of conduct you never know what might have come up.”

**Q: Looking back now, how do you feel about those historic events for policing?**

“It’s very rewarding that you were part of bringing this technique to use in forensic science. Because every time it’s used now, you do get a buzz. Especially with some of the more remote cases where somebody has come to light 20 years after he has committed a crime and he is brought to justice.”

**Q: How has it changed policing?**

“It’s changed policing tremendously because there is now more care taken at scenes of crime, more samples are recovered which can be subject to DNA testing and the forensic side of crime investigation has increased tremendously.”

**Q: Did you realise the global significance DNA fingerprinting would have for police when you were involved in these two investigations back in the 1980s?**

“Yes. Once we’d used it and the implications became clear, we were keen then to publicise it to the police forces in the UK and also the international community.”

**Q: How do you feel about these events now being reflected in a TV drama?**

“It’s interesting, to say the least. I’ve done quite a few bits for documentaries to spread the word of it. But it’s interesting to see this drama is going to a global audience.”

**Q: And your thoughts about being portrayed on screen by David Threlfall?**

“I’ve met David and I’m quite sure he will do a first class job.”

## PROFESSOR SIR ALEC JEFFREYS



### **Q: Why did you agree to take part in Code of a Killer?**

“This is a landmark case of the 20th century. So it’s very much a tradition of TV to dramatise these sort of investigations. It is by any measure an extraordinary drama. And it’s not just DNA. It’s that combination of DNA and excellent police work, converging together to crack what were very, very serious crimes.

“2014 marked the 30th anniversary of the very first DNA fingerprint and after the initial work of immigration cases and paternity cases, we then got involved with the Dawn Ashworth murder case in Enderby. That is an extraordinary case and the story needed to be told. Particularly with such distinguished actors as John Simm and David Threlfall playing the key parts.”

### **Q: How do you feel about John Simm playing you?**

“John is such a nice guy and a great actor. I can’t think of anybody more suitable to portray me. There’s something about him that reminds me of myself. He’s very much a character actor and has done a great job. I was already a fan of his work.

“It was a slightly surreal experience to meet ‘me’. My hair was somewhat longer than that. I was a bit of a ‘beardie-weirdy’ back in the mid-80s. But in terms of overall build and looks and so on, it’s not a bad match.”

**Q: What was the background to that Monday morning on September 10th 1984 and the 'Eureka Moment' when you discovered DNA fingerprinting?**

"I had arrived at Leicester University in 1977 and one of my first jobs was to try and identify variation directly in DNA, in the genetic material. We were one of the first labs ever to attempt this. And we did it. But then our interests started focusing on highly variable bits of DNA. Why? Because we were interested in using these for medical genetic analysis. Trying to identify genes involved in inherited disease and cancer, for example.

"So when the key experiment happened it was purely accidentally that we came up with what proved to be the world's first DNA fingerprint. That was Monday morning on the 10th of September 1984, five past nine. Imagine, if you will, me rather bleary from a weekend doing whatever, going into the dark room, developing this piece of X-ray film, switching the light on and then looking at this very complicated bar-coded patterns on the film.

"The first reaction was, 'What on Earth is going on here? This is not what I expected.' It was quite a complicated looking mess. Then the penny dropped. Lo and behold here were, by accident, the world's very first DNA fingerprints.

"On that bit of film we had the DNA of a technician from the department and her mother and father. We could see how we could tell them all apart in a single DNA test. How the DNA fingerprint of the technician was a composite of bits of mum and bits of dad. That told us we could use it for family relationships.

"The film also contained a whole series of non-human species. We had a cow and a monkey and a rat and even tobacco DNA. Everything seemed to work. So not only was this DNA-based identification applicable to humans, it was applicable to just about everything. And that opened up great vistas, not just in terms of human applications but things like conservation, biology, wildlife, crime and so on. All of which have come to fruition."

**Q: And that Monday morning itself in 1984?**

"It really was a 'Eureka Moment'. That is not myth. The best description I've ever seen of how we came across DNA fingerprinting was a school project from my grandson who said, 'My grandad invented DNA fingerprinting by accident when he was messing around in the lab.' And that is as good a description as you could possibly get. It was purely by accident we stumbled across an alternative use for these bits of DNA."

**Q: You were pushing at an open door and immediately realised the full implications of this discovery?**

"It was doors opening upon doors that we hadn't realised were even there. So it was five past nine on a Monday morning when we got that result. At ten past nine we were thinking serious forensic thoughts, 'This is DNA-based biological identification.' The important point is that at 9am, five minutes before developing that film, I didn't have a single forensic thought in my head. My focus was on medical genetics.

"We didn't just realise the full implications of what we had discovered. We ran with it. By the end of the year we'd improved the technology to the point where we knew it could be applied. By April 1985 we were doing the first DNA case ever anywhere in the world - in an immigration dispute."

**Q: How would you describe the outcome of that immigration case where DNA identification was used for the first time at a tribunal?**

"It was my golden moment. Being down at the Immigration Tribunal in London where we saved a young lad from deportation by proving he was, indeed, who his family said he was. The look in the mother's eyes, that was a magic moment. Suddenly two years of grief and stress just lifted off her. All thanks to DNA."

**Q: Did you have any doubts this new DNA technique might not be endorsed by the authorities?**

"The question was, 'Would they accept it?' So here was this long-haired scruffy academic coming out of nowhere, waving these bits of DNA around. And, of course, nobody had heard of DNA in those days. Everybody knows today that you can use DNA to catch criminals and work out paternity cases. That's common knowledge now. Back in those days it wasn't even on the radar. So we had what I thought was going to be a gigantic mountain to climb of getting this evidence accepted. But, again, it was pushing at an open door. We took the first paternity case on in the summer of 1985 and then the Enderby murder case came in early 1986."

**Q: What was your reaction when police first contacted you about a murder investigation?**

"This was a double rape and murder case local to Leicestershire. So we obviously felt a huge moral obligation to take it on. We could not say no. It was a very important investigation. But we took it on in the full expectation we would get absolutely nothing out of it in terms of results.

"Nobody had ever attempted this before. It's one thing doing DNA fingerprinting on fresh blood samples. But real crime scene samples were a whole new and different kettle of fish. So we took it on expecting to get nothing and, to our amazement, it worked."

**Q: The first test requested by police did not provide the result they were expecting?**

"It was a real shock. And I think the person most shocked was myself. The police already had this young man in custody who had confessed to the second murder but not the first. My remit was to confirm he was tied in to the first murder. But also to try and tie him in to the first murder because both murders were very similar. So we took that on expecting to get everything matching up.

"What we found was the key forensic evidence from both victims matched at the DNA level. So there was a single rapist/murderer out there. But the results were a complete mis-match with this young man.

"My first reaction was one of complete horror. That there was something wrong with the technology. Not that this was a false confession. It took additional testing, not just by me but also by some of my colleagues at the Home Office Forensic Science Service who we gave these samples to. We all came to the same conclusion. This was a false confession."

**Q: You had cleared a young man who may well otherwise have gone to prison for a long time?**

"I have little doubt, given the confession and other circumstantial evidence, he would have gone to jail for the rest of his life. And the true perpetrator would still be out there killing other people."

**Q: Then came a police request for mass DNA screening of men in the area?**

"This was the only lab in the world that could do this sort of DNA testing at the time. So we were inundated with immigration disputes, paternity disputes and requests from other criminal investigations. I was also trying to keep the science going and negotiating with Home Office ministers about ramping up the immigration aspect. I was a very busy person. So it was a great relief when I heard the Forensic Science Service was going to carry on with the next phase of the screening."

**Q: Your reaction when in September 1987 the real double rapist and the killer was arrested and later convicted?**

"Great relief for the families of both victims. That they had caught the perpetrator and those families could now start moving towards closure. Also huge personal relief. Here was a serial murderer who I knew had to live fairly close to where I lived, who was out on the loose. He would have known who I was, where my laboratory was, where my home was. So there were issues of personal security."

**Q: Your name, that of your team and the University will live on forever in history. Now retired and looking back, how do you feel about that?**

"I still have to pinch myself. It really is a fairy tale. We knew we were on to something, right back at the beginning in September 1984. But we had no idea just how big it would get. We always thought DNA, in the forensic arena, would be a technology of last resort. So if you were to tell me back then that in 2015 we would now have DNA directly having touched the lives of at least 50 million people - a startling number - worldwide and every single one of those applications is a human drama, I would have said, 'No way.' It is gigantic. I think we're up to one per cent of the entire world population has now been directly affected by this."

**Q: It has given police around the world the most powerful scientific tool they have ever had?**

"You can debate whether fingerprints was equally or more important. But DNA fingerprinting was a new and very powerful tool. You have to put it in the context of what they had before with genetics. Which was blood groups of very limited utility. I remember at the time when we first came up with DNA, there were paternity tests in particular where they said, 'You don't need DNA. You've got all these blood groups and they're great. We can get to a point of being 99 per cent sure that man really is the father of a child in a paternity case.' Well that's not good enough. If you happen to be the one in a 100 where they get it wrong and you're being falsely strapped for maintenance, year in year out. So there was a degree of resistance from the old blood grouping community. But that collapsed almost immediately. And that is a huge area of science that has gone completely extinct. It's just vanished."

**Q: Has the use of DNA fingerprinting become even broader than even you expected?**

"Oh yes. In the way it has played out over the years. Obviously there have been big technological advances. The way we did it back in the mid-80s is Stone Age technology. Nobody would do it that way now. Today it is actually visually rather dull. You have a machine that gets the DNA and another machine that reads off a profile. So it's basically hitting a button and seeing what happens."

"But in terms of a range of applications, first of all on the human side you can extend all this out to not just forensics and paternity cases but whole issues of human origins. Where we've come from. A very good example of that would be the discovery a couple of years ago of King Richard III buried in a car park here in Leicester. DNA played a significant part in identifying those remains. By tying a certain type of DNA within the remains through to known living descendants of Richard III."

"And that was a criminal investigation. This is a missing person case. 500 years old. Where one is using genealogy as a critical part of the investigative process. So the whole area of genealogy is really important."

**Q: The numbers impacted by this technology are huge?**

“Gigantic numbers. All I can say is the current estimate of how many people are now sitting in criminal DNA databases around the world is likely to be 50 million.”

**Q: DNA testing is commonplace now and taken for granted, especially by younger generations. It's even a staple of ITV's Jeremy Kyle Show. Did you envisage that widespread use?**

“No. I never saw the impact being that broad. It is slightly sad that even within the forensic community you're starting to see people losing the track of the history of this. 30 years is nothing in the grand scheme of things. This is a young technology that is still evolving very rapidly indeed.

**Q: It may be astonishing for people of a certain age, but Code of a Killer - set in the 1980s - is a period drama?**

“It is a period drama, yes. If you look at what we were doing then and the way that a forensic laboratory would do the corresponding analysis now, it would actually look very different. But the basic concepts haven't changed one little bit. You target this DNA that are extremely variable between people and use those to individualise. That's exactly what we're doing now and what they did then.”

**Q: Was there ever a hope of another 'Eureka Moment' in the rest of your career?**

“Most scientists would not get a moment like this. It is actually something very rare in science. To have a sudden blinding revelation which just opens up doors like this. To get that once in your career you count yourself very fortunate. To get it twice is just pure greed.

“But I've done stuff before DNA fingerprinting and stuff after DNA fingerprinting which I'm equally proud of. These are fundamental scientific discoveries but nothing is ever going to rank along with DNA fingerprinting. Simply because of the social impact.

“Code of a Killer is a recognition, first of all of fundamental curiosity-driven research that's impacted on the world. So we must protect that type of investigation in universities.

“And there are so many thousands upon thousands of people now engaged in forensic DNA analysis right around the world that I think this TV drama is a recognition for the whole community. Not just for me.”

**SIMON HEATH  
EXECUTIVE PRODUCER**



**EXECUTIVE PRODUCER SIMON HEATH**

**Q: How did Code of a Killer come to the screen?**

“The director James Strong and I have worked together on two other projects. A film called United for BBC2 and then The Great Train Robbery for BBC1. James had directed a documentary about the discovery of DNA fingerprinting and how it was used to catch the killer. He mentioned it to me, sent a couple of pages and a link to the documentary. I watched it and I was open mouthed at the story and the way it evolved. It was something no script writer could make up. I immediately said, ‘I think it would make a fantastic drama.’ It had been in James’s head for a while because he had made the documentary 12 years ago. We teamed up with a writer James had worked with previously, Michael Crompton, and took it to ITV.”

**Q: It is surprising this story has not been made into a TV drama before?**

“Yes. Which was always the thing people said about United, about the Munich Air Disaster. You know you’re on to something then. Because there’s all kinds of reasons why stories don’t get to the screen. In the development of Code of a Killer we discovered there were a couple of previous attempts to bring the story to the screen. But there’s timing and research and access and, ultimately, delivering a script the broadcaster feels confidence in.”

**Q: An extraordinary story?**

"I love the fact it has these two disparate elements. A science story - science stories always fascinate me. That ability of one man to break through the barrier of knowledge. But then a classic crime investigation with a dogged detective who's prepared to take a massive leap of faith. They almost sound like feature films in and of themselves. And then to actually weave them together and create a unique DNA in themselves, it just feels to me like a no-brainer."

**Q: What approach did you decide to take?**

"We realised there was quite a lot of story before our two heroes - David Baker and Alec Jeffreys - met each other. So there was a discussion of where was the best point to start? Michael, James and I agreed it was fine to watch those stories happening in parallel. As long as you were suggesting to the audience that at some point these two strands were going to come together in a very potent way. In some ways they meet quite late in film one. And then film two is about how the science and the police really do come together to catch a killer."

**Q: DNA testing is commonplace today. But the world of policing and science was a very different place in the 1980s?**

"It was. It's interesting not just being on the cusp of DNA fingerprinting when our story is set but also on the cusp of PACE (The Police and Criminal Evidence Act 1984). So all of the regulations we've come to see as standard in terms of police procedure, having a solicitor present, recording interviews and so on, they just weren't around."

"Even the use of computers was relatively new in investigations and that's acknowledged by David Baker's senior officer early in the first film. David was very much a pioneer of computers as well and sat on a central committee. So we're talking about almost the last days of an old era of policing. DNA fingerprinting, computing and PACE ushered in a brand new era that started at the end of the 80s."

**Q: This is, of course, a heartbreaking and sensitive story for the family and friends of both victims, Lynda Mann and Dawn Ashworth. You liaised with the families?**

"Initially we approached both the mothers. Dawn's mother Barbara spoke to us straight away and was fantastically supportive and open and shared with Michael a huge amount of stuff. And it's through her we've contacted Lynda's mother Kath. She's read the scripts and is very happy with the approach we're taking. I think to have the blessing of both mothers was hugely reassuring. We're trying to portray that aspect of the story as sensitively as possible. You see very little, if anything, of the attacks. It's just the sense that they did happen. Because, in essence, this is about how Alec and David came together and achieved justice for those two mothers and the rest of the families."

“Barbara, who we have more direct communication with, is very pleased because it keeps the memory of her daughter alive. She said to us that she wants as many people as possible to watch the films.”

**Q: The focus of the drama is not on the killer?**

“No. That is a deliberate choice. We’re not interested in his point of view. We’re interested in how David and Alec’s work flushed him out, effectively.”

**Q: Can you tell us about Alec Jeffreys and David Baker as characters and the casting of John Simm and David Threlfall?**

“Alec Jeffreys was very young when he made the discovery. So we were looking at a younger actor and John Simm is youthful for his age and seemed to fit the spirit of Alec, who is not a toff. And I think John plays that rather well, that mix of someone who is an academic but he’s also a bloke from Luton.

“With David Baker, who was 15 years older than Alec, he’s a classic old school copper in the sense of being quite lugubrious, doesn’t get easily flustered, doesn’t get overly-excited when the breakthroughs come. And David Threlfall delivers that perfect dead-pan...it’s a Midlands thing. If something’s fine, that’s brilliant. People don’t get over-excited.”

**Q: What sort of relationship did Alec and David have in the 1980s?**

“One of the things the film has done is to extrapolate that relationship in film two. Because in some ways their relationship was at arm’s length. But as a way of capturing the way the science worked alongside the police, for the purpose of the drama it seemed much better to expand that relationship. Because what’s interesting now, with the film being made, is they are seeing even more of each other 30 years on. There was a dinner while filming which was delightful. David and Alec and their wives came along and various other people connected to the University of Leicester. It was wonderful to be able to host it and thank everyone for allowing us to tell the story.”

**Q: The interview is taking place in the very same laboratory where that ‘Eureka Moment’ happened in 1984. It’s quite an astonishing thing to contemplate?**

“It is. When DNA testing was used firstly in immigration and paternity cases, Alec was called away on lecture tours and he went on a couple of tours of America. He was on a chat show in America and the first question was, ‘Well, if this DNA fingerprinting test is so important, why wasn’t it invented in the States?’ I think that sums up the arrogance of a broader world. That they couldn’t believe this research scientist working in a slightly unfashionable British university had the major breakthrough in criminal investigation in the 20th century.”

**Q: David Baker was a visionary in terms of making that leap in policing?**

“He was. David is a very traditional, solid man. If you were writing this character in a drama you might get some brand new young detective coming in. David had done his time but he was someone who was prepared to use any tool available to make an investigation work. That started with things like computers. He was a pioneer of taping suspects’ interviews, which was incredibly important. But then also when he heard about the science of DNA fingerprinting. Bear in mind all the articles were saying at that time was that it was applicable to immigration and paternity cases. Alec hadn’t envisaged it being used, initially, as a tool of police investigation. Partly because there were questions over whether DNA would get contaminated or degrade at crime scenes. So David was taking a big leap when he approached him.”

**Q: The very first result of a criminal DNA test actually cleared an innocent young man who may have otherwise spent his life behind bars?**

“It’s one of the amazing things that it saved somebody’s life, really. A local teenager had confessed to the murder of the second girl. It was only his denial of the first murder, and I think David’s own genuine concerns about the validity of the confession, that led David to Alec. But it was almost the only piece of evidence the rest of the world would have believed to reverse the direction it had gone in. It needed something as categoric and scientific as DNA fingerprinting for people to believe the confession was a false one.”

**Q: A younger audience might be surprised it was only discovered some 30 years ago?**

“I think they will be surprised. There are lots of people who assume DNA fingerprinting has been around since the Second World War. And so to know it’s only 30 years old - in America it was only first used or allowed in court in the 1990s. This is very recent stuff. It will be surprising.”

**Q: What locations have you used for filming?**

“We’ve been all over, including the university in Leicester. There is a disused science park at Dagenham in east London which has been fantastic. Both to recreate Alec’s laboratory, because we can’t get under everyone’s feet at Leicester Uni while they’re still trying to do their work. Also Aldermaston, which is where all the actual mass screening results went. So we created a big scale laboratory there. We also built Enderby Police Station there.

“Then in terms of the villages and the houses that are period correct, we’ve gone right out into Surrey and found places around there that match very closely the locations we need to get. There was never any question of filming in the real villages. It did not feel right to be shooting there. That was an easy decision to make.”

**Q: The geography of those three neighbouring Leicestershire villages - Narborough, Enderby and Littlethorpe - is important. These crimes had a big impact on those communities?**

“Yes, absolutely. Visually we’ve tried to find locations that link the houses with the Black Pad and the Ten Pound Lane. So you really aware of the fact this is a very small area. So that when the mass screening comes about you understand if you go round a five mile area, there are only 5000 men that were of the correct age. It was still an extraordinary endeavour. And that those men came forward voluntarily because of the tight-knit community spirit that had been ruptured by these terrible crimes.”

**Q: While this is relatively recent history, it is a period drama. What were the challenges of depicting this era?**

“It is always difficult sourcing period cars. But I think the art department have done wonderfully. I worried about period science equipment but Leicester University has been fantastic and we’ve shipped down lorry loads of props to flesh out our ‘Alec’s laboratory’ and our Aldermaston. When you’ve got such a fantastic team they can access this stuff. I have no idea where some of it comes from but it just looks brilliant.”

**Q: This was a time before mobile phones when many homes also did not have telephone landlines. Dawn Ashworth was attacked having called on a friend to tell her she could not go out that night - because her friend did not have a landline to call?**

“It is extraordinary. It was not uncommon for people not to have a telephone in the house. It was the age of the phone box. But if two houses didn’t have a phone and you were living in the villages, you just flitted backwards and forwards. Those places had been very safe places to live and then these terrible murders happened.”

**Q: How does it feel on a personal level to bring a story as important as this to a wide audience?**

“I always feel I’m very privileged to have this job because you get to explore other worlds. You’re making a drama but you get to learn so much. Learning about DNA fingerprinting has been a real privilege. It’s something I got very excited about. Then being able to make a matter of record this brilliant historical moment where David Baker and Alec Jeffreys came together. As a producer you’re privileged. I’m curious about the world and drama is a good way of accessing those different worlds.”

## SYNOPSIS

### EPISODE 1



In 1983, in a small village outside Leicester, 15-year-old Lynda Mann is found by a footpath, raped and strangled to death. A year on, after an exhaustive but fruitless search for the killer, Detective Chief Superintendent David Baker is forced to scale down the investigation.

Meanwhile, just a few miles up the road at the University of Leicester, scientist Dr Alec Jeffreys invents a remarkable technique to read DNA – the unique genetic fingerprint of every individual – something never previously achieved despite decades of research across the globe. His discovery is first put to use in an immigration case, proving the parentage of a young Ghanaian boy and preventing his deportation. The acceptance of Jeffreys' findings in a court of law opens the door to DNA testing and he and his university laboratory are swamped by paternity and immigration cases.

Summer 1986, and 15-year-old Dawn Ashworth goes missing – last seen just a hundred yards from where Lynda's body was discovered. Dawn's body is found two days later, she has been strangled and hidden in undergrowth near a footpath shortcut. DCS Baker is back on the case – convinced the same culprit has struck again. This time the investigation bears fruit when a young man from the area is seen acting suspiciously at the time of Dawn's murder, confesses to her killing. However, he refuses to admit he had anything to do with the death of Lynda Mann.

Reading about Jeffreys' work in a local paper, Baker approaches him at the university – perhaps the DNA test can prove the teenagers involvement in Lynda's death? Jeffreys is hesitant – the DNA sample from the murder scene is nearly three years old, and the technique was not intended or designed for criminal investigation. Furthermore, having only been used in paternity and immigration cases, would the findings be accepted in a criminal court?

But Jeffreys is able to obtain a clear genetic fingerprint of the murderer from a sample and it proves that the teenager did not kill Lynda Mann... could the murders have been committed by two different men, or is he innocent?

## EPISODE 2



In a storm of publicity, the local teenager is released and the world is introduced to the idea of DNA fingerprinting – forensic DNA. But in the villages of Narborough and Enderby there's a real sense of fear: there's a murderer in their midst ...

Baker calls together his team of officers, some of whom doubt the new science and firmly believe they had their man and have been forced to let him go. Baker tells them that the investigation must go back to square one: the statements and paperwork are to be gone through again and again. The killer is dangerous and is likely to strike again. A Crimewatch special is filmed of Dawn's last journey and an emotional appeal made to the public ... but still no new evidence comes to light.

Baker realizes the usual routes of enquiry just aren't working, they need something else and they need it to work before the killer strikes again. He sees that the science offers them an opportunity. If this new DNA fingerprinting can eliminate a killer, it can surely catch one. Baker grabs the local map off his wall and drives to the university.

Baker explains to Jeffreys: they now have the DNA code of the killer; he wants to conduct the world's first DNA manhunt, testing the blood of every man in the area aged between 18 and 34, seeking a match with the killer's. Jeffreys is in awe of the magnitude of the idea, and the confidence that Baker has in this new science – the eyes of the world will be on them, the future of forensic DNA will be at stake. Both men know that it's a risk they have to take if they want the killer caught.

Baker makes the radical plea to his superiors. Despite the vast expense, the Home Office eventually concede – the testing will be carried out by the Forensic Science Service. It is agreed that the mass screening must be voluntary; for reasons of civil liberty, no-one can be compelled. In order for the manhunt to work, they need the whole community to believe in the science and get behind the idea. Without the villagers support and a high turnout, it won't work.

January 1<sup>st</sup> 1987: the first day of screening. Baker and Jeffreys and their teams of police and doctors wait with bated breath ... will they catch the killer?

# **A Beginner's Guide to DNA fingerprinting**

*By Dr Ed Hollox, Code of a Killer Science Advisor*

*Department of Genetics, University of Leicester, July 2014.*

**Seven steps:** **E**xtracting the DNA from cells

Cutting up the DNA using an enzyme **S**eparating the DNA fragments on a gel

**T**ransferring the DNA onto paper **A**dding the radioactive probe

**S**etting up the X-ray film **Y**es – we've got the result!

**= ECSTASY!**

## **Extraction of DNA**

*All cells (except red blood cells) in all living creatures contain DNA.*

DNA can be thought of as a length of letters A, C, G and T (6 billion of them in a human cell). Some letters code for proteins, which then do stuff in the cell (like making the cell move or speeding up chemical reactions). Other letters do nothing at all and are just "spacer" or "junk" DNA. The DNA is a double helix, with the letters facing each other and paired up, so that "A" matches with "T" on the other strand, and "C" matches with "G" on the other strand. The first step in DNA fingerprinting is getting your DNA in a pure form. You can get DNA from any cell/tissue such as muscle, semen, saliva but blood is normally easiest. The blood is treated with a series of chemicals until pure DNA emerges as a white solid. The DNA is stored, dissolved in essentially water, in a small plastic tube and kept in a fridge until ready for the next stage.

## **Cutting up the DNA**

Freshly extracted DNA in water is quite sticky, because the DNA strands are very long. They are too long to be separated in the gel in the next stage. The next step is to cut up the DNA strands using a "restriction enzyme". This "restriction enzyme" doesn't cut randomly in the DNA, but at specific letter sequences. This stage involves adding the restriction enzyme (colourless liquid) to the DNA (another colourless liquid), using a pipette. The enzyme takes a few hours to cut at all the places it can in the DNA strands.

## **Separating the DNA fragments on a gel**

The gel is like a sieve, in that it separates the different sizes of DNA fragment generated by cutting up the DNA. We add a blue dye to the DNA fragments using a pipette, and use a pipette to move the blue DNA liquid from a colourless tube into

the “well” – little hole – in the gel (see the top picture on the next page). We use a blue dye to see where we have added the DNA on the gel – it’s just for our benefit so we don’t add two different DNA samples in the same hole! There would be a DNA sample from several people, each sample in a different hole.

The gel is made from something called agarose (derived from seaweed) and is just a pure firm jelly. The gel is placed in a colourless liquid and electrodes are attached to the gel equipment, and a power supply is turned on. By putting the liquid DNA fragments in the hole at one end and passing an electric current through the gel, the DNA fragments move into the gel with the electric current. Small fragments move faster than larger fragments, so the DNA fragments are separated as they move in the gel. After several hours the gel is ready. The gel is checked by shining ultraviolet light on it to check for a nice strong DNA smear (see bottom picture on the next page).

In the gel there is a chemical called “ethidium bromide” which sticks to all DNA fragments and allows the DNA to be seen when an ultraviolet light is shone on it. At this stage, the DNA can be seen as a smear in the gel rather than the “lots of bands” that is characteristic of DNA fingerprints – that is what comes later.

A gel (similar to one Alec would have used, for DNA fingerprinting, they are larger but essentially the same). Notice the holes on the right where the DNA is added. The DNA would move right to left when an electric current is applied.

What separated DNA fragments look like under ultraviolet light – a smear. Picture is orientated like the picture above – the holes are by the labels. Colour here is artificial – DNA is normally pink under ultraviolet light.

## **Transferring the DNA onto paper**

The gel-separated DNA fragments (the smear shown above) are converted to single stranded fragments by dunking the gel in weak acid, so that the DNA letters are exposed, rather than being in the middle of the double helix. The gel-separated DNA fragments are then transferred to white nitrocellulose paper, so the paper now carries an exact replica of the DNA on the gel. This is called “Southern blotting”. The Southern blot equipment is quite Heath Robinson, involving trays, paper towels, and lots of solutions so can get quite messy. Heavy books are placed on top of the towels to squash everything down. The blot can be left overnight, typically.

## **Adding the radioactive probe**

This is the clever bit. Most of the method I have described is quite routine in the lab since the late 1970s and not developed by Alec but by Ed Southern at Oxford (hence “Southern blotting”). Alec’s particular contribution was the choice of the “probe”. This “probe” determines which DNA fragments can be seen at the end of experiment. It is a small chunk of radioactive DNA of a particular sequence of letters. The probe sticks to the fragments of the DNA that has the matching sequence, but only those fragments that have the matching sequence of letters, no other

fragments.

In DNA fingerprinting the probe is a sequence of 33 letters that is found in the repeated “stutters” of the genome. Therefore, only the DNA fragments that contain these repeated “stutters” are seen at the end of the experiment. They are seen as the dark bands you will be familiar with, on a DNA fingerprint.

Essentially, to put it another way, there are lots and lots of differently sized DNA fragments on the nitrocellulose paper (remember the smear from the gel). What we have done is “ask the paper” which fragments have a particular sequence of letters within them. Those are the ones that appear as dark bands.

The nitrocellulose paper and the probe (colourless, radioactive liquid) are placed together in a glass tube in a hybridisation oven at 65 degrees Celsius (think a rotisserie) for an hour or two, so that the probe covers the paper and can stick to the DNA fragments with the matching sequence. The nitrocellulose paper is then rinsed to remove any radioactive probe liquid that has not stuck. The paper should be mildly radioactive because of the probe stuck to it – it should make a nice crackling noise (not screaming, not silent) when the Geiger counter detector is passed over the paper. All of this stage is done in a working area set aside for radioactivity.

## **Setting up the X-ray film**

In the dark room, the nitrocellulose paper is placed against a piece of X-ray film, in a large film cassette (typically bigger than A3 size). The X-ray film can record the pattern of radioactivity on the paper – i.e. where the probe has stuck. Therefore the X-ray film, when developed, will have the pattern of bands which are the DNA fragments where the probe has stuck. The film cassette is shut and your name and date written on a bit of masking tape on the outside. It's left on the bench overnight, or over the weekend, so that the film is exposed to the radioactivity for long enough to make an image.

## **Yes – we've got the result!**

The development process is similar to a traditional photograph.

## **A hybridisation oven**

The glass tubes are placed horizontally in the oven on a wheel which moves slowly around. In the early days of DNA fingerprinting, instead of a hybridisation oven, Tupperware containers were used for 65 degree Celsius stage, and the paper was washed in plastic seed trays.

The film cassette is taken into the dark room and opened. The film can be either held with a gloved hand or placed in a metal frame. It is then dunked in three chambers “developer”, “stop” and “fix”, in the same way as traditional photograph developing. The bands appear slowly in the developer – you take it out occasionally and check it by holding it up against the red light – if the intensity of the bands is good then you

dunk in “stop” then “fix”.

The developed film is then taken to the lab and examined on a white light box (horizontally placed on a lab bench, not vertically, not like “House”). The name and date, and details of the samples would be written in pen.

The key to the DNA fingerprint is the probe, the radioactive bit of DNA that identifies lots of fragments that contain the “minisatellite repeats”. These repeats have the 33 letters of DNA that are used in the probe but repeated lots of times. The number of repeats differ between different people. So the DNA fragment sizes with these different sized-repeats are different for different people – hence different black bands on a film for different people.

## **Some notes on PGM testing**

We are familiar with blood groups A B and O to distinguish people. It’s best to think of PGM as another blood group with three types: PGM1, PGM2 and PGM2-1. It has the advantage over blood groups in that it can be typed on semen as well as blood – I suspect this was why it was chosen for the screen because the PGM type of the murderer was known from the semen.

The science behind PGM is interesting. PGM stands for phosphoglucosmutase, and is an enzyme with different variants that is on the surface of red blood cells and sperm (and other cells). It is a protein, with two variants 1 and 2 so that an individual can be just 1, just 2, or both 1 and 2. There are also subtypes plus and minus, so that each individual can be 1+, 1-, 1+1-, 2+, 2-, 2+2-, 2+1+, 2+1-, or 2-1+. The forensic team would have used a gel separation technique called isoelectric focusing and polyacrylamide, not agarose gels, to separate the different PGM variants. This was cutting-edge forensic science at the time, but based on proteins not DNA. Like DNA fingerprinting, PGM testing is now not used in forensic investigations, being replaced by more modern DNA profiling techniques, but still rely on the same scientific principles.

## Cast

DCS David Baker ..... David Threlfall  
Alec Jeffreys ..... John Simm  
DI Alan Madden..... Lorcan Cranitch  
DCC Chapman..... Robert Glenister  
Sue Jeffreys ..... Anna Madeley  
Joy Blakefield..... Siobhan Redmond  
DC Taran Kholi ..... Jaz Deol  
DS Geoff Taylor ..... Andrew Tiernan  
Kath Eastwood ..... Hannah Walters  
Eddie Eastwood..... Ged Simmons  
Lynda Mann..... Jessica Hargreaves  
Susan Mann..... Lucy Carless  
Dawn Ashworth..... Emma Lundy  
Barbara Ashworth ..... Dorothy Atkinson  
Robin Ashworth..... Neil Edmond

## Production

Writer ..... Michael Crompton  
Executive Producer ..... Simon Heath  
Executive Producer ..... Priscilla Parish  
Director ..... James Strong  
Line Producer ..... Elizabeth Binns  
Production Designer..... Anna Pritchard  
Make-Up Designer ..... Jo Williams  
Costume Designer ..... Ray Holman  
Editor ..... Mike Jones  
Locations Manager ..... Gary Pickering  
Casting Director..... Jill Trelvellick  
Script Editor..... Gwen Gorst