Qu 40 Name _____

Total /20 Marked by J.Bell

a.

Type of Stem Cell Differentiation	Where Found	Differing Differentiation Ability
Totipotent	Zygote (1-3 days)	Can differentiate to form all specialised cells of the body (and placenta…)
Pluripotent	Blastocyst (8-14 days)/Primary germ layers	Can form a wide range of specialised cells
Multipotent	Adult stem cells (eg umbilical cord blood/red bone marrow)	Can form a few specialised cells

½ each **1 mark each** **½ each** **Max /6 marks**

b. Marking key (1 mark each with a maximum of 14)

- The gene hGH is isolated from DNA
- by cutting it at a recognition site/particular DNA sequence
- using a specific restriction enzyme
- To produce sticky ends (so unpaired nucleotides overhang at the break).
- PCR can be used to amplify copies of the hGH

Max / 5 marks

Then

- A plasmid which is a circular strand of DNA is removed from a bacterium.
- The plasmid is cut with the same type of restriction enzyme (endonuclease) that was used to cut the gene of interest
- to create complementary sticky ends (between the plasmid and the segment of DNA containing the gene of interest).
- The hGH gene and plasmids are placed in a mixture with DNA ligase
- DNA ligase is used to reform the sugar-phosphate bonds between the isolated gene and the plasmid.
- To form recombinant DNA/plasmid which is inserted into a new bacterial cell to produce a transgenic organism.
- The transgenic organisms are isolated from any bacteria that failed to take up the recombinant DNA.
- The transgenic bacteria is then cloned
- So that large amounts of the hGH (human growth hormone) can be produced in the laboratory.

Max /9 marks

Question 41 Name _____

/20 Marked by Mr Argus ☺

- The lab tech will need to; amplify the microsatellites / STR / VNTR.
- Which will be run on a gel electrophoresis to determine their relative lengths.
- Define STR – Short Tandem Repeats – 2-5 base repeats in DNA.

PCR

- PCR can be used to amplify the small amount of DNA extracted from the blood
- The DNA is placed in a mixture that consists of taq polymerase, free nucleotides and appropriate primers
- Run through 3 stages. Denaturing, annealing and extension / elongation.
- Denaturing; The mixture is heated to ~95◦C **[1/2]** so as to separate/denature the DNA strands.
- Annealing; The mixture is then cooled (~50◦C) **[1/2]** to allow primers to bind to the end of the gene.
- Extension; The mixture is then heated again (to ~72◦C) **[1/2]** which allows Taq to attach and create a complementary DNA sequence.
- This cycle of heating and cooling occurs many times to produce huge numbers of DNA.

Producing the Fragments

- The DNA is then cut using specific restriction enzymes
- Which will cut at specific nucleotide sequences **– recognition site**
- The DNA pieces are run through a gel electrophoresis
- The strands are placed into the wells at the negative end of the electrophoresis tray
- Electric current is run though the gel, pulling DNA fragments towards positive end.
- As DNA is negatively charged.
- Large pieces will move slower, small pieces travel faster.
- DNA bands are created, based on the lengths of STR / VNTR / microsatellites

Comparing Profiles

- Banding pattern unique to individuals.
- These lengths can be compared to the suspects to determine if it their DNA.
- If bands of crime scene DNA / DNA profile / matches known profile then evidence suggests suspect was at crime scene.

Alternative Fragment Creation

- The DNA sample is PCRed with Taq, pirmers (specific to microsatellite locations) and free nucleotides.
- This causes only the microsatellites to be replicated.
- Run through 3 stages. Denaturing, annealing and extension / elongation.
- Denaturing; The mixture is heated to ~95◦C so as to separate/denature the DNA strands.

- Annealing; The mixture is then cooled (~50◦C) to allow primers to bind to the end of the gene.
- Extension; The mixture is then heated again (to ~72◦C) which allows Taq to attach and create a complementary DNA sequence.
- This cycle of heating and cooling occurs many times to produce huge numbers of DNA.

Question 39 NAME _____ /20

a.

- ☐ Stimulus: when an athlete exercises on a hot day the body temperature rises
- ☐ Rise in body temperature is due to heat produced from increased cellular respiration
- ☐ Receptor: peripheral thermoreceptors in skin detect this increase in temperature
- ☐ Receptor: central thermoreceptors in the hypothalamus detect this increase in temperature
- ☐ Modulator: Hypothalamus receives information from thermoreceptors and fires off a nerve impulse to various effectors
- ☐ Effector: blood vessels
- ☐ Effector: sweat glands
- ☐ Response: vasodilation of blood vessels
- ☐ Increasing blood flow to the skin
- ☐ Heat is lost via radiation
- ☐ Response: sweat glands are stimulated to produce sweat
- ☐ Evaporation of sweat cools the body
- ☐ As a result, body temperature decreases

Note- for a short term activity change in metabolism due to thyroxine changes would not be evident

b.

½ mark for each physiological change (max 3 marks)

1 mark for the explanation (max 6 marks)

	Physiological Changes That Give A Survival Advantage		**How Survival Advantage Gained**
	Increased heart rate/strength of contraction/ cardiac output		Increases cardiac output which increases flow of oxygen and nutrients to the cells for increased cell respiration/energy production
	Dilates bronchioles/ increased breathing rate		Increased O_2 into blood increasing O_2 into cells for increased cell respiration (and CO_2 removal)
	Decreased activity of stomach/intestines		Increased blood flow to skeletal muscles for ….(above)
	Increased blood flow to skeletal muscles		Increases flow of oxygen and nutrients to muscle cells for increased cell respiration/energy production
	Increased glycogenolysis in the liver/muscles. Increased gluconeogenesis		Increased glucose in blood stream increases cell respiration ….(above)
	Relaxed iris/pupil dilation		Increases visual acuity for better vision…
	Increased sweat production		Remove heat via evaporation created by increased cellular respiration so the body can perform optimally
	Adrenal medulla secretes noradrenaline and adrenaline		Increased glycogenolysis/ gluconeogenesis/increased blood pressure/heart rate