

PRINTABLE RESOURCES TO SUPPORT LESSON 5 Teacher notes and student printable worksheets

TEACHER CRIB SHEETS- ANTIBODY RESEARCH

Breast Cancer-

- HER2 stands for human epidermal growth factor 2 and is overexpressed on the surface of cancerous cells i.e. those with uncontrolled growth although they are also found on normal cells. Not all breast cancers are HER2 positive – about 15-25% of women will be HER2 positive and only these women will respond to this drug. Fewer men tend to have HER2 positive breast cancer.
- Pharmaceutical name is Trastuzumab. Usually taken alongside chemotherapy (chemotherapy is broad-spectrum and widely cytotoxic hence the severe side effects vs. targeted drugs like this which are much more specific)
- Further information:
 - ✓ <http://www.cancerresearchuk.org/cancer-help/type/breast-cancer/>
 - ✓ <https://www.breastcancercare.org.uk/news/media-centre/breast-cancer-facts-statistics>
 - ✓ <http://www.macmillan.org.uk/Cancerinformation/Cancertreatment/Treatmenttypes/Biologicaltherapies/Monoclonalantibodies/Trastuzumab.aspx>

Heart attack –

- This is a higher level work sheet as there is a lot of new learning re. causes of heart attacks and functions of platelets.
- Specifically, Abciximab (US) or Reopro (UK branding) is the antibody therapy licensed for treating patients who have had angioplasty and / or widening the coronary artery with stents / balloons to prevent heart attacks or for patients with angina. The antibody targets platelets and the antibody receptors actively block the receptors required for aggregation of platelets.

- Abciximab is a chimeric human / mouse antibody fragment i.e. it is only made up of the parts of the antibody that bind the receptor / antigen and does not elicit a downstream function. Only serves to block.
- Abciximab has a short half-life in blood however receptor blocking is sustained for up to 15 days. Treatment involves an intravenous injection and if taking after angioplasty, should be given a month after treatment. Those with unstable angina are also given intravenously when other treatments have failed.
- Risks – haemorrhaging / bleeding as blood clotting is impaired. Can treat with infusion of platelets however will be impaired as drug will also bind these new platelets. Thrombocytopenia condition of massive decrease in platelets. Other symptoms include bruising and pinpoint marks due to burst vessels just under the skin. Bleeding gums and nose bleeds possible. Bleeding becomes normal again after 12 hours.
- Further information:
 - ✓ <http://www.nhs.uk/medicine-guides/pages/MedicineOverview.aspx?condition=Medicines%20used%20in%20heart%20procedures&medicine=Reopro&preparation=ReoPro%2010mg/5ml%20solution%20for%20injection%20vials>
 - ✓ <http://dailymed.nlm.nih.gov/dailymed/lookup.cfm?setid=033d4c3b-4630-4256-b8f7-9ed5f15de9a3>
 - ✓ <http://www.drugs.com/cdi/abciximab.html>

Leukaemia – Teacher crib sheet

- There are 5 different types of leukaemia:
 - Acute myeloid leukaemia
 - Acute lymphoblastic leukaemia
 - Chronic myeloid leukaemia
 - Chronic lymphocytic leukaemia
 - Hairy cell leukaemia

Acute myeloid leukaemia is the target type for this drug. CD33 is a cell surface marker that the antibody recognises.

- This is an example of attaching a drug to an antibody to reduce side effects in order to make the drug much more specific. The name of the drug is gemtuzumab (which is the antibody) which is attached to ozogamicin, the cytotoxic agent, which works non-specifically therefore requiring the antibody to direct it to the target cancer cells. The trading name is Mylotarg.
- This drug is currently in clinical trials in the UK. It was previously licensed in the US but then withdrawn again however there are other countries that are continuing to use it e.g. Japan, Argentina, Israel, Venezuela
- Further information:
 - ✓ <http://www.macmillan.org.uk/Cancerinformation/Cancertreatment/Treatmenttypes/Biologicaltherapies/Monoclonalantibodies/Gemtuzumab.aspx>
 - ✓ <http://www.macmillan.org.uk/Cancerinformation/Cancertypes/Leukaemiaacutemyeloid/AboutAML/WhatisAML.aspx>
 - ✓ <http://www.cancerresearchuk.org/cancer-help/type/leukaemia/?gclid=COvKrd35vLOCFXMPtAodOzEAdA>
 - ✓ <http://www.drugs.com/cdi/mylotarg.html>

XLA – Teacher crib sheet

- This case study would be suitable for lower ability students as the idea is to replace lost antibodies – no antibody ‘engineering’ is necessary
- X-linked agammaglobulinemia – as an X-linked disease, which means it is due to a genetic mutation on the X chromosome that in males due to the Y chromosome they only have one copy of. This means that as it is a recessive disease, it is much more likely for males to have the disease than females although if females inherit 2 copies of the recessive gene, they will still get the disease. Haemophilia and colour-blindness are alternative X-linked diseases.
- In XLA, B cells do not mature properly and are therefore unable to make antibody leading to increased susceptibility to infection. These infections usually appear in babies. Initially babies are protected by antibodies that have passed from the mother through the placenta before birth or to neonates through breast milk however after this, they become more susceptible to infection after these initial stages.

- Common infections are pneumonia (bacteria / virus in the lungs), sinusitis (bacterial / viral infections in the nasal passages, diarrhoea, ear infections due to impaired immune response.
- Treatment: antibody therapy. Large dose of intravenous antibody that has been isolated from blood in the plasma component from thousands of healthy donors that make up a pool to be injected.
(<http://bdipharma.com/Clinical-What-is-IVIG.aspx>)
- Further information:
<http://ghr.nlm.nih.gov/condition/x-linked-agammaglobulinemia>
<http://emedicine.medscape.com/article/884942-treatment>
<http://www.aaaai.org/conditions-and-treatments/primary-immunodeficiency-disease/x-linked-agammaglobulinemia.aspx>

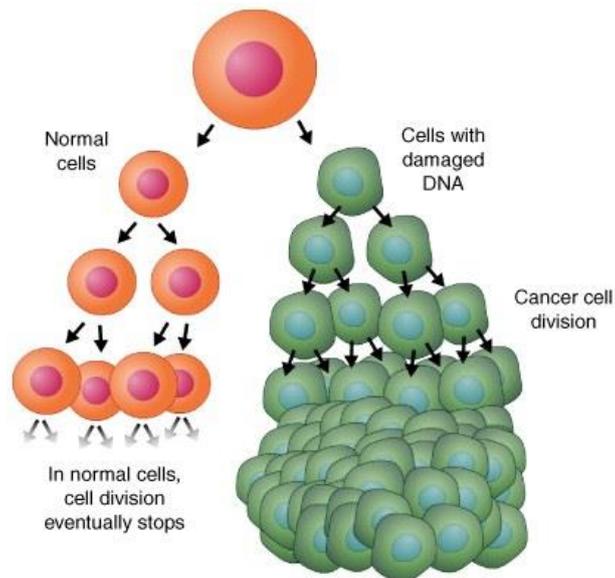
PRINTABLE STUDENT QUESTION SHEETS NOW FOLLOW

Breast cancer: What's the story?

Breast cancer is the most common cancer in the UK. Although mostly in women, it can also affect men

Extra amounts of a chemical (protein) **HER2** is found on the surface of breast cancer cells compared to normal cells. HER2 helps the cells to grow.

What causes breast cancer? Use the diagram to help you write an explanation.



How might we treat patients with cancer made up of cells with HER2 on the surface?

What is the function of HER2? Use this information to think about what the risks of blocking HER2 might be?

Heart Attack: What's the story?

Heart attacks happen when the heart does not get enough oxygen because the **coronary artery** that supplies it with blood which delivers the oxygen is blocked

Platelets are found in blood and stick together to form clots. This is good if you have cut your finger but what happens when a clot forms in the coronary artery?

What causes heart attacks?



We can engineer antibodies so that they recognise the surface of platelets. How can we use this to prevent heart attacks?

What are the risks of preventing platelets being able to stick together?

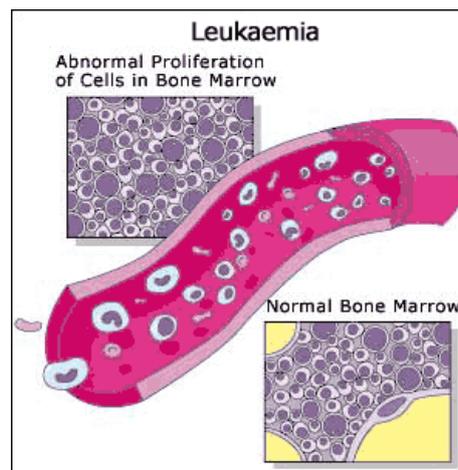
Leukaemia: What's the story?

Leukaemia is cancer of the white blood cells. There are 4 different types of leukaemia.

CD33 is a marker found on cancerous white blood cells only. This is a good way of identifying cancer cells and can be used to target drugs at them

White blood cells are made in the bone marrow.

Use the diagram to explain what causes leukaemia.



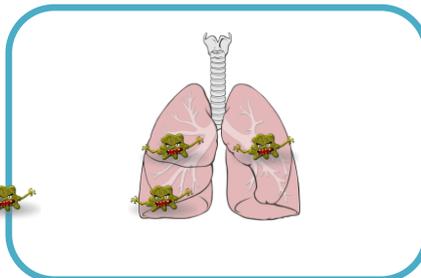
Ozogamicin is a drug that kills cancer cells but it can also kill normal cells. How might we use antibodies to treat leukaemia? What are the benefits of using antibody therapy rather than just giving the patient the drug?

XLA: What's the story?

Genetic diseases are diseases that have been passed on from your parents.

XLA (X-linked agammaglobulinaemia) is one of these diseases that means that your white blood cells can't make antibody

What do you think the symptoms of XLA are?



How might we treat patients with XLA?

We can purify antibody from human donors. What are the risks of the treatment?

In the UK, babies have to have lots of vaccinations. Some of these vaccinations are made from live bacteria or virus. What risks can you think of for a baby with XLA?