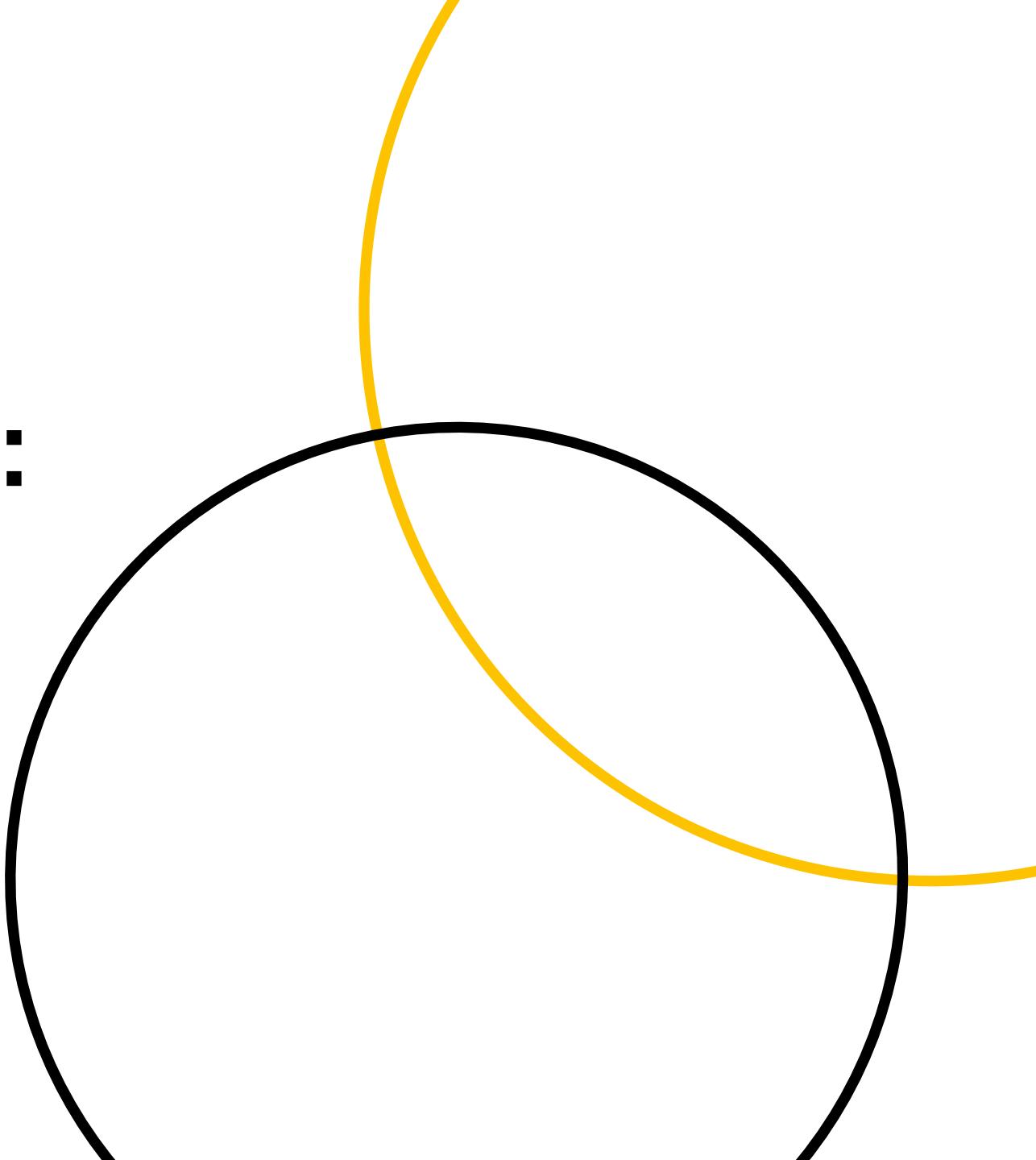


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Genome Academy: DNA to Data

9 – 11th April 2024

Francesca Gale
Head of Science Engagement



Before we start – the important bits



If the alarm sounds for more than one minute, please evacuate. Your host will guide you to the nearest assembly point



If you feel unwell or suffer an accident, let your host know and they will summon appropriate first aid



Please stay together and with your host(s) at all times during your visit



All buildings on the Campus are non-smoking

The core training team



Fran Gale

Head of Science
Engagement



Sam Shingles

Science Engagement
Officer



Cassandra Soo

Laboratory
programme manager



Aaron Dean

Laboratory Assistant



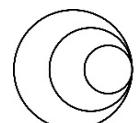
Chris Adamson

Laboratory Operations
Officer



**Jorge Batista
da Roche**

Education Developer

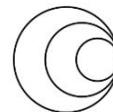


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Find all the resources on GitHub

<https://wcscourses.github.io/genomeacademy/>

Genome Academy



The manual and programme for Wellcome Connecting Science's Genome Academy

[View the Project on GitHub](#)
WCSCourses/genomeacademy

This project is maintained by
[WCSCourses](#)

Hosted on GitHub Pages — Theme by [orderedlist](#)

[Visual Assistive Version](#)

Genome Academy

Welcome to the Genome Academy, a three day programme that will provide an in-depth look into genomics, with a particular focus on how we translate DNA into Data.

Genomics is a rapidly developing field of research and is increasingly weaving its way into everyday life, from playing a role in vaccine development, virus tracking, personalised cancer treatments, unveiling family histories, solving crime, and tackling the planet's fragile ecosystems. There are a wide range of career opportunities in this field, some that didn't even exist several years ago.

Across three immersive days you will learn and experience the end to end process of how we translate DNA into data. The packed programme of activities will include talks on the latest cutting-edge science taking place at the Wellcome Sanger Institute, lab tours, hands-on experience with wet lab techniques such as DNA Extraction, PCR, DNA Sequencing as well as training with bioinformatics tools. You will also get the opportunity to meet a range of different staff working in this field.

Course overview

The Genome Academy is a course designed and delivered by Wellcome Connecting Science, based at the Wellcome Genome Campus, Hinxton.

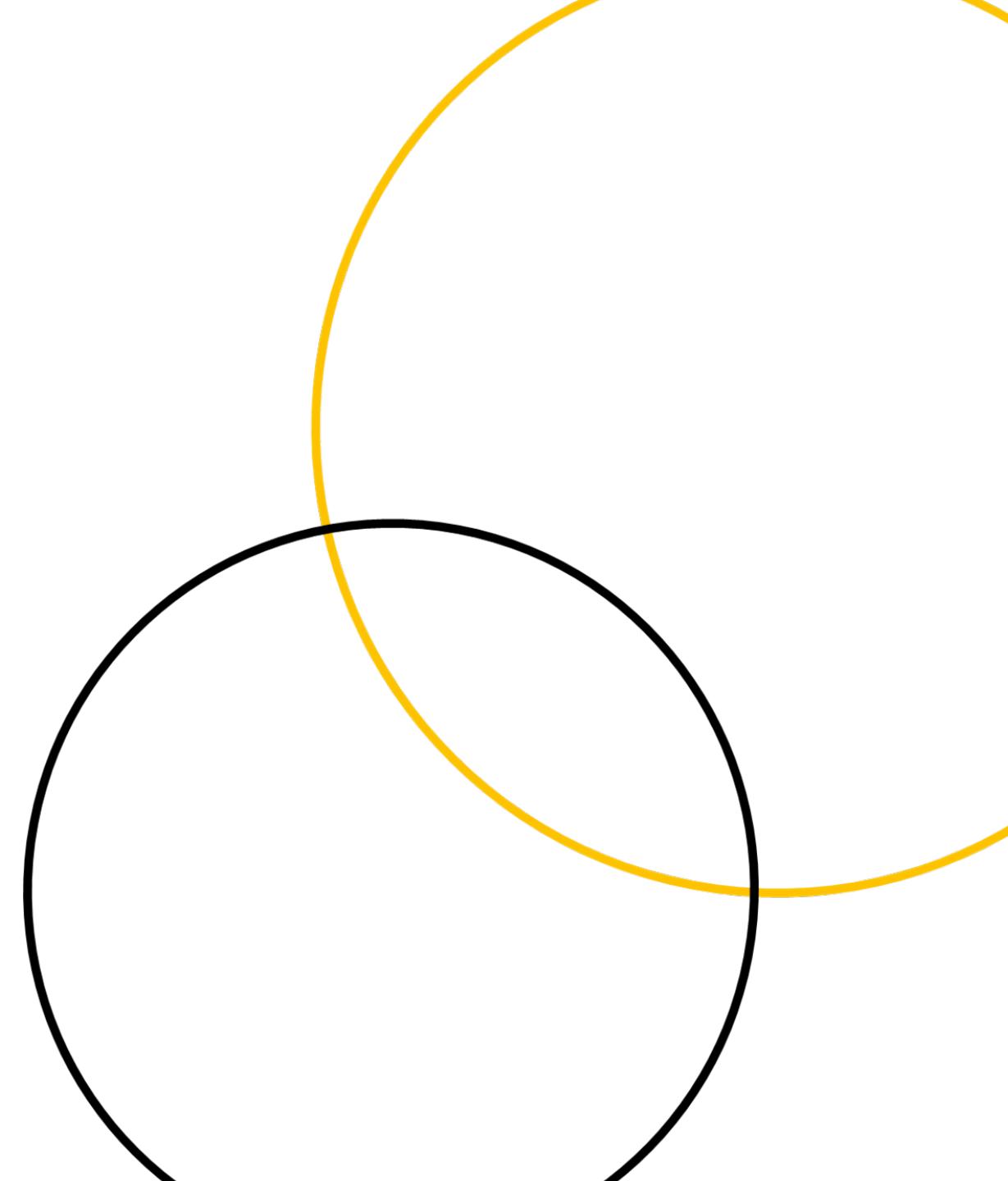
In this section find out who your instructors will be and what you will be

Time table for today

Time	Activity
10:00	Welcome and Introduction to the campus
10:30	Introduction to lab safety and our practicals
10:45	Lab practical – Pipetting skills and DNA extraction
11:15	Lab Practical – PCR
11:45	Speaker: Michael Ansah, Tree of Life programme
12:15	Lunch
13:00	Lab practical – running a Lonza Gel
13:30	Lab tour – CASM team
15:00	Reflections on the day
15:30	Depart

Introductions

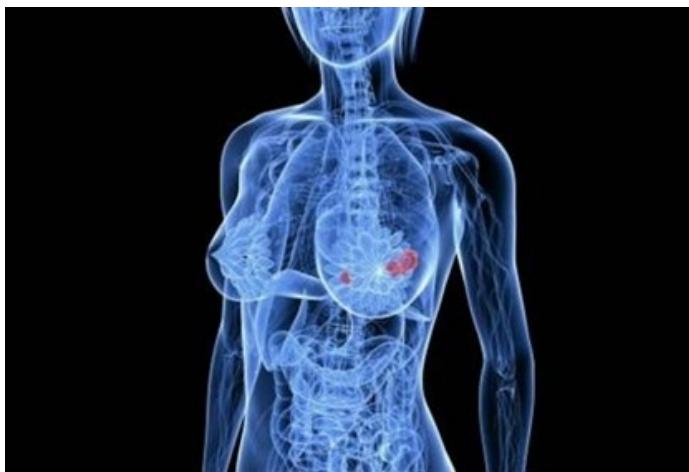
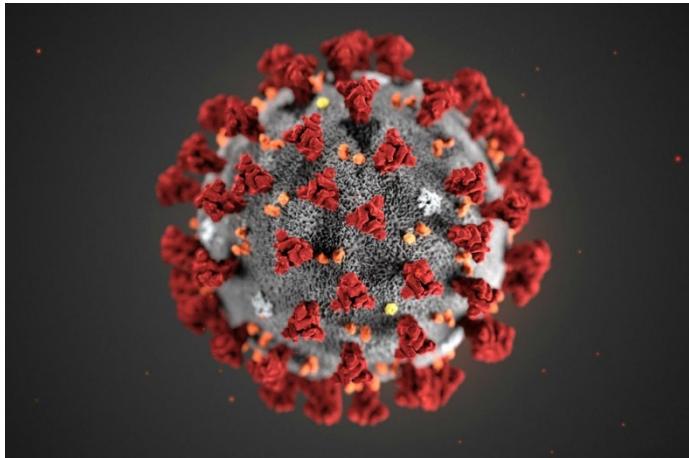
An introduction to everyone and
quick survey to see how we feel at
the start of the course



Wellcome Genome Campus



Areas of campus research





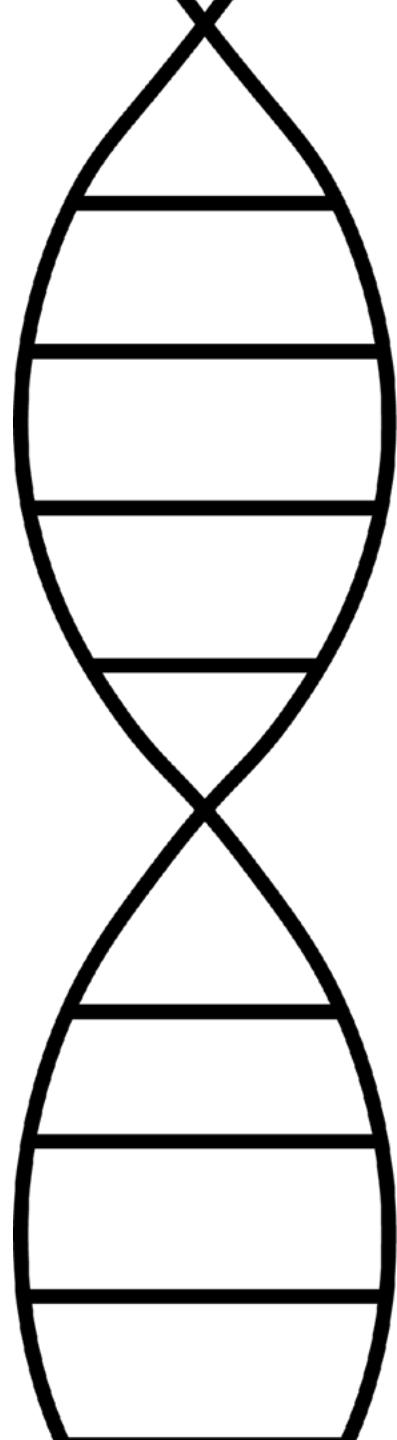
research fellows



research assistants



group lead



genetic counsellors



computer science
apprentices

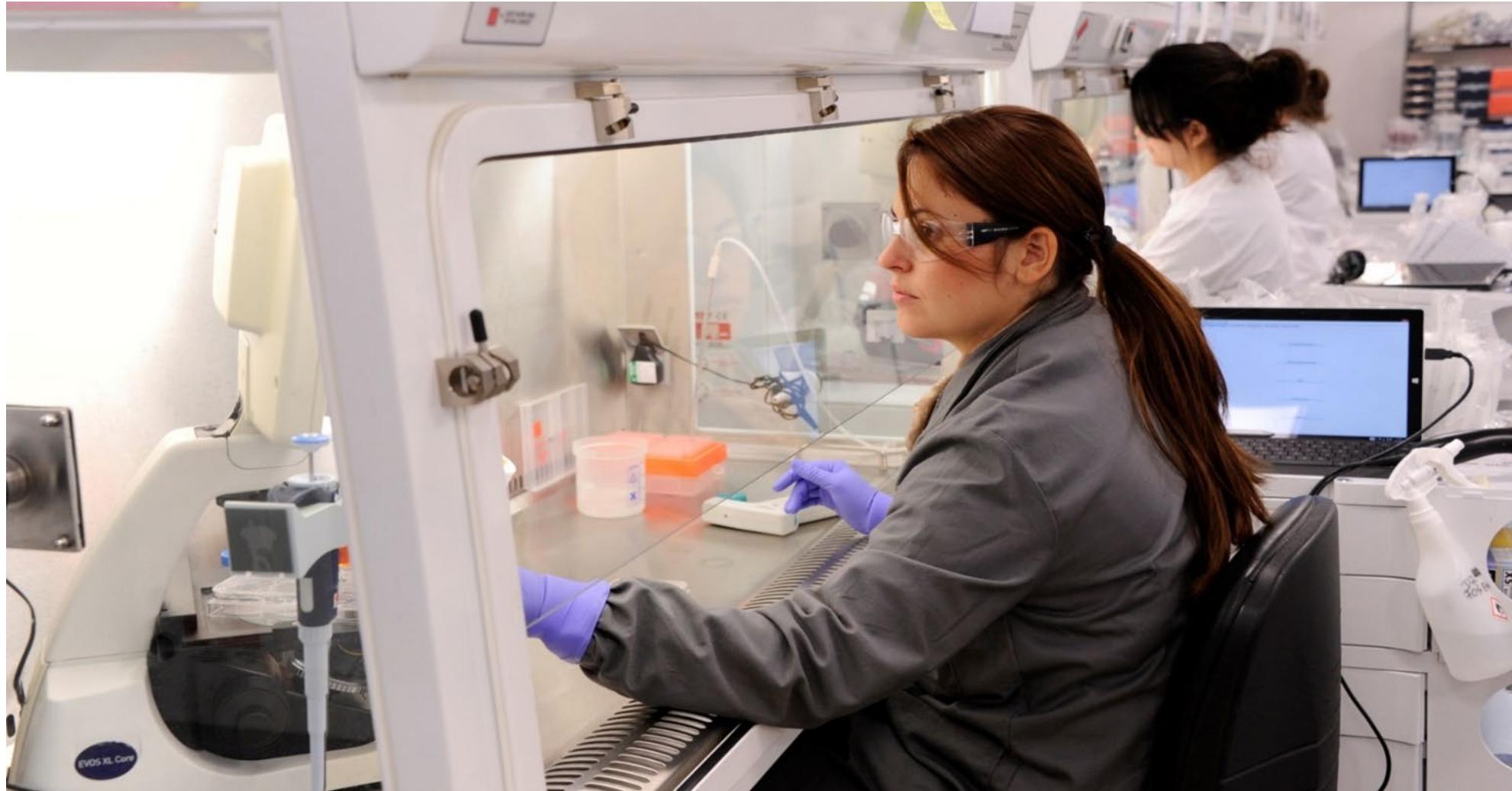


research students

The Sequencing labs



Cellular operations

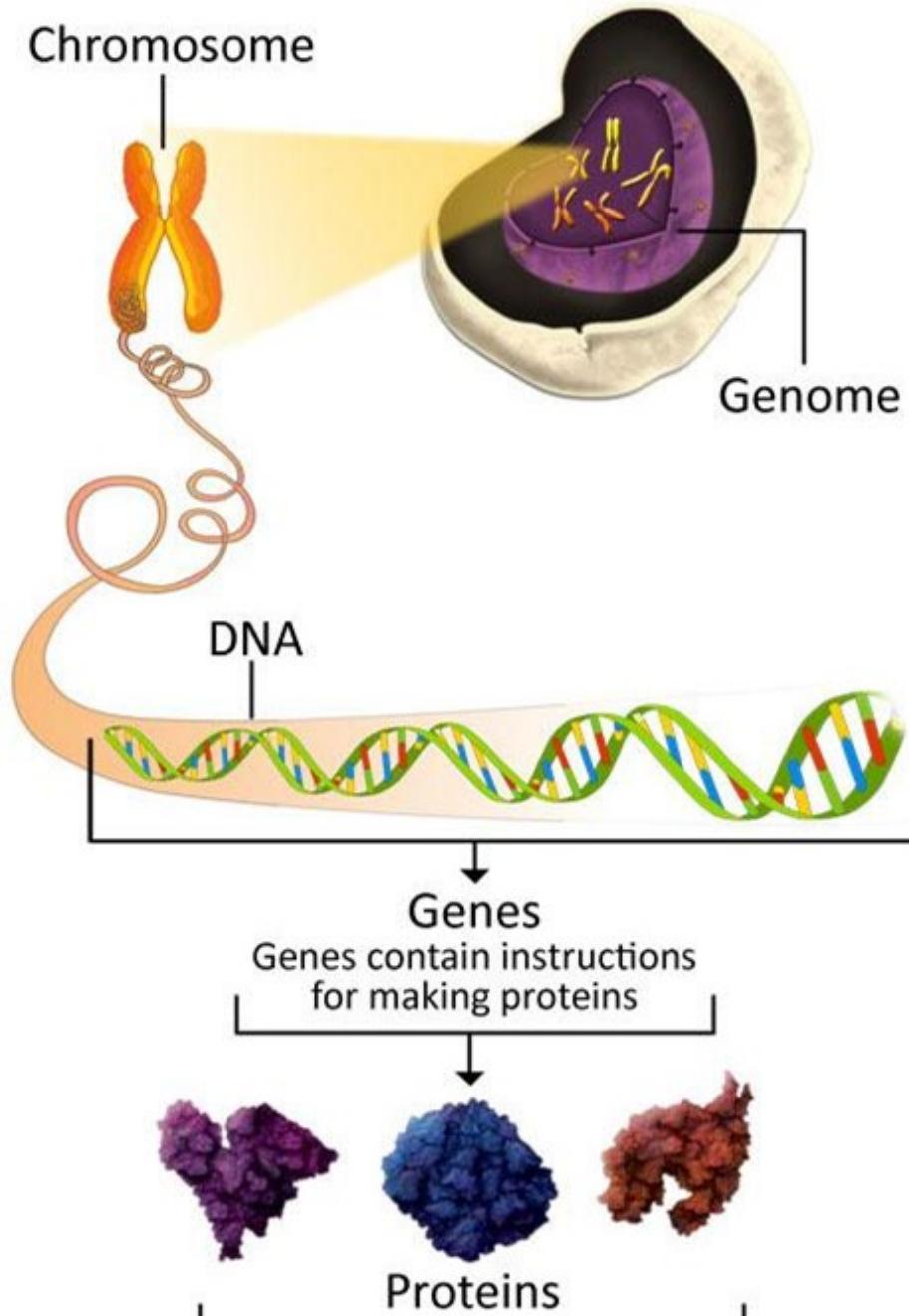


The data centre



What is a gene?

- A sequence of DNA that carries the information required to make a molecule, usually a protein.
- Proteins have functional roles to play in our bodies



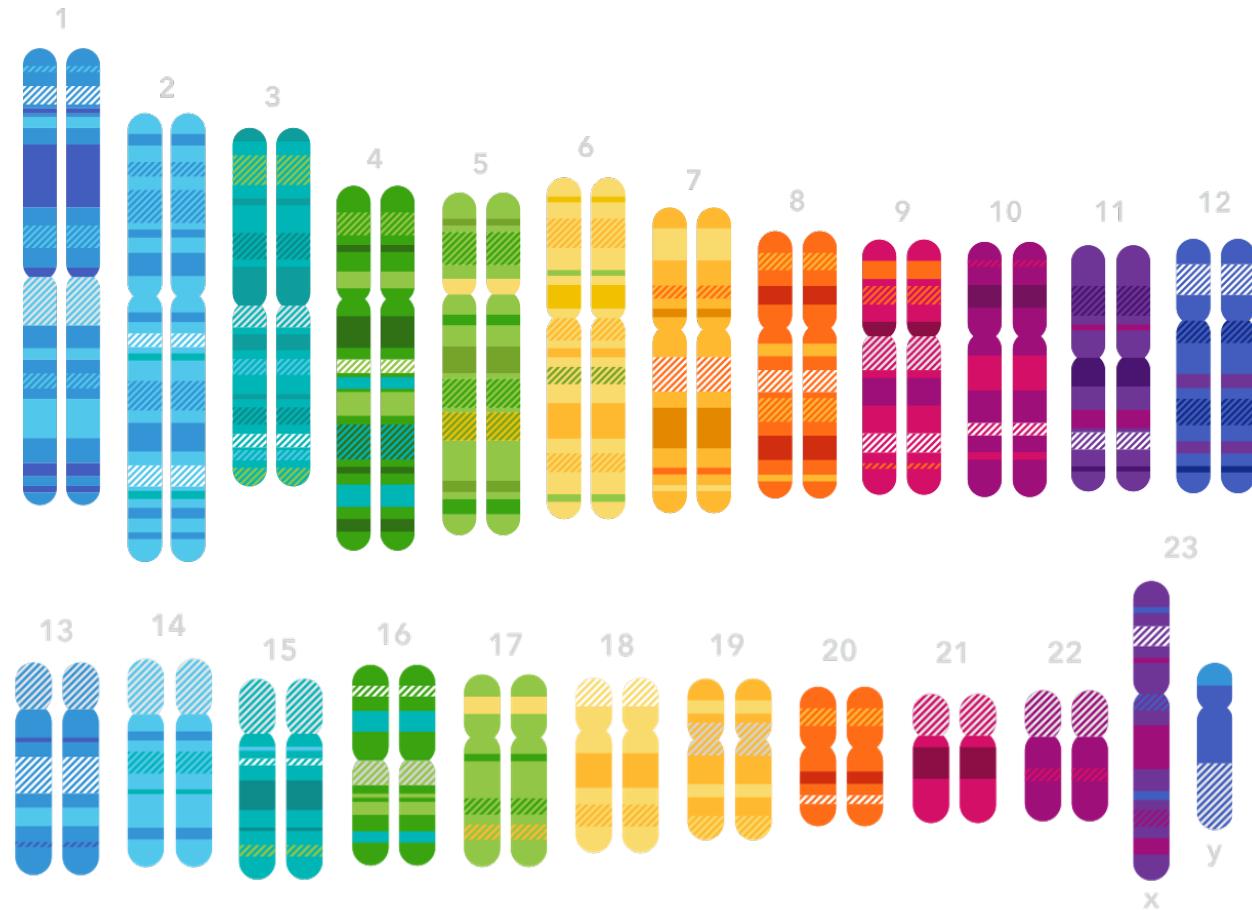
What is a genome?

A copy of all the DNA instructions used to make an organism

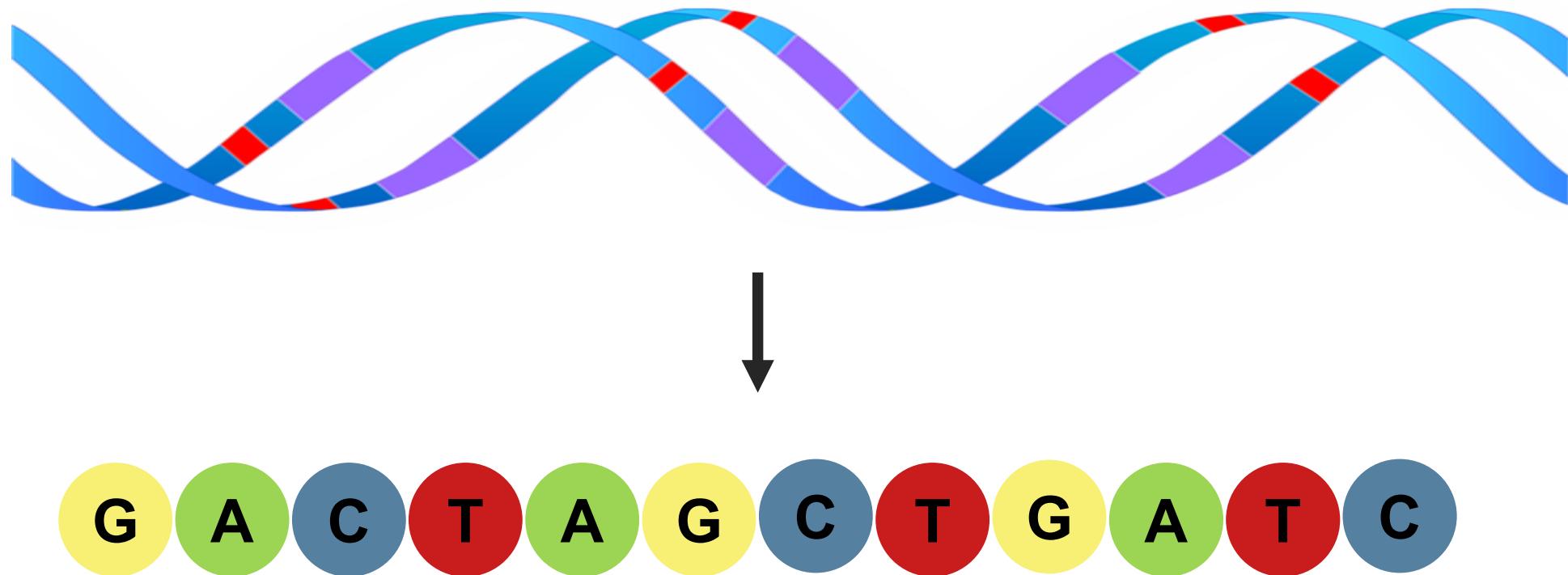
“The Book of Life”

All organisms have genomes

We have 2 copies of our genome packaged in 23 pairs of chromosomes



What is DNA sequencing?



genomics: then and now

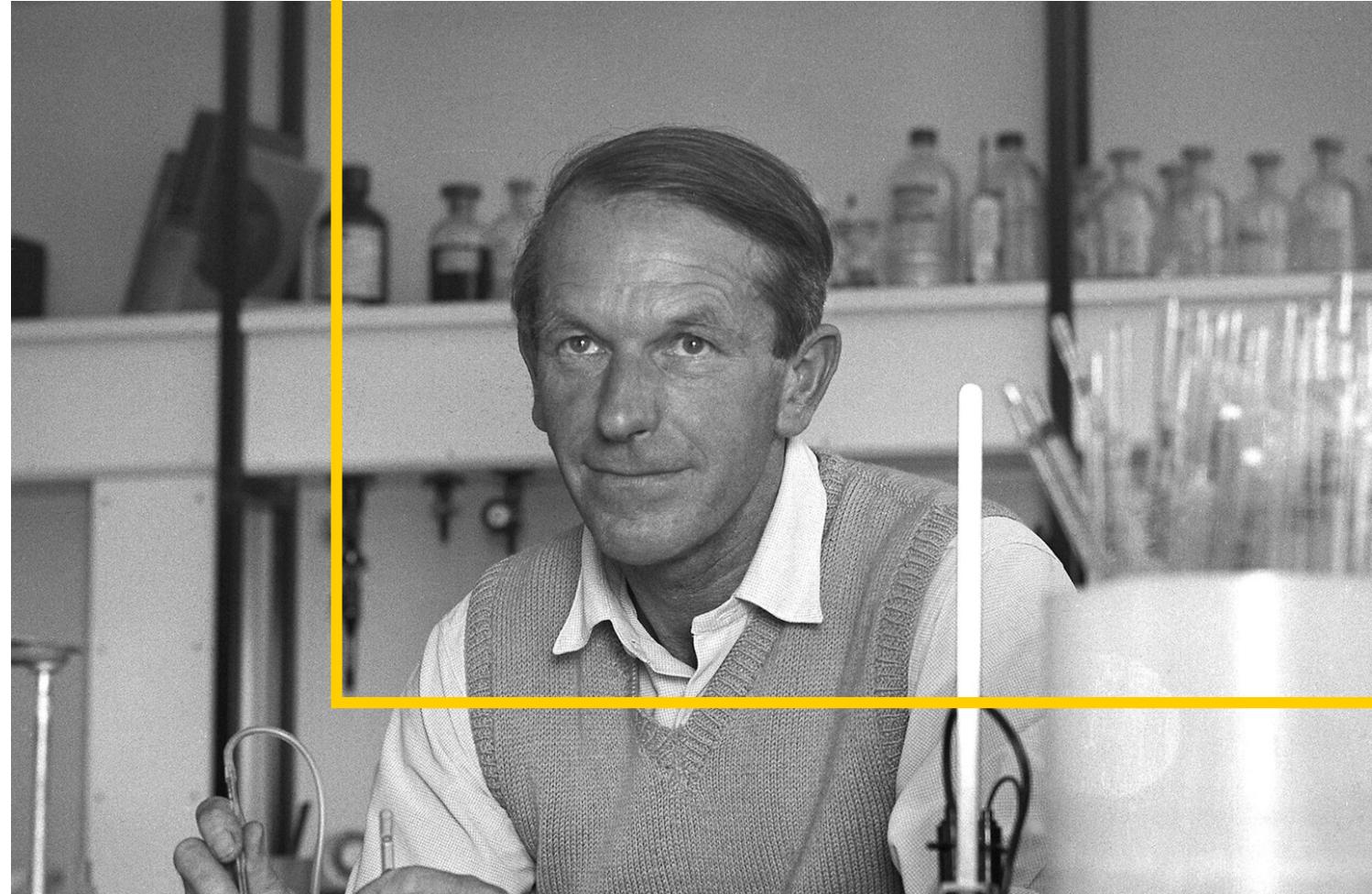


image credit: MRC LMB

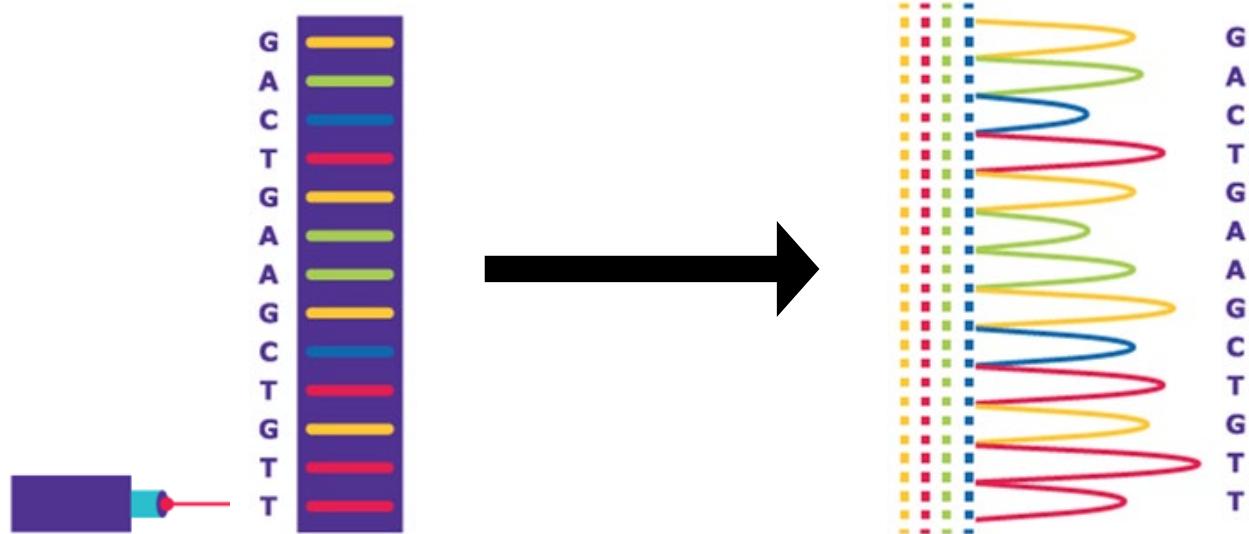
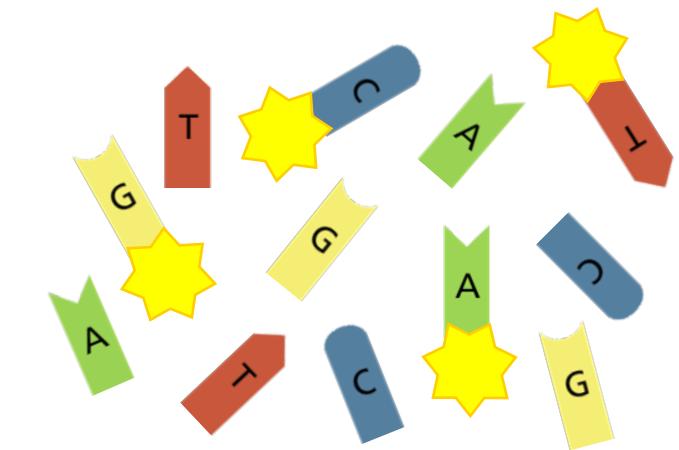
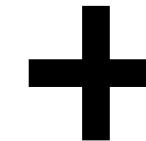
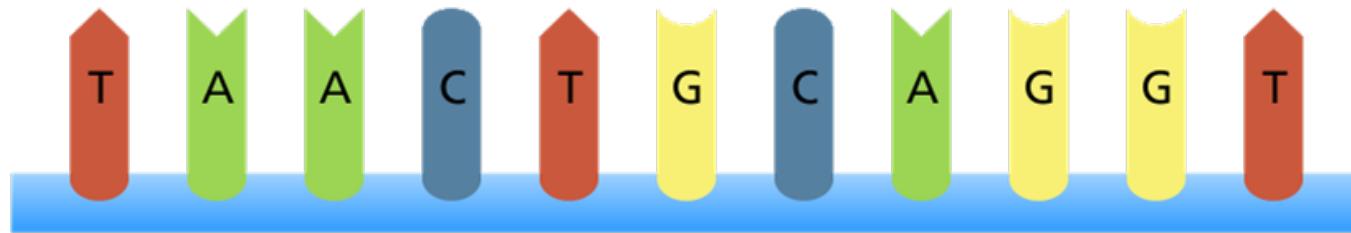
Fred Sanger and DNA sequencing

- First DNA sequencing methods was developed in 1977 by Fred Sanger and his team” at the Medical Research Council Laboratory of Molecular Biology in Cambridge, UK.

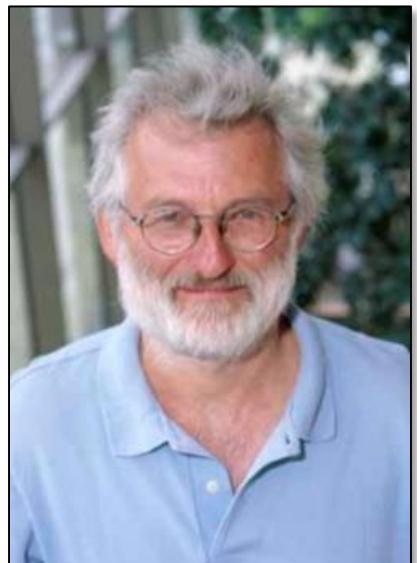
Based on the natural process of DNA replication, but used radioactively labelled “terminator” bases and gels to separate the DNA fragments



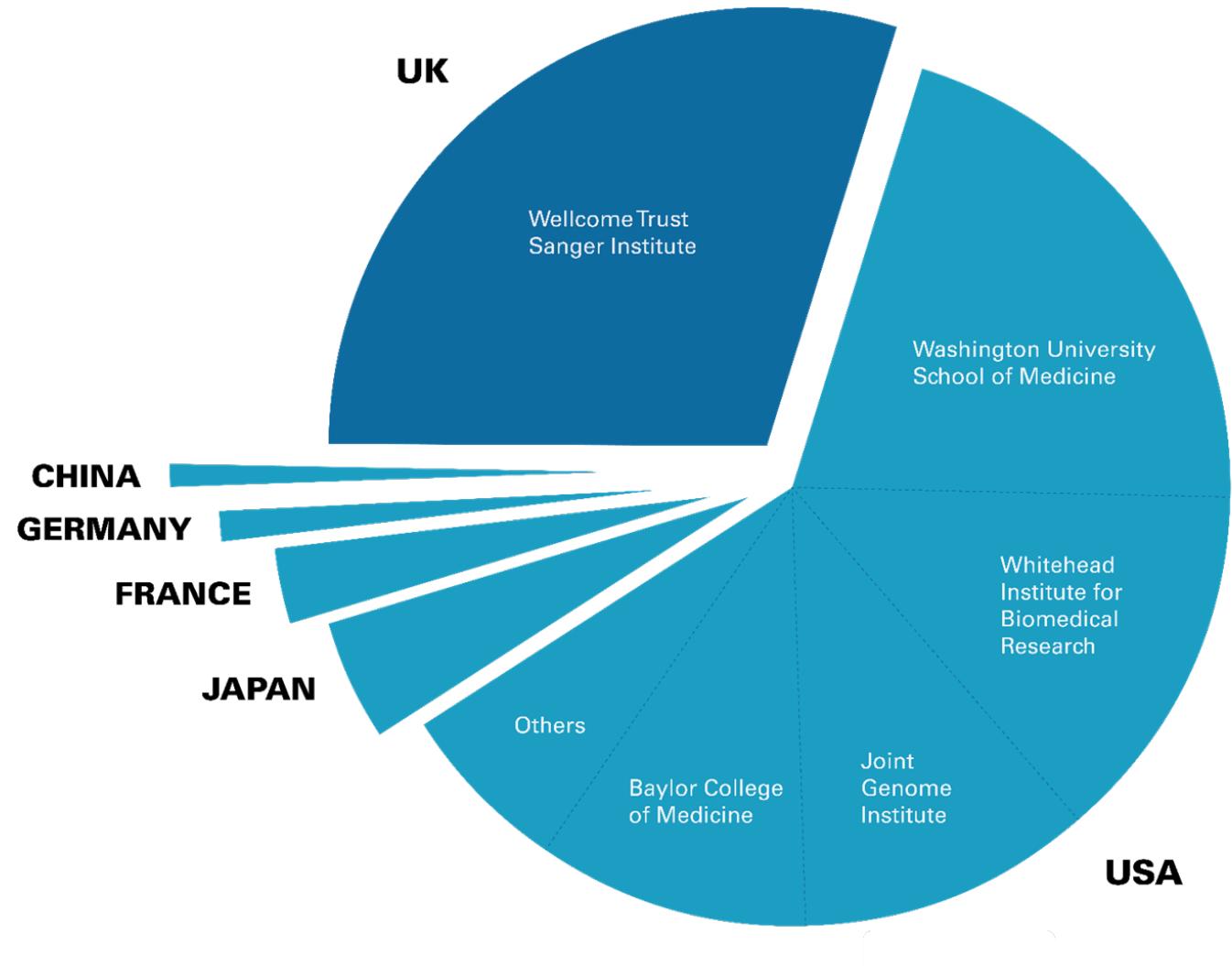
Safer Sanger Sequencing



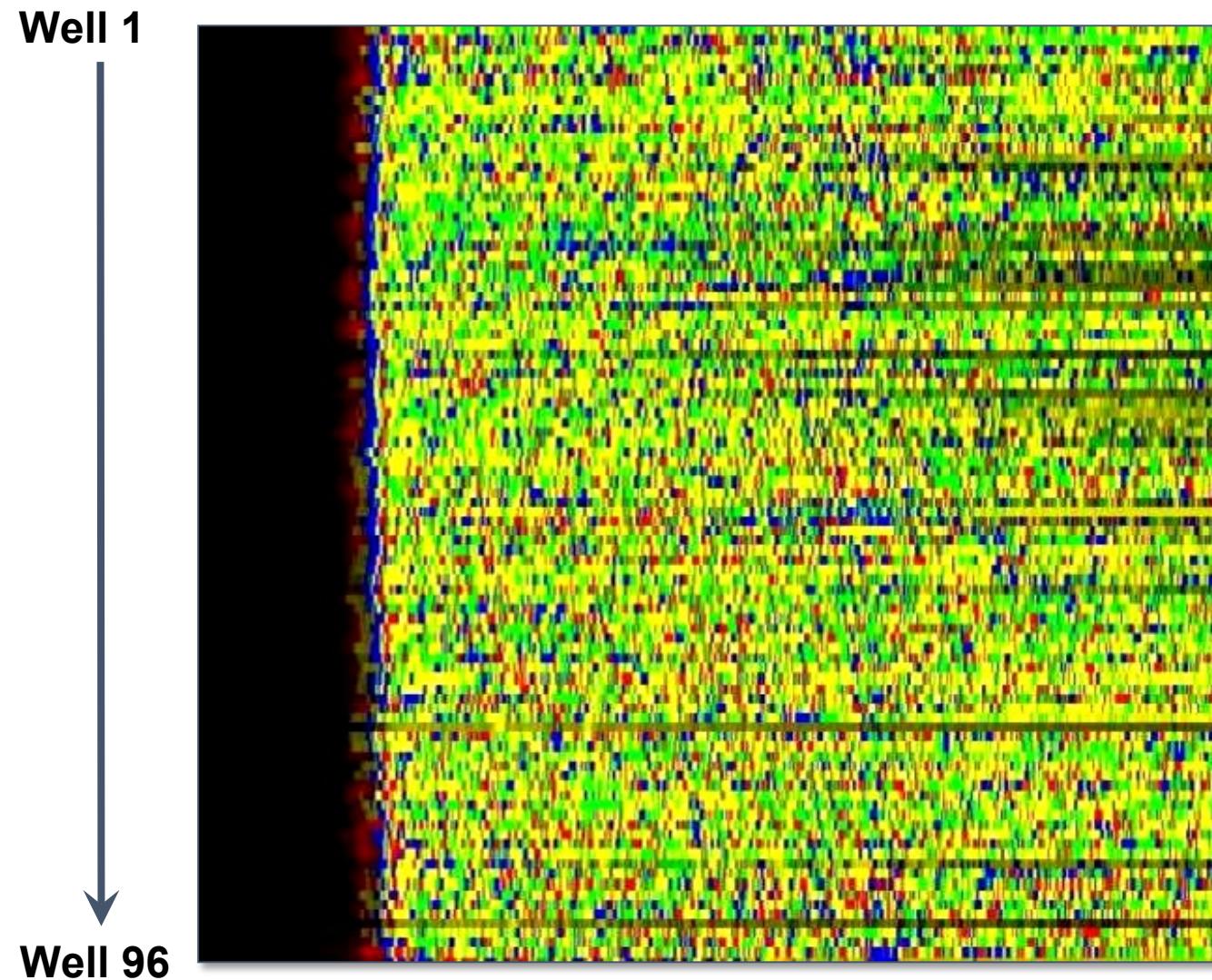
The Human Genome Project



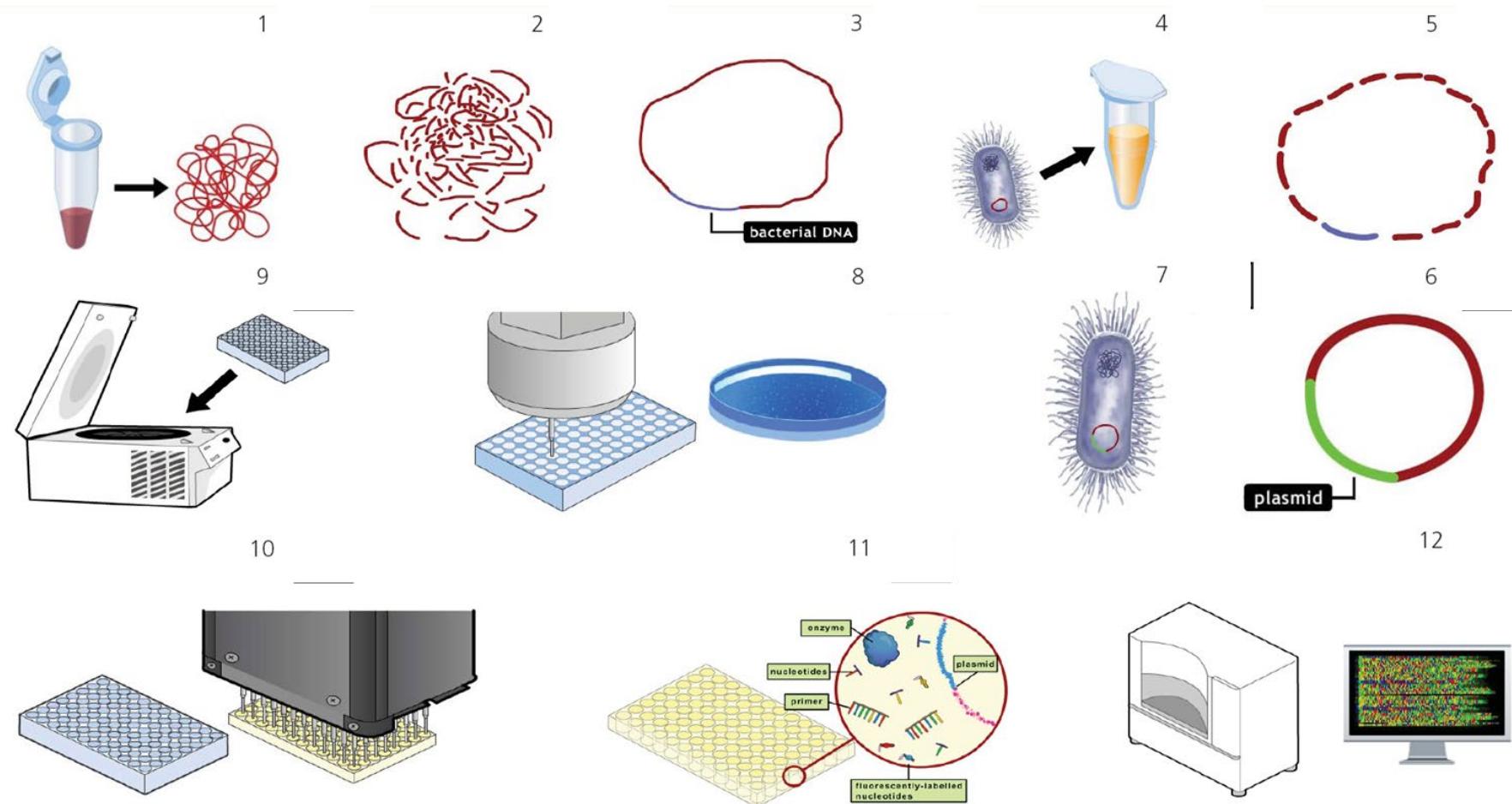
John Sulston



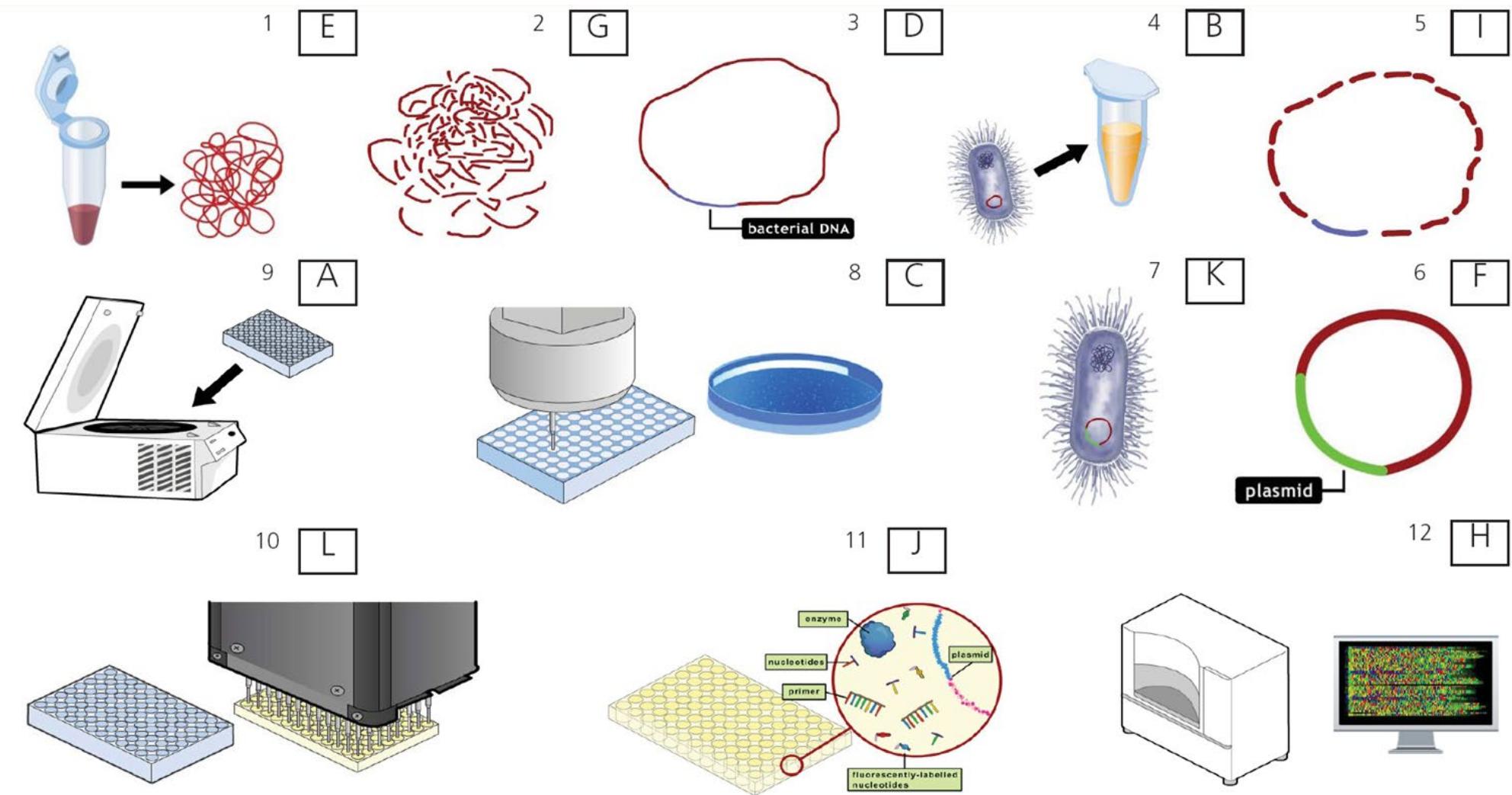
Sequence output (ABI 3700)



DNA to Data



DNA to Data



What does a genome sequence look like?

19430551 acagtca...
19430701 ttgtcc...
19430851 tgc...
19431001 gta...
19431151 cttgg...
19431301 eto...
19431451 acccagg...
19431601 ctcagg...
19431751 gcac...
19431901 cagg...
19432051 gg...
19432201 cagg...
19432351 a...
19432501 g...
19432651 tg...
19432801 etg...
19432951 acag...
19433101 at...
19433251 ot...
19433401 st...
19433551 tt...
19433701 catctgg...
19433851 ot...
19434001 et...
19434151 ga...
19434301 ca...
19434451 gac...
19434601 eg...
19434751 aaaa...
19434901 at...
19435051 a...
19435201 gt...
19435351 aa...
19435501 acat...
19435651 gt...
19435801 tccc...
19435951 tta...
19436101 tttt...
19436251 ge...
19436401 caga...
19436551 ca...
19436701 tac...
19436851 ag...
19437001 ~~~~~

Introns

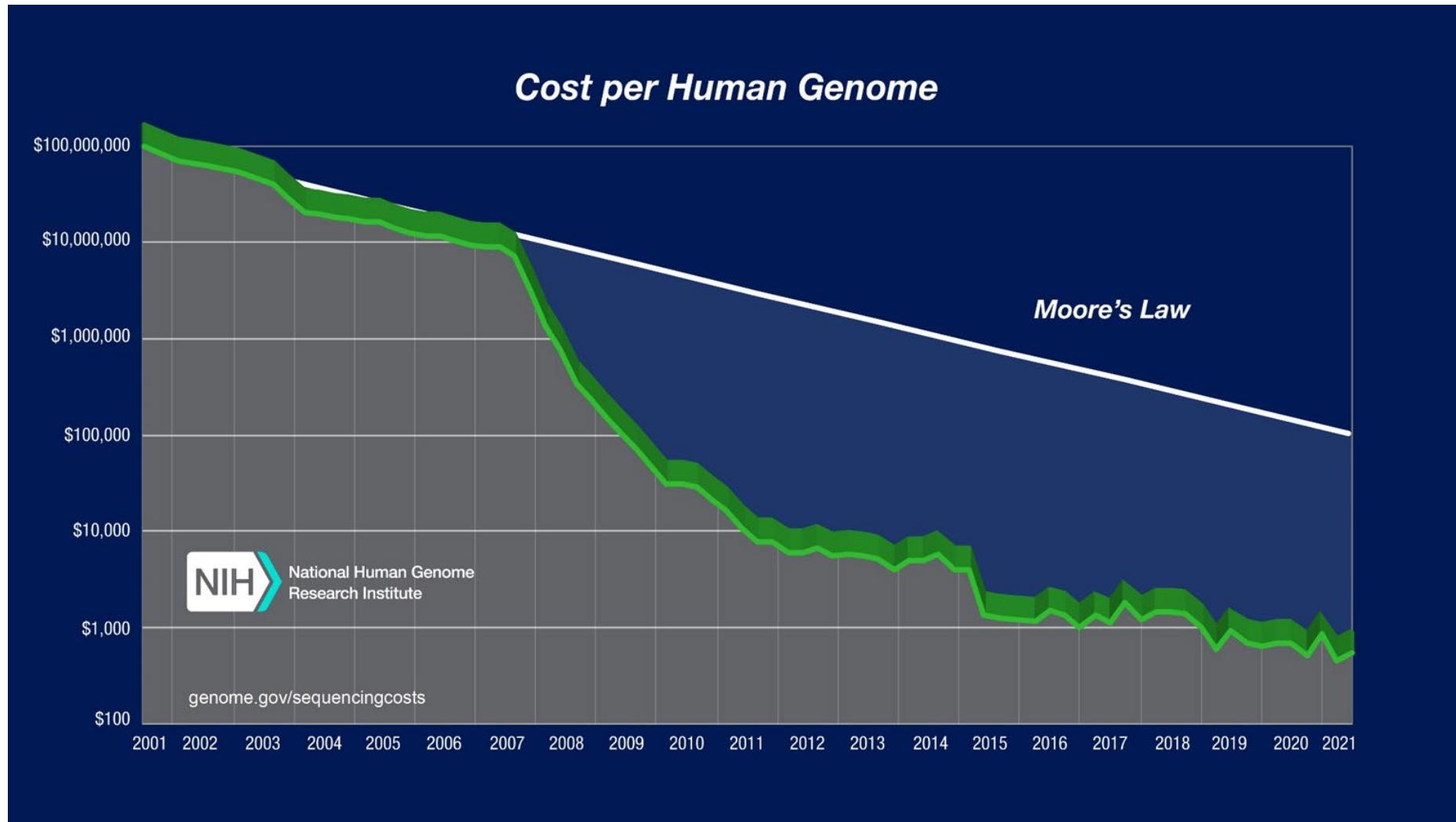
Exons

Non-coding
DNA

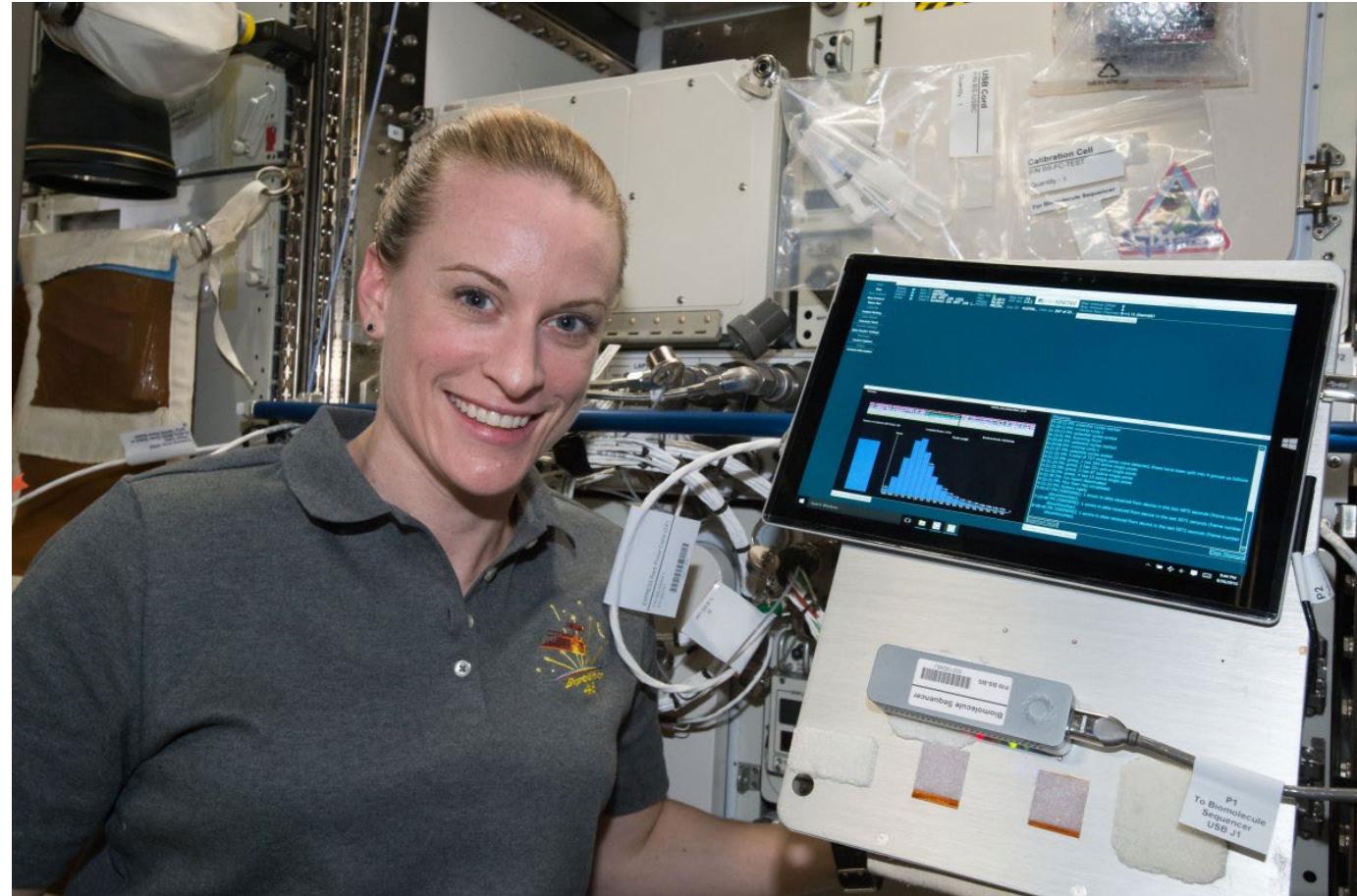
DNA sequencers then vs now



DNA sequencing today



Sequencing everything and everywhere



Getting ready for the lab session



Working Safely in the Lab

Complete Working safely in the lab simulations:

- Dressing for the lab
- Lab safety simulation

Safety

Dressing For The Lab

By the end of this interactive, you will be able to outline the basic dress code that allows you to work safely in a lab.

Always check local rules before working in the lab

- ✓ Dress appropriately for the lab
- ✓ Outline the function of basic personal protective equipment (PPE)



START

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Safety

Safety Features and Hazards

By the end of this interactive, you will be able to outline the basic safety rules that should be adhered to when working in a lab.

Always check local rules before working in the lab

- ✓ Identify common lab safety equipment such as fire extinguishers and eye wash stations
- ✓ Identify hazardous behaviour in a lab
- ✓ Outline the steps you should take before leaving the lab



START

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What are the key lab safety rules?



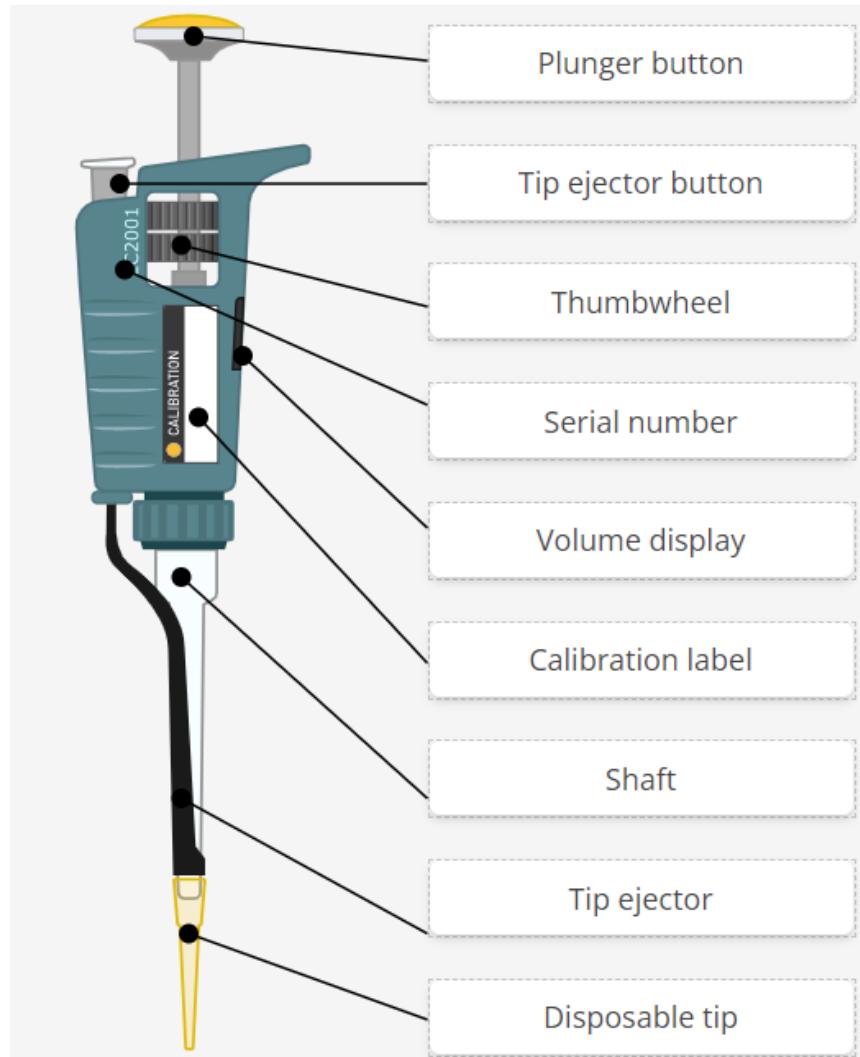
Practical skills: Pipetting



What is a pipette?



Key parts of a pipette



Sizes of pipette



Practical 1: DNA extraction

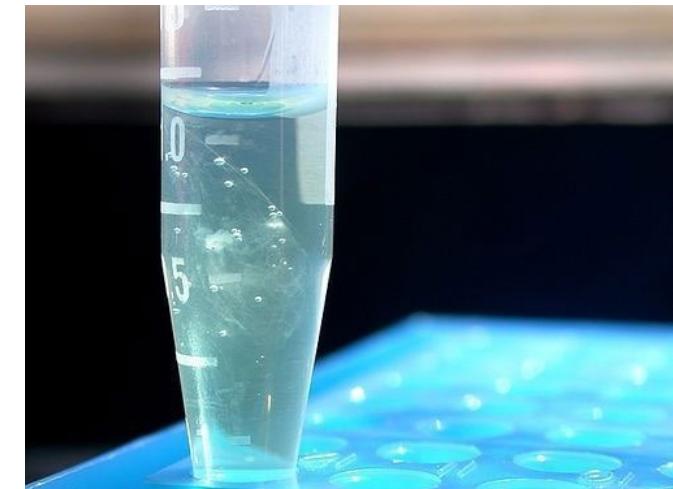
Aim:

- Understand three main stages involved in extracting DNA from plant cells (strawberries)



Stages of DNA extraction

- The process of DNA extraction is fairly straightforward, incorporating the following basic steps:
 1. Breaking cells open
 2. Separating DNA from proteins and other cellular debris
 3. Precipitating the DNA with an alcohol
 4. Cleaning the DNA (purification)
 5. Confirming the presence and quality of the DNA



Practical 2: PCR

Aim:

- Understand the processes involved in carrying out a PCR reaction.



Practical 2: PCR

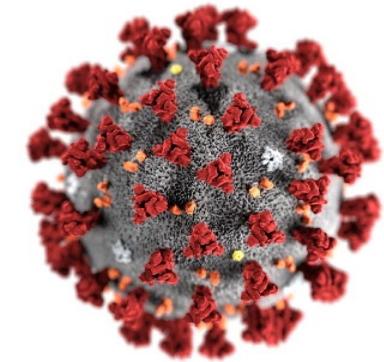
Polymerase Chain Reaction

Uses cell's mechanism of DNA replication to make lots of copies of small sections of DNA

Why would that be useful?

Uses of PCR

- Detection of Virus or bacteria
- Identification of Individuals (DNA fingerprinting)
- Identification of species (DNA barcoding)
- Diagnosis of genetic disorders



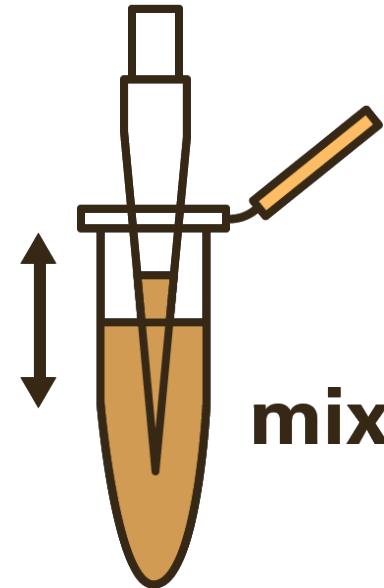
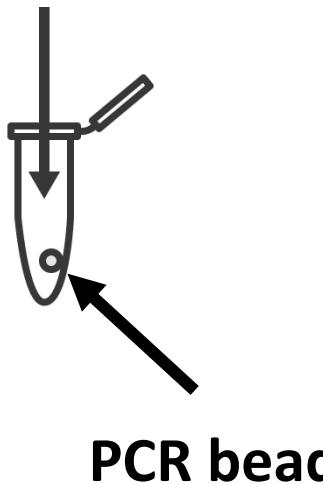
What do you need for a PCR reaction?

- A **DNA template** to be copied
- A **primer** – a short piece of DNA that is designed to bind with the DNA you want to copy
- **DNA bases** - the building blocks of the DNA molecule
- **DNA polymerase** – enzyme to build the new DNA fragments
- **Buffer** – this ensures the conditions remain stable for the reaction to take place.
- A **thermal cycler** – a machine that heats and cools the sample

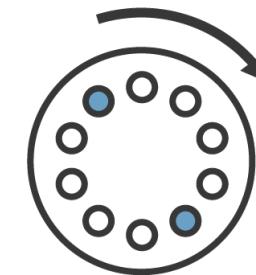
What will we be doing in the lab?

5 μ l DNA template

20 μ l primer mix

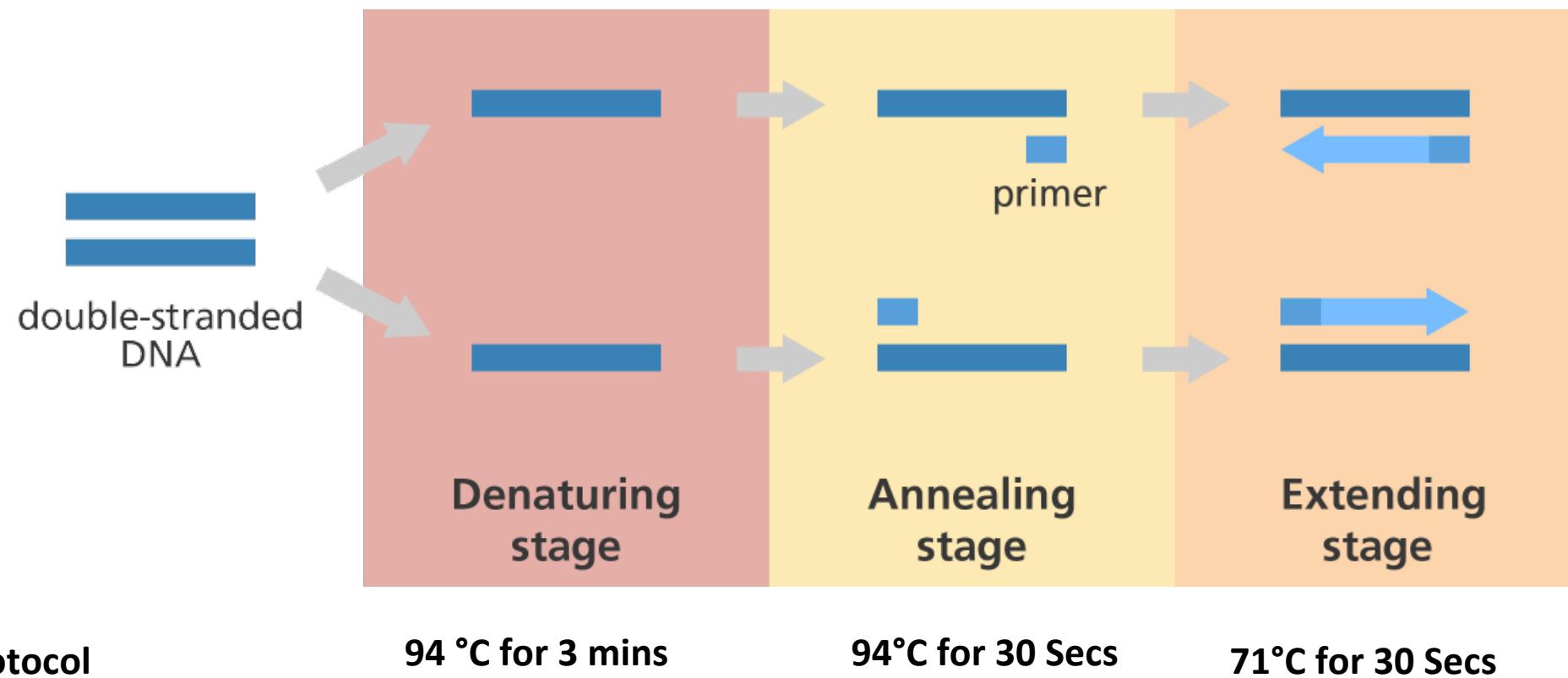


few seconds

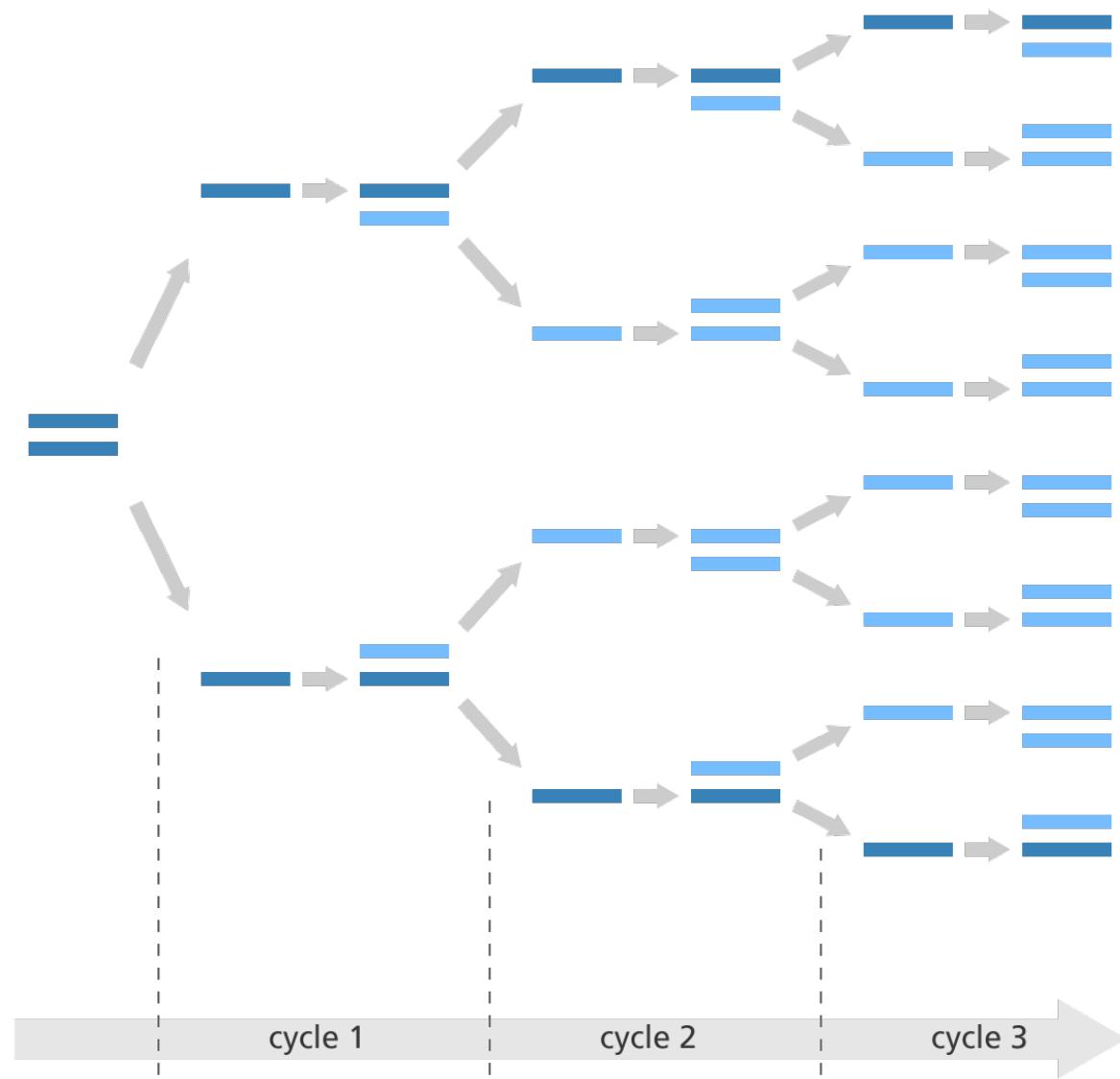


centrifuge

PCR cycling conditions



What will be happening in the PCR machine

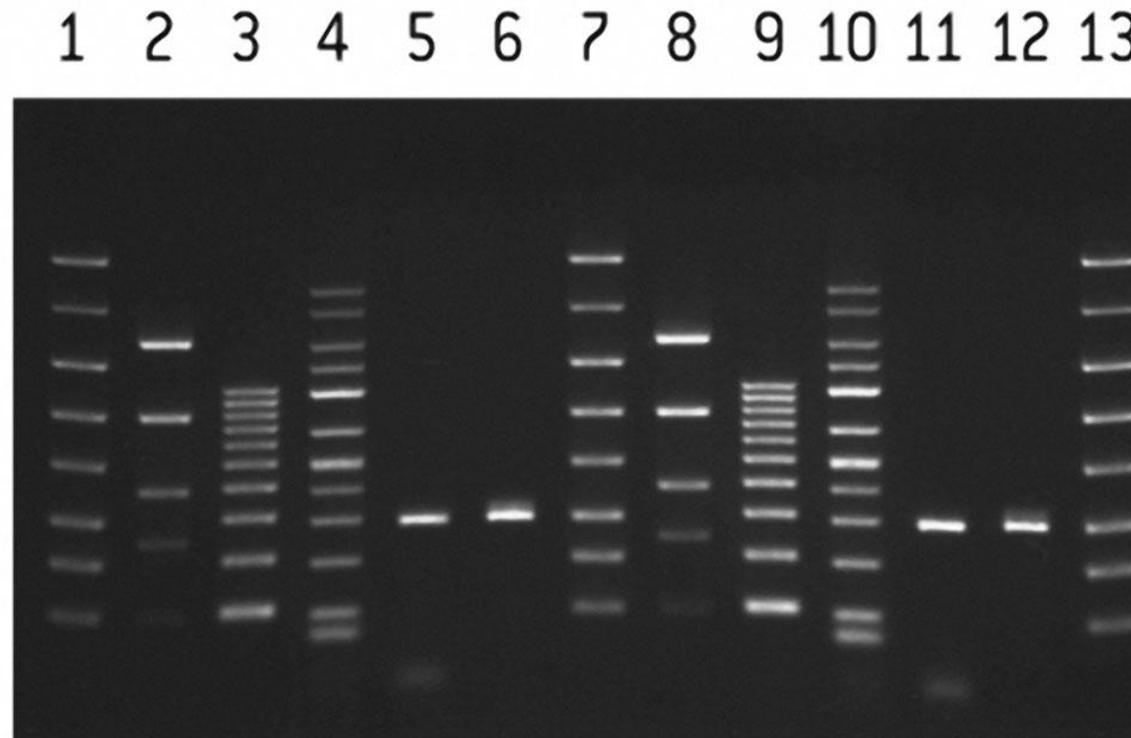


Using the Lonza Flashgel system

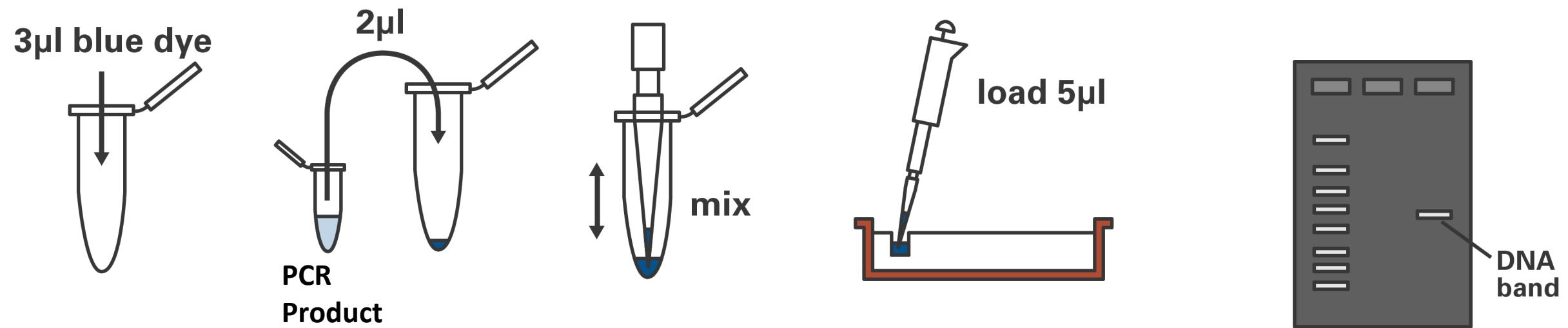


Visualising results

Gel electrophoresis can be used to view whether your PCR has been successful



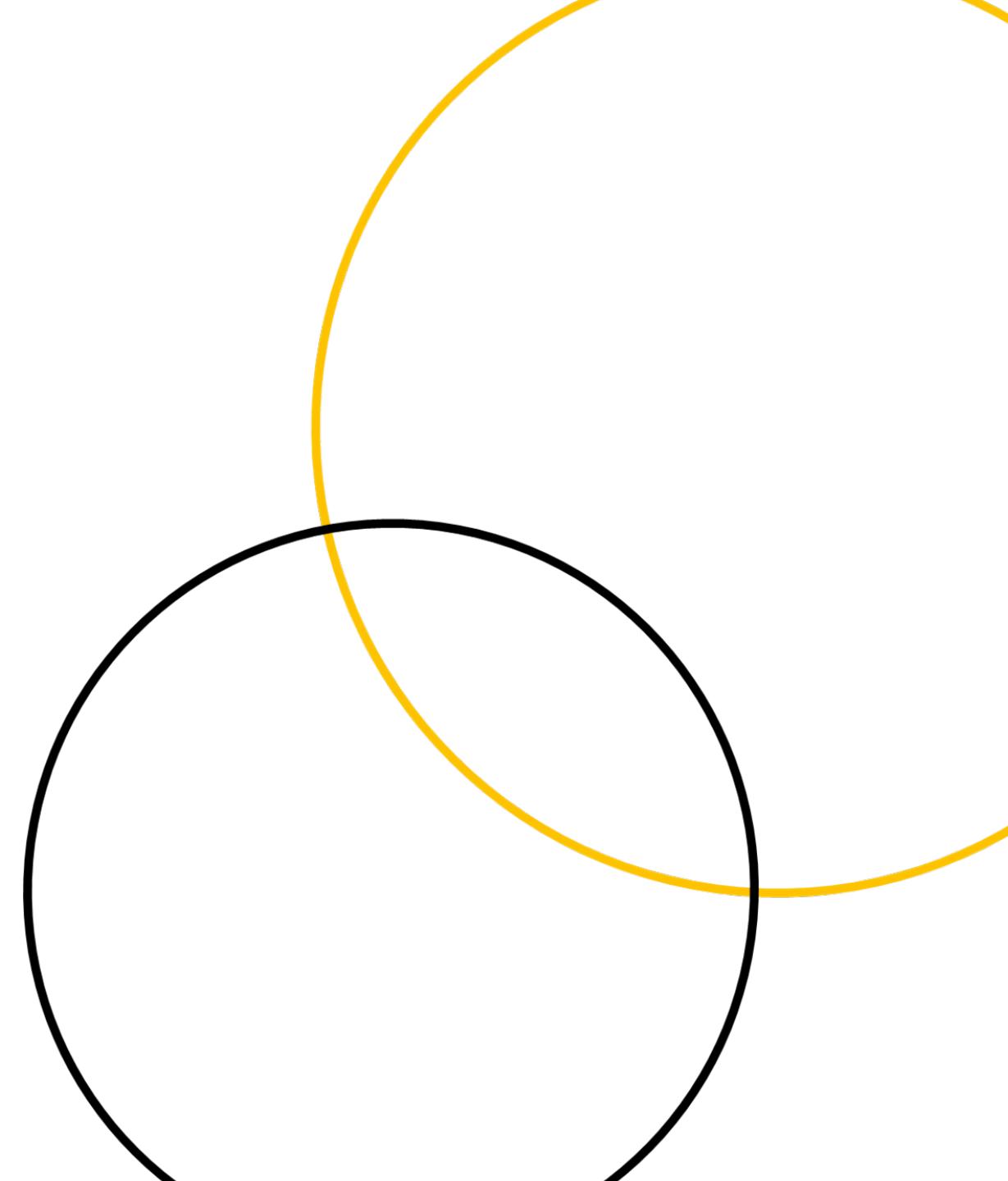
Lonza Flashgel (Gel electrophoresis)



Reflections

Day 1

Genome Academy: Day 1





Today has met my expectations.

- ⓘ Start presenting to display the poll results on this slide.



**Did you learn anything from today
that you didn't know previously?**

- ⓘ Start presenting to display the poll results on this slide.



**What was your most enjoyable or
most interesting moment from today?**

- ⓘ Start presenting to display the poll results on this slide.



Was there anything from today that you would like more information on or clarified?

- ⓘ Start presenting to display the poll results on this slide.



**What are you most looking forward to
for tomorrow's session?**

- ⓘ Start presenting to display the poll results on this slide.

thank you

see you tomorrow!

