MEDICAL TECHNOLOGY ASSIGNMENT

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Due date\_\_\_\_\_\_\_\_\_\_\_\_\_\_. MARK /86

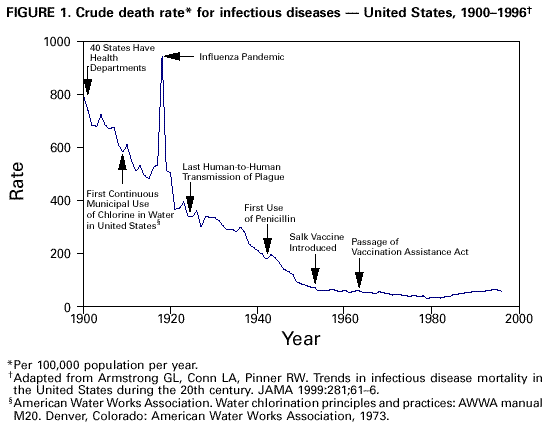
1. Look at the graph below

|  |  |  |
| --- | --- | --- |
|  | Change in Life Expectancy Since 1850 AD |  |
| Average life  Expectancy  (years) | <http://perfecthealthdiet.com/wp/wp-content/uploads/2011/02/Life-expectancy-US-1850-1990.jpg> |  |
|  | Date by Year |  |

1. State 3 causes for this change.

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1. marks)

Now look at the following graph.  
  


X

x

X**X** x

Y

1. What is the overall trend shown in this graph?

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(1 mark)

c. Research and then state the reason for the rapid decrease in death rate from infectious disease after point X on the graph.

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(1 marks)

d. Using the correct layout state the reference you used to answer c.

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(1 marks)

e. Point Y on the graph shows an anomaly. Research a reason for this anomaly.

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(3 marks)

f. Using the correct layout state the reference you used to answer e.

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(1 marks)

g. Relate your answer to question 1.a. to an increased incidence of Alzheimer’s disease in the population of the USA.

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(3 marks)

1. Complete the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| Disease | Brief description of cause and symptoms | Changes to diet that would help when treating/managing the disease. | Pharmaceuticals  used to treat/manage the disease. Do not just quote Drug brand names. |
| Osteoarthritis |  |  |  |

1. marks)
2. Read the following article and answer the questions that follow.

**HRT and Osteoporosis**

* The support group Osteoporosis Australia states that even at low doses, HRT helps to slow bone loss, reducing the risk of osteoporosis and fractures in women who have gone through menopause. HRT is safe and effective for most women under the age of 60 who have osteoporosis and who also need hormonal treatment to relieve the symptoms of menopause. It may also be prescribed for women under 60 who are unable to take other osteoporosis medicines. It is particularly useful for women who have undergone early menopause (before 45 years of age).
* Due to the small increased risk of heart disease, strokes and breast cancer in older women other osteoporosis medicines are more suitable for women over the age of 60.
  + 1. What is HRT?

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* + - 1. mark)
    1. If a medical practitioner was to prescribe HRT for a patient what would they need to do in order to behave ethically?

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1. marks)
   * 1. Other than treating osteoporosis, why else might a medical practitioner prescribe HRT?

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1. marks)
   * 1. What suggestions might a medical practitioner make, other than HRT, to help a person prevent the development of and reduce the impact of Osteoporosis?

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1. arks)
   * 1. Using the correct layout state 2 (two) references you used to answer question 3. One reference must be a book and one must be a web site.

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(2 marks)

1. Complete this table

|  |  |  |
| --- | --- | --- |
| Disease | Cause | Symptoms |
| Alzheimer’s disease |  |  |

(4 marks)

1. The bionic limb is an example of mechanical external technology.

Give a brief description of this limb.

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(2 mark)

1. a. Artificial joints are an example of mechanical internal technologies. Under which conditions would it be appropriate to use artificial joints?

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(1 mark)

b. List 3 situation where Physiotherapy would be beneficial.

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1. marks)
2. Corticosteroids, aspirin (salicylates) and NSAIDS drugs are all examples of anti-inflammatory drugs.

Why might they be given to someone with a joint injury?

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1. a. Complete the table

|  |  |  |
| --- | --- | --- |
| Technology | Definition | Potential situations where this technology can be used |
| Tissue regeneration |  |  |
| Tissue grafting |  |  |

(6 marks)

b. Using the correct layout state the reference you used to answer 7.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(1 mark)

1. Transplanting Tissues

Sometimes tissues can be transplanted from one part of a person’s body to another part of the same person’s body. This is called an autograft. Autografts are useful as the person’s body recognizes the tissue as being their own and there is less chance of the body rejecting the graft. Autografts can be used to treat damaged skin, muscle tissue and in some cases damaged blood vessels. Sometimes it is not possible to do an autograft so organs and tissues are transplanted from one person to another. A problem that may arise here is that the body of the recipient recognizes the donated tissue as being foreign. Special proteins called leucocyte antigens present on the cells of the donated tissue are recognized by the recipient’s immune system. In response the cell mediated and/ or antibody mediated immune systems attack the transplanted tissue. This is called organ or tissue rejection. As a result tissue matching is needed to increase the chances of transplant success. Immunosuppressant drugs can also be used.

1. What are immunosuppressant drugs?

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(1 mark)

1. What is it that needs to be matched in tissue matching?

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(2 marks)

1. When would an organ transplant be considered necessary?

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(1 marks)

1. Read this article from the Imperial College London News and answer the questions that follow.

# Gene therapy for Parkinson's disease yields promising results in first patients

By [Sam Wong](http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_9-1-2014-16-19-43#authorbox) 10 January 2014

A new gene therapy for Parkinson's disease has achieved promising results in its first human tests, involving 15 patients.

[Professor Nicholas Mazarakis](http://www.imperial.ac.uk/AP/faces/pages/read/Home.jsp?person=n.mazarakis&_adf.ctrl-state=12f5s996b2_3&_afrRedirect=2507917928701048), the Lucas Lee Chair of Molecular Biomedicine at Imperial College London, devised the approach while working at biopharmaceutical company [Oxford BioMedica](http://www.oxfordbiomedica.co.uk/) in 1997. Sixteen years later, the results of the first tests in humans have been published in medical journal [The Lancet](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)61939-X/abstract).

“It’s taken a long time to get to this point,” he says. “We’ve been fought all the way. People are hesitant to accept it as it’s so dramatic.”

The treatment, called ProSavin, uses a modified virus to deliver three genes into the striatum, a part of the brain that controls movement. The genes are intended to boost the production of a chemical that becomes deficient in patients with Parkinson’s.

Current treatments can boost the production of this chemical temporarily, but the cells that produce it continue to degenerate until the treatments are no longer effective.

“I'm very pleased that it has appeared to work in the clinic. It has the potential to move to the next phase.”

– Professor Nicholas Mazarakis

The new therapy aims to provide a long-term solution by stimulating the production of the chemical in a different set of cells.

Other gene therapies have been tried in Parkinson’s disease, but all employ a different approach. Professor Mazarakis’s strategy is to deliver three genes that code for enzymes that produce the important chemical. They are smuggled into the brain by a virus, closely related to HIV, which incorporates its genetic material into the genome of the cells it infects, ensuring a long-lasting effect.

After first testing the treatment in rats, Oxford Biomedica worked with Professor Stéphane Palfi’s group at the University of Paris to carry out a study in macaque monkeys. While the study was ongoing in France, Professor Mazarakis received an unexpected phone call from his collaborator. “I can’t tell you what it is on the phone, but you’d better come over,” Professor Palfi said.

When he arrived in Paris, Professor Mazarakis saw monkeys that could barely move before the treatment climbing their cages.

“The surgeons couldn’t believe the effect,” he said. “Since then I knew that if the effect on movement in humans was as good as in primates, it would be something that can help people in late stage Parkinson’s disease, where they become very disabled.”

The team showed that [the treatment corrected the movement deficits of the monkeys](http://stm.sciencemag.org/content/1/2/2ra4.long) for up to three and a half years, without any visible adverse effects. Notably, it didn’t result in abnormal involuntary movements caused by treatments in use today.

Those results paved the way for the first tests in humans. Before beginning a double-blind, placebo-controlled trial straight away – the most rigorous type of trial – the team decided to test different doses on a small group of patients.

The trial participants, three in the UK and 12 in France, all in the advanced stages of the disease, underwent a single operation to inject the virus into the brain.

The treatment has been safe, with no serious adverse effects. The patients’ scores on movement tests have improved on average by 30 per cent, and they also report having a better quality of life. The first patients to have the surgery have now been followed up for four years, and the effect has been sustained. PET scans confirm that the important chemical is being produced in the brain where it wasn’t before.

You have to remember that gene therapy is a field that's still maturing. – Professor Nicholas Mazarakis

In such a small study, it’s difficult to compare the effects of different doses, but there are indications that the highest dose had the strongest effect.

The absence of a placebo group for comparison means the results have to be interpreted with caution, but the researchers are certainly optimistic.

“I’m very pleased that it has appeared to work in the clinic,” said Professor Mazarakis. “It has the potential to move to the next phase. It needs to be done in more people; we have to find the most effective dose, to further increase efficacy, and prove beyond doubt that this is not a placebo effect.”

The treatment is currently very expensive, but Professor Mazarakis expects that the cost will come down as gene therapies become more established and more companies produce viruses for gene delivery.

“You have to remember that gene therapy is a field that’s still maturing. The first trial was in 1990. Only now are we starting to see treatments getting close to the clinic.”

The team will continue to test the treatment on more patients, and plan to carry out a larger, placebo-controlled trial once they have optimised the dose and delivery method.

Questions

1. What is the cause of Parkinson’s disease?

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1. marks)
2. What are the symptoms of Parkinson’s disease?

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1. marks)
2. What was the vector in this study? Also what did it do and cause?

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1. marks)
2. The experiment has not been run yet with a placebo group. What characteristics would the placebo group need for this experiment?

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1. marks)
2. What is gene therapy?

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(2 marks)

1. What is meant by a double blind experiment and why is it useful?

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(2 marks)

1. At present what pharmaceutical treatments are used to treat Parkinson’s disease? Do not just state brand names.

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1. marks)

The End