Notice of Assessment Task
Year 12 Biology: Secondary Source Investigation

Date of initial notification:	Date of submission of task:
Thursday 6 March 2025 Week 6, Term 1	Thursday, 20 March 2025 Week 8, Term 1

Teacher: Miss Nunes	Task Number: 2

Time Allowed: 2 weeks	Weighting of task: 20%

Course Component/Focus area/topic/module:
Module 6 – Genetic Change

The Task

Students will answer an extended response question after investigating the specific applications of reproductive technologies and consider the social and ethical issues related to the application of reproductive technologies with respect to the following inquiry question:

"How do genetic techniques affect Earth's biodiversity?"

At its simplest, biotechnology is the merging of 'biology' and 'technology', and at its broadest, it is an interdisciplinary technology which encompasses many fields of science and technologies along with biology including chemistry, physics, mathematics and engineering, to help improve the future of humans and the planet.

Task Outline

1. Students will read a short article and respond to some guided questions in PART A before they launch into their own research in PART B.
2. Students will conduct their own research in a secondary-source investigation aimed at investigating the possibilities CRISPR has to offer.
3. Students will communicate their findings in and extended response question.
4. Students will prepare a list of references in accordance with the Harvard style of referencing.
5. Students will submit Part A as a hardcopy to the teacher by the due date.
6. Students will submit Part B via Google Classroom by the due date.

Instructions

- Ensure your name, class, and teacher is clearly labelled.
- All work submitted must be original and completed individually.
  (NOTE: Any work deemed to be plagiarised will be treated as a non-serious attempt and dealt an appropriate consequence in accordance with the school and faculty policy)

Outcomes/Competencies to be assessed in this task:
BIO12-4 - selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media
BIO12-5 - analyses and evaluates primary and secondary data and information
BIO12-13 - explains natural genetic change and the use of genetic technologies to induce genetic change

Feedback: How will I receive feedback on this task?
☒ Written
☒ Individual

- *If you are absent on the day that the task is due, you MUST see your teacher the next day (not your next lesson) that you are present at school to show your medical certificate or produce a misadventure form (refer to your Assessment Booklet for a copy of the form).*
- *Exemptions and extensions for any other reason will only be determined at the discretion of the Head Teacher, and only in extenuating circumstances. You must advise the Head Teacher as soon as possible if you know you are unable to submit the task on the due date.*
- *All appeals must be lodged within 48hrs of receipt of the task. Students who may consider an appeal are not permitted to take their task home. The original task cannot be altered in any way prior to the appeal process.* See Assessment booklet for details.

Secondary Source Investigation – Genetic Technologies

INTRODUCTION

In this Secondary Source Investigation, you will consider two genetic technologies - preimplantation genetic diagnosis (PGD) and CRISPR, a cutting-edge genetic technology that allows scientists to edit the genome of embryos carrying faulty genes, replacing faulty DNA sequences with 'normal' ones. In Part A you will read a short article and respond to some guided questions before launching into your own research in Part B.

While these technologies give hope to individuals and families, they also raise a number of social, economic, legal and ethical issues for society. In this task you will consider the issues raised by the different technologies and communicate your understanding.

Part A – An examination of some assisted reproductive technologies

- Read the short article on Pre-implantation genetic diagnosis (PGD) provided in PART A.
- Respond to the guided questions

Part B – CRISPR: a new frontier in genome editing

CRISPR is an abbreviation for 'clustered regularly interspaced short palindromic repeats'. That means just what it says-short DNA sequences that are palindromic (read the same both forwards and backwards) and appear in clusters with regular spacing between them. The spacers contain unique DNA segments, i.e. they are not repeats, but different from each other.

Why has CRISPR been the centre of so much attention in recent times if it is just DNA? And why is it so controversial?

CRISPR is a special kind of DNA found in bacteria, which use it to combat viral infections. In association with a protein called Cas9, scientists have been able to construct a bacterial CRISPR-Cas9 system that can edit DNA sequences in living cells. The possibilities are profound. The genomes of organisms could be manipulated to confer desirable characteristics in plants and animals, for example, to improve crops in agriculture; bacteria and viruses could be altered to combat disease; and genetic errors in faulty genes could be corrected to bypass genetic disease.

In this part of your Secondary Source Investigation, you will find out more about CRISPR and the possibilities the technology has to offer. You will raise issues and ask questions, as well as make some predictions about potential longer-term consequences of some CRISPR applications.

While conducting your research, you are to answer an extended response question to communicate your findings and ideas about this cutting-edge technology.

Part A – an examination of some assisted reproductive technologies

Investigating an issue

Pre-implantation genetic diagnosis (PGD) is a prenatal and predictive genetic technique developed in the 1980s that offers hope for families with a history of genetic disease. Combined with IVF technology, it allows embryos to be screened for genetic diseases-only 'healthy' embryos are selected for implantation.

Unfortunately, it is not uncommon for families to become aware of a genetic disease only upon the birth of an affected child. In these instances, families typically seek every possible avenue to remedy the situation for the sick child. Advances in reproductive and genetic technologies provide hope for such families, but the possibilities are not without controversy.

PGD combined with IVF technology can be used to produce healthy subsequent children who are free of the devastating genetic disease that afflicted the first child. However, these technologies are increasingly applied to screen embryos for tissue matching, improving the chance that a subsequent child can be a successful donor for the first.

multiple embryos produced / cells removed for biopsy				
affected	✓	×	✓	×
compatible bone marrow	×	×	✓	✓
implanted	×	×	×	✓

Such was the case for an Australian family whose story was reported in *The Age* in 2004. They made medical history while seeking a cure for their sick first child, who suffered from the genetic disease hyper lgM. Hyper lgM is a disease in which the immune system is compromised, leaving patients vulnerable to infection, so that what is considered a mild infection for a healthy person can be life-threatening for these patients. To save his life, the child needed a bone marrow transplant. With no suitable donors available, either in the family or on the bone marrow registry, the family decided to turn to technology. In this groundbreaking case, PGD was applied to screen embryos not only for hyper lgM, but also to ensure the new sibling would be a tissue match for his sick brother. After a marathon 36 embryos and a great deal of financial investment, a successful tissue-matching embryo was achieved. Paired with IVF technology, a brother to the first sick child was born in 2004.

Hyper lgM is a genetic condition that affects around 30 children in Australia each year. A multitude of other genetic diseases afflict children around Australia and the world. The pairing of genetic and reproductive technologies offers hope to such children and their families. At the same time, debate continues around the ethics of applying science to create what have been dubbed 'designer babies' by some critics.

Adapted from 'Changing conceptions' by Rachel Browne, The Age, 26 September 2004

ANALYSISING DATA AND INFORMATION

1. a) What does 'Preimplantation Genetic Diagnosis' mean?

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b) Explain why Preimplantation Genetic Diagnosis (PGD) needs to be used in conjunction with IVF technology.

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2. Describe the twofold benefits to the family that result from PGD application.

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3. Debate surrounding embryo screening continues in Australia and around the world. Write a list of issues that arise from the application of this technology. Include social, economic, legal and ethical concerns.

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4. Consider carefully the positions of people on different sides of the PGD debate. Identify at least two different stakeholders and prepare arguments from their points of view.

Part B – CRISPR

1. CRISPR is an emerging genetic technology. **Critically analyse** the use of this technology. Ensure your response includes the following points:
   - Flow chart of the process and labelled diagram.
   - Applications of CRISPR
   - Issues raised in its use
   - Social, cultural, and economic implications
   - Possible long-term effects (positive or negative)

2. Conclude by answering the inquiry question proposed at the start of this investigation '*How do genetic technologies affect Earth's biodiversity?'*

- As a guide to length for this task, your response should be approximately 2-3 pages in length.
- Keep your work to the point. You will be assessed on addressing each criterion logically and clearly, not on volume.
- Use the marking criteria provided to help you complete the task.

MARKING CRITERIA
HSC Biology Secondary Source Investigation - Genetic Technologies

PART A – Creative conception - an examination of some assisted reproductive technologies

4	3	2	1	0	Marks
BIO12-5 **Analysing data and information** analyses and evaluates primary and secondary data and information					
		Sound definition of PGD provided	Basic definition of PGD provided	Definition not provided	
		Sound explanation to why PGD needs to be used in conjunction with IVF technologies	Basic explanation to why PGD needs to be used in conjunction with IVF technologies	Explanation not provided	
	Thorough description of twofold benefits to family that result from PGD application	Sound description of twofold benefits to family that result from PGD application	Basic description of twofold benefits to family that result from PGD application	No description provided	
Extensive list of issues that arise from PGD technology, including social, economic, legal & ethical concerns	Thorough list of issues that arise from PGD technology, including social, economic, legal & ethical concerns	Sound list of issues that arise from PGD technology, including social, economic, legal & ethical concerns	Basic list of issues that arise from PGD technology, including social, economic, legal & ethical concerns	No issues identified	
Detailed argument prepared from TWO different stakeholders in PGD debate	Sound argument prepared from TWO different stakeholders in PGD debate	Sound argument prepared from ONE different stakeholder in PGD debate	Basic arguments provided	No arguments provided	
				PART A SUB TOTAL:	/15

PART A SUBTOTAL:	
PART B SUBTOTAL:	
TOTAL MARKS:	
%:	
GRADE:	

COMMENT:

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PART B – CRISPR-a new frontier in genome editing

Outcomes	Elementary	Basic	Sound	Thorough	Extensive	MARKS
BIO12-4 **Processing data and information** selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media	- Requires teacher assistance to collect valid and reliable secondary data and information - Provides elementary information about what CRISPR is and how it works - Lists CRISPR process, including limited definitions and limited use of diagrams - CRISPR focus application not identified - 1-2 number of references used - References from non-reliable sources - Footnotes not included	- Requires some teacher assistance to collect valid and reliable secondary data and information - Provides basic information about what CRISPR is and how it works - Identifies CRISPR process, including limited definitions and no use of diagrams - CRISPR application topic not clearly identified - 1-2 number of references used - References from both reliable and non-reliable sources - Some evidence of footnotes	- Collects suitable valid and reliable secondary data and information - Provides sound information about what CRISPR is and how it works - Sound description of CRISPR process in flowchart, including some definitions and limited use of diagrams - CRISPR focus application clearly identified - 3-4 number of references used - References from reliable sources - Sound uses of footnotes	- Collects suitable valid and reliable secondary data and information - Provides thorough information about what CRISPR is and how it works - Thorough outline of CRISPR process in flowchart, including some definitions and some use of diagrams - CRISPR focus topic clearly identified - 5-6 number of references used - References from reliable sources - Thorough use of footnotes	- Collects suitable valid and reliable secondary data and information - Provides extensive information about what CRISPR is and how it works - Extensive outline of CRISPR process in flowchart, including all definitions and a wide use of diagrams - CRISPR focus application clearly identified - >6 number of references used - References from reliable sources - Extensive use of footnotes	
	1-2 marks	*3-4 marks*	*5-6 marks*	*7-8 marks*	*9-10 marks*	
	- Elementary list of issues raised by using CRISPR (less than 5 issues) - Limited outline of how CRISPR could be used to advance identified goal - Identifies some relevant information	- Basic list of issues raised by using CRISPR (less than 5 issues) - Basic outline of how CRISPR could be used to advance identified goal - Identifies some relevant information	- Sound list of issues raised by using CRISPR (at least 5 issues) - Sound description of how CRISPR could be used to advance identified goal - Explanation includes advantages and disadvantages of the goal and some other relevant information	- Thorough and clearly explained list of issues raised by using CRISPR (at least 5 issues) - Thorough description of how CRISPR could be used to advance identified goal - Explanation includes advantages and disadvantages of the goal and relates information to the ethnicity of the issue	- Extensive and concisely explained list of issues raised by using CRISPR (at least 5 issues) - extensive explanation of how CRISPR could be used to advance identified goal - Explanation includes numerous advantages and disadvantages of the goal and relates detailed information to the ethnicity of the issue	
	1 mark	*2 marks*	*3 marks*	*4 marks*	*5 marks*	

Outcomes	Elementary	Basic	Sound	Thorough	Extensive	MARKS
BIO12-13 explains natural genetic change and the use of genetic technologies to induce genetic change	- Demonstrates elementary knowledge and understanding of genetic technologies - Attempts to identify some potential benefits and drawback of CRISPR - Difficulty suggesting implications for the future due to use of CRISPR - Provides elementary outline of reasons to why we should proceed with caution when using CRISPR - Attempts to provide an overall position on CRISPR and difficulty supporting position with research and data	- Demonstrates basic knowledge and understanding of genetic technologies - Identifies potential benefits and drawback of CRISPR - Difficulty suggesting implications for the future due to use of CRISPR - Provides basic outline of reasons to why we should proceed with caution when using CRISPR - Identifies an overall position on CRISPR and difficulty supporting position with research and data	- Demonstrates sound knowledge and understanding of genetic technologies - Describes potential benefits and drawback of CRISPR - Soundly suggests implications for the future due to use of CRISPR - Provides sound description of reasons to why we should proceed with caution when using CRISPR - Outlines overall position on CRISPR and uses some research and data to support position	- Demonstrates thorough knowledge and understanding of genetic technologies - Explains potential benefits and drawback of CRISPR - Thoroughly suggests implications for the future due to use of CRISPR - Provides thorough explanation of reasons to why we should proceed with caution when using CRISPR - Thorough justification of overall position on CRISPR and uses research and data to support position	- Extensive knowledge and understanding of genetic technologies - Analyses potential benefits and drawback of CRISPR - Extensively suggests implications for the future due to use of CRISPR - Provides extensive analysis of reasons to why we should proceed with caution when using CRISPR - Extensive justification of overall position on CRISPR and uses research and data to support position	
	1-2 marks	*3-4 marks*	*5-6 marks*	*7-8 marks*	*9-10 marks*	
Communication and Presentation	- Limited use of scientific and appropriate terminology to demonstrate familiarity with the language of the topic - Limited use of a reference list - Presentation style not appropriate for audience or purpose	- Uses basic scientific terminology with limited information - Attempt of use of in-text referencing - Provides a reference list attempting to use the appropriate reference style - Uses an appropriate presentation style	- Uses language that is relevant and with accurate scientific terminology and information - Use of in-text referencing that may be limited and/or have minor errors - Provides a reference list using the appropriate referencing style that may be limited and/or have minor errors - Uses an informative and mostly easy to read presentation style	- Uses language that is mostly clear and precise with accurate and relevant scientific terminology and information - Correct use of in-text referencing - Provides an accurate reference list using the appropriate referencing style some minor errors - Uses an informative and easy to read presentation style	- Consistently uses language that is clear and precise including accurate relevant scientific terminology and information - Correct use of in-text referencing - Provides an accurate reference list using the appropriate referencing style - Uses an eloquent, concise, informative presentation style	
	1 mark	*2 marks*	*3 marks*	*4 marks*	*5 marks*	
					PART B SUB TOTAL:	/30