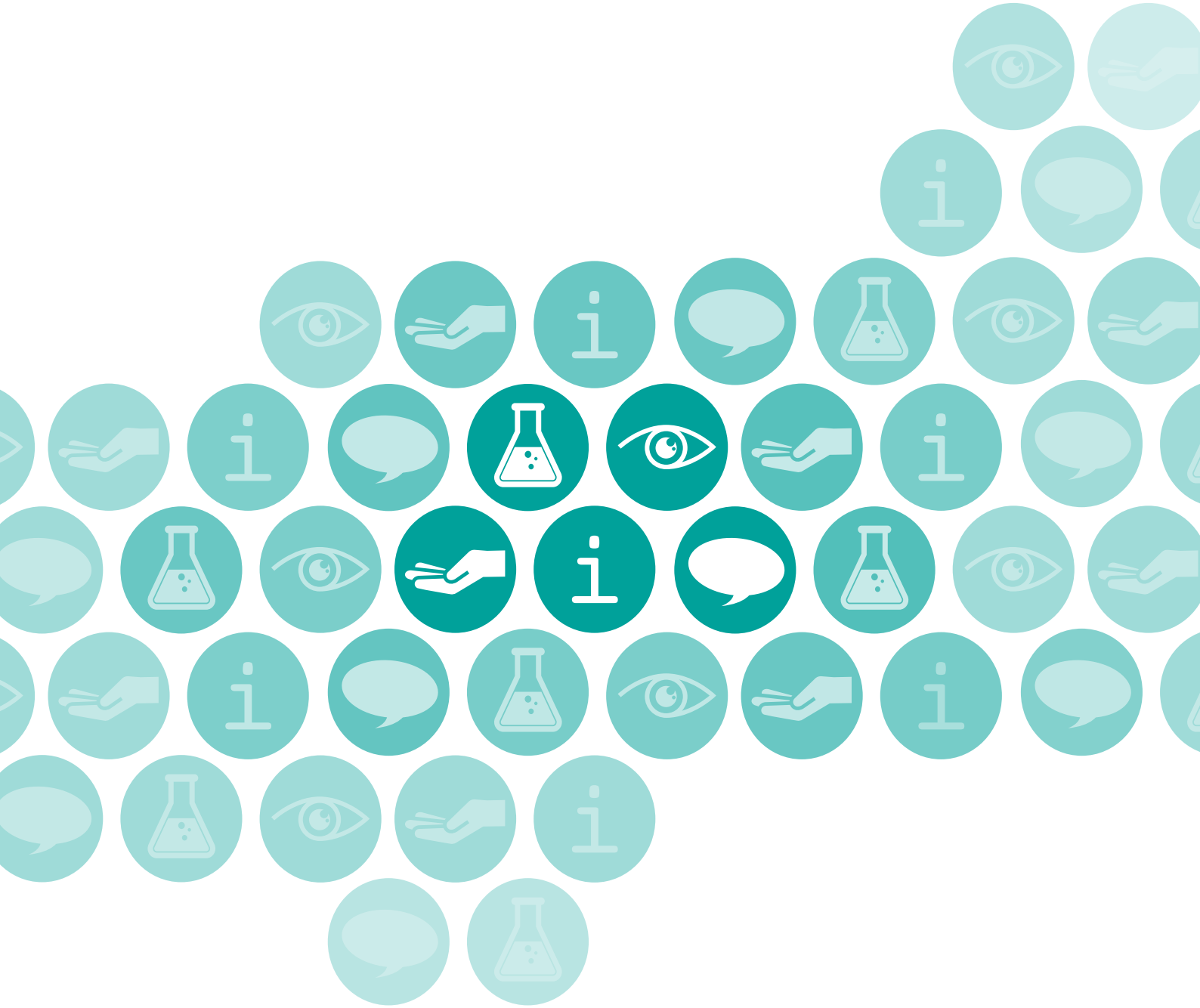
The Royal College of Pathologists
Pathology: the science behind the cure



CANCEL CANCER
RESOURCE PACK

Introduction

Cancer is a very common condition where cells in part of the body grow and multiply, invading and destroying healthy cells, tissues and organs. The process of cancer spreading to anywhere in the whole body is called metastasis.

There are over 200 different types of cancer, each with its own diagnosis methods and treatments. The 4 most common cancers in the UK are: breast, lung, prostate and bowel cancer. It is thought that more than 1 in 3 people will develop cancer at some point in their life. Our lifestyles can also cause cancer, such as if we smoke, or are exposed to asbestos.

Learning Objectives

- Learning about molecular pathology and what this means for cancer diagnostics
- Using a simple simulation to understand that we may all seem the same, but our genetics can predispose us to certain conditions
- Learning about inherited conditions and mutations
- Understanding of social, ethical and moral implications
- Learning to question and discuss issues that may affect their own lives, the directions of societies and the future of the world.

Materials Required

- Set of 2ml Eppendorf tubes half-filled with different solution mixes (see below)
- UV torches
- Bicarbonate of soda
- Tonic water (preferably flat, and must contain quinine)
- Water
- Bromothymol blue indicator
- Plastic cups/beakers for the indicators and solutions
- Plastic pipettes for students to add indicator 'treatment'
- A large box/bag for storing the tubes, allowing random selection by students

Making up the tubes:

- Enough tubes for the number of students.
- Two sets of half-filled tubes:
    1. Set 1: Contains bicarbonate of soda solution
       (dissolve the powder in water to give a colourless liquid)
    2. Set 2: Contains flat tonic water

Time Taken

(excluding preparation time) 20 minutes

Practical

If a pathologist is available, ask them to give a quick background on cancer and their role as a pathologist.

Give out tubes randomly to each student (or let them pick one out of a box/bag).

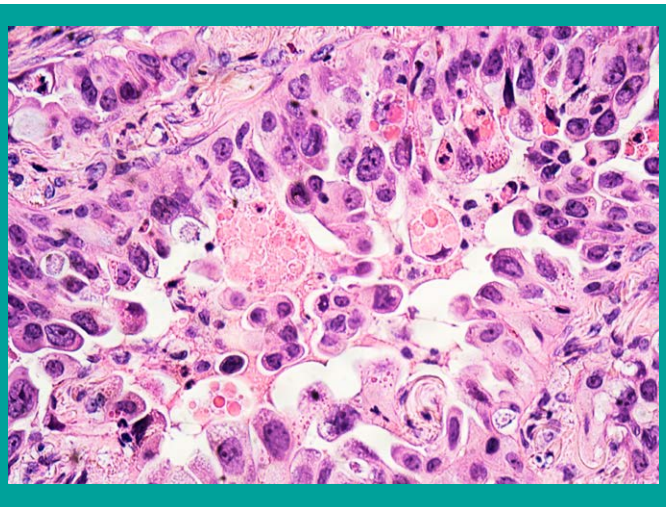
Explain that this is a simulation to help us understand what molecular pathology is, and why our individual genetic make-up is useful to know for effective treatment.

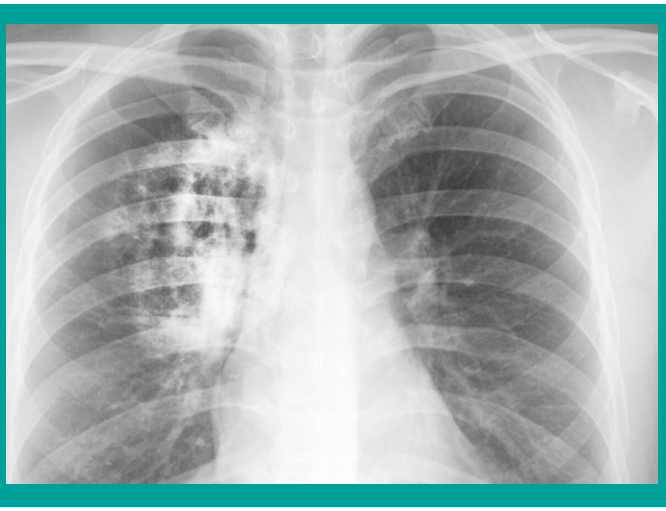
Each tube is a person with cancer. They all look the same (the tubes are colourless, containing colourless liquid)...we're all human beings. These 'people' all happen to have lung cancer.

But each human being is an individual. Our individual genetics can mean that although two people have lung cancer – the cancers can be very different.

Adenocarcinoma of the lung is one of the more common types of lung cancer (cancer of the mucus-making lining cells of the lung airways). There are different subtypes of this cancer.

The various genetic mutations in adenocarcinoma of the lung are treated differently and each tumour type needs a different type of treatment (e.g. **EGFR positive treatment, ALK positive treatment, chemotherapy** - EGFR: epidermal growth factor receptor; ALK: anaplastic lymphoma kinase). The advantage of using molecular pathology techniques to test patients for the type of cancer they have, is that you can ensure they receive the right treatment and avoid wasting time, expense and unwanted side-effects (that can happen with the wrong/ineffective treatment).





Each 'person' is going to undergo two tests to find out which subtype of adenocarcinoma they have: Test A (Bromothymol blue indicator) and Test B (UV torch).

The non-colour change with the indicator or glowing with the torch will signify if the test(s) are positive. The opposite means that the test(s) were negative. As these are all lung cancer patients, further tests need to be done on ones that show negative results.

Ask each student to try one of the tests and to note the response.

If it's negative, then ask them to try the second test and again record what happens. They can compare their results with each other verbally, and which subtype of adenocarcinoma of the lung they think their patient has.

If Test A is the indicator for Subtype 1 (Bromothymol blue would turn (stay) blue if bicarbonate is present, so the test is positive), and Test B is the UV lamp indicating Subtype 2 (and the tube would glow if tonic water is present, so the treatment works) – see table provided.

Ask students what they saw in their 'cancer patient'. Which test was positive? What cancer subtype did their patient have? Did others in the group see the same results with their patients? Why not?

Then explain the subtypes and possible treatments that follow:

If person 1 tests positive for EGFR lung cancer, they will get EGFR positive treatment. If EGFR doesn't work they will use chemotherapy;If person 2 has ALK positive lung cancer and will get ALK positive treatment. If ALK doesn't work they will try EGFR and if doesn't work they will use chemotherapy;

Any patient who doesn't respond to tests for EGFR and ALK, may need to undergo further tests, and be treated with standard chemotherapy.

Because our genetics are different, the cancers are different and therefore the treatments too will be different.

Useful Links

About lung cancer:

http://www.cancerresearchuk.org/about-cancer/type/lung-cancer/about

Molecular pathology:

https://pathologists.org.uk/specialities/molecular-pathology/

Person 1 (bicarbonate) - indicator **stays blue**, UV lamp **doesn't cause glow** (Test A positive, Test B negative): Subtype 1 adenocarcinoma of the lung.

Person 2 (tonic water) - indicator **turns yellow**, UV lamp **causes glow** (Test A negative, Test B positive): Subtype 2 adenocarcinoma of the lung.

TEST	POSITIVE RESPONSE	NEGATIVE RESPONSE
Test A (indicator)	This patient has Subtype 1 adenocarcinoma of the lung.	Further tests need to be done. Try Test B.
Test B (torch)	This patient has Subtype 2 adenocarcinoma of the lung.	Further tests need to be done. Try Test A.