

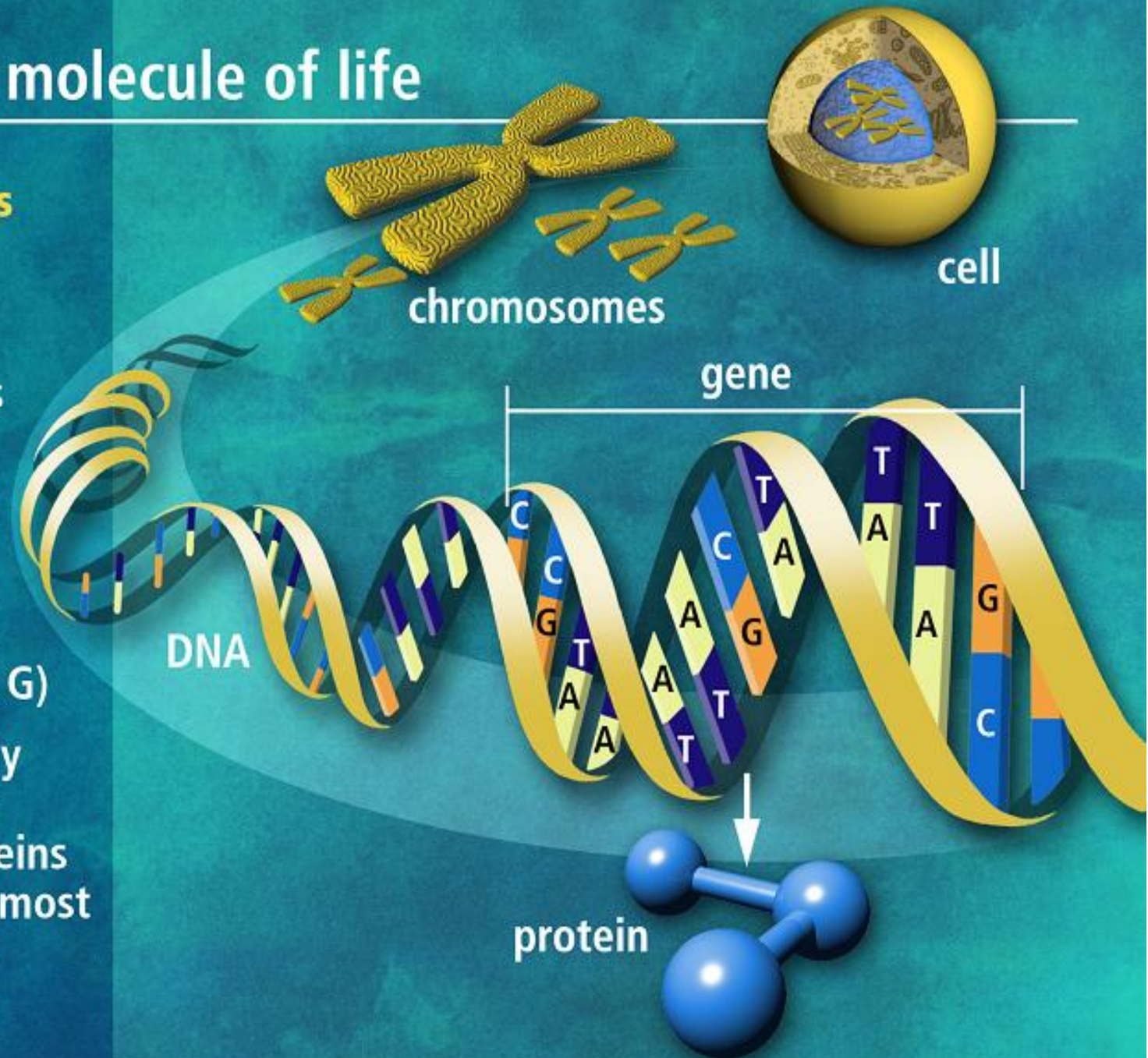
**ISSUES IN  
GATHERING,  
INTERPRETING  
AND  
DELIVERING  
DNA  
EVIDENCE**

# DNA the molecule of life

## Trillions of cells

Each cell:

- 46 human chromosomes
- 2 meters of DNA
- 3 billion DNA subunits (the bases: A, T, C, G)
- Approximately 30,000 genes code for proteins that perform most life functions



$$\sum_{j=1}^P p(S_j|H_p)r_j = p(S_1|H_p)r_1 + \sum_{j=2}^P p(S_j|H_p)r_j$$

$$\begin{aligned} \frac{LR}{LR_G} &> \frac{r_1 \sum_{k=1}^q p(S_k|H_d)}{p(S_1|H_d)r_1 + \sum_{k=2}^q p(S_k|H_d)r_k} \\ &> \frac{p(S_1|H_d) + \sum_{k=2}^q p(S_k|H_d)}{p(S_1|H_d) + \sum_{k=2}^q p(S_k|H_d)r_k/r_1} > 1 \end{aligned}$$

# Quick Guide to Science & Statistics

1. Unless we have an identical twin every one of us has unique DNA.
2. There are commercially available kits that allow DNA to be extracted, processed and converted into a profile that allows for its analysis and comparison with other samples of DNA.
3. The DNA profile is obtained from only a small fragment of a person's DNA, as a consequence it cannot be said that the profile is unique.
4. The rarity or otherwise of the profile can be calculated using models based on statistical 'rules' adjusted to take account of what we know about population genetics.
5. All models are wrong.
6. No police investigation, expert opinion or scientific process is infallible: humans are involved.

# DNA Report NSW

**“The accused has the same profile as the DNA recovered from the crime scene sample. This profile is expected to occur in fewer than one in ten billion individuals in the general population.”**

**“The final statistical calculation... does not prove uniqueness, but provides strong support for the hypothesis (without taking other evidence into account) that the DNA from the evidence sample originates from the matched individuals. The profile frequency calculation does not apply to closely related individuals”.**

# Jury Reactions

**“In this day  
and age,  
DNA is  
crucial”**

**“Like a  
lifeboat in  
a rough  
sea of lies”**

**“Even smallest  
amount of DNA  
would’ve  
swayed me”**

**“Suddenly, with the  
summings up, came  
the final realisation  
that we weren’t going  
to get any forensic  
help”**

**“How did they  
convict people  
in the old days  
[before DNA  
evidence]?”**

***“If your experiment needs statistics you ought to have done a better experiment”***

***“Statistics are like bikinis. What they reveal is suggestive, what they conceal is vital”***

***“Statistics mean never having to say you’re certain”***

# The Unknown

*As we know,  
There are known knowns.  
There are things we know we know.*

*We also know  
There are known unknowns.*

*That is to say  
We know there are some things  
We do not know.*

*But there are also unknown unknowns,  
The ones we don't know  
We don't know*

# Reason to be Careful

1. The estimates are not intended to be precise.
2. They are the products of mathematical and scientific theory not concrete facts.
3. They do not purport to define the likelihood of guilt.
4. They should only be used to form a notion of the rarity of the genetic profile of the accused.
5. The DNA evidence must be considered along with all the other evidence in the case relating to the issue of identification.

# Defence Fallacies

*“She was one in a million. So there’s five more just in New South Wales.”*

## (a) **Double murder arrest**

Release date: Tue 22 July 2008

Homicide Squad detectives will today travel to Sale, in Gippsland, to interview a man in relation to the double murder of a mother and daughter more than 20 years ago.

Members will this morning arrest a 43-year-old pensioner at the Fulham Correctional Centre, where he will be taken to the Sale police station for questioning.

“We were able to run DNA evidence found on an item of Seana’s clothing through the national DNA computer database and compare it to tens of thousands of profiles across Australia.

Much to our delight, the DNA sample from the Tapp murder scene matched one of the DNA profiles on the database.”

(b) **Murder charges dropped**

Release date: Thurs 7 August 2008

DNA evidence contaminate

Bodies found in home in 1984

Victoria Police said today that forensic officers had identified a possible contamination of the biological evidence after a laboratory review.

The contamination occurred in 1999 when clothing containing the DNA of Gesah – from an unrelated offence – was examined on the same day that clothing from the Tapp murder case was examined.

# Reason to be Careful

1. The potential for human error;
2. The potential for contamination of samples;
3. Handling errors because of the conditions in which the DNA is kept or stored;
4. That as we are dealing with statistical models a chance match cannot be excluded (and the possibility of a chance match increases if relatives or those from certain racial groups may be involved);
5. There is always a possibility of tampering with the crime scene. This is not to impugn the police or DAL staff, other criminals could have left the sample; and
6. The suspect's sample could have got to the crime scene for a number of innocent reasons – secondary transfer or prior contact with the scene or exhibit.

[86] There are various equally mathematically valid ways of expressing the same DNA statistic. Using a random occurrence ratio of 1 in 1000, and taking the population of Australia as 21 million, these include:

- 1. 1 in 1000 people would be expected to have the DNA profile found in the hair specimen.
- 2. 999 out of 1000 people would not be expected to have the DNA profile found in the hair specimen
- 3. 0.1% of people would be expected to have the DNA profile found in the hair specimen.
- 4. 99.9% of people in Australia would not be expected to have the DNA profile found in the hair specimen.
- 5. 21,000 people in Australia would be expected to have the DNA profile found in the hair specimen.
- 6. 20,979,000 people in Australia would not be expected to have the DNA profile found in the hair specimen.

*Aytugrul v R* [2010] NSWCCA 272, McClelland CJ at CL at [86].

Personally I preferred  
it when you could just  
verbal us.

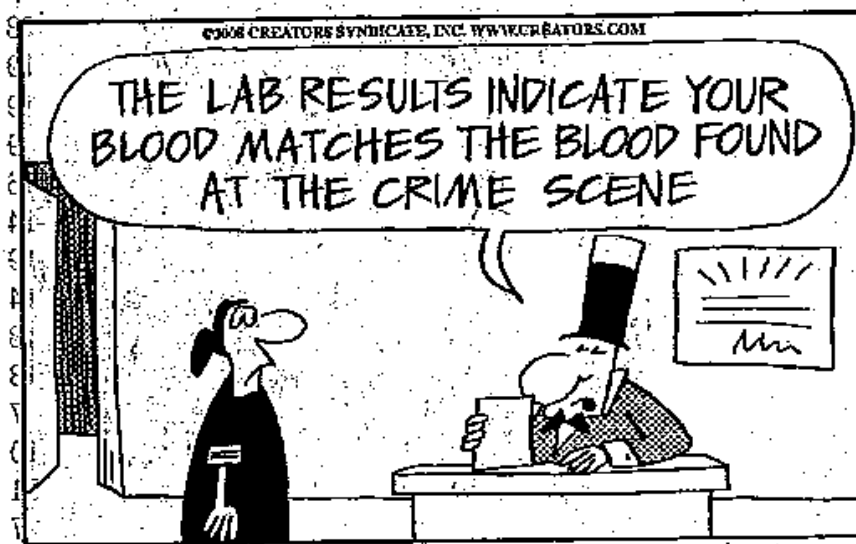


# Blood results

WIZARD OF ID BY PARKER AND HART

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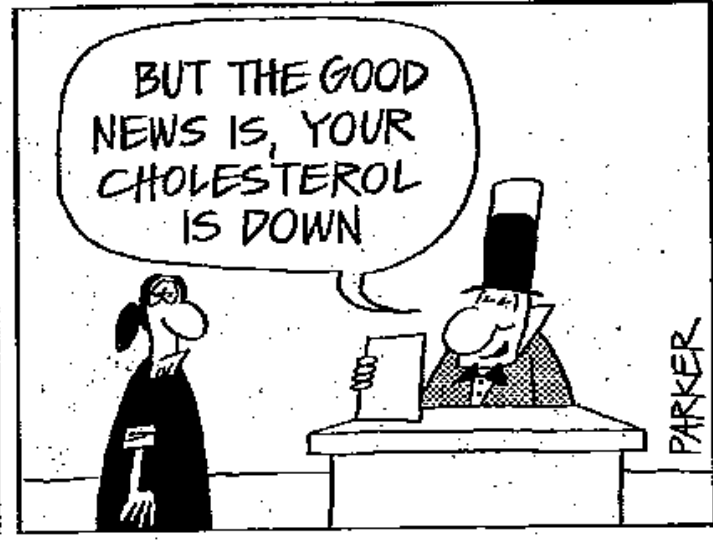
THE LAB RESULTS INDICATE YOUR BLOOD MATCHES THE BLOOD FOUND AT THE CRIME SCENE



UH OH!



BUT THE GOOD NEWS IS, YOUR CHOLESTEROL IS DOWN



HAGAR THE HORRIBLE BY CHRIS BROWNE

