Name: _____
Score: _____ / _____

Quiz 8 on Medical Biotechnology

Part 1

What are the origins of medical practice? Humans have been involved with medical biotechnology

- A. since the cloning of the insulin gene in the 1980s
- B. since 1998 and the discovery of stem cells ac cellular pharmaceuticals
- C. to establish a eugenics program since the 1930s that is now actively in progress through the BGI in mainland China
- D. as a conspiracy with the American Medical Association (AMA) to increase health care costs.
- E. for hundreds of years to address a wide variety human health issues whenever intervention can be applied

Loss of cell or tissue function characterizes many degenerative diseases. Many degenerative diseases are characterized by organ failure or cell loss. These types of disease are attractive candidates for stem cell therapy and gene therapy which include:

- A. disease states that require gene therapy
- B. only degenerative disease of unknown etiology or autoimmune disease
- C. all of the disease states described in the other answers
- D. only age-related degenerative diseases, such as Parkinson's and Alzheimer's
- E. only cell or organ destruction due to genetic, environmental or infectious disease, such as diabetes.

It has been suggested that the same technologies that have been developed for human embryonic stem cells, or hES stem cells, and therapeutic cloning, could be used for other purposes. Stem cell research in humans has been controversial for some time over various issues, in part, because of the so-called ‘slippery slope’ argument. These technologies could easily be extended to

- A. a policy of ethnic cleansing
- B. determining who can and cannot have children
- C. reproductive cloning and genetic engineering of humans
- D. increased abortions
- E. the creation of new and dangerous bioweapons

Cells from an animal embryo can be isolated and grown in culture. Research and development of human embryonic stem cells for therapeutic purposes is controversial because

- A. these types of cells can be used only for reproductive cloning and germline genetic engineering of humans for non-therapeutic designer characteristics
- B. they have been used to clone President George W. Bush
- C. a three month old fetus must be aborted in order to produce them
- D. they have been shown to cause delusions in NIH researchers about the prospects of receiving federal funding for this important work
- E. a blastocyst stage embryo usually must be ‘dissociated’ to recovery ICM (Inner Cell Mass) cells in order to produce them in culture

Can we use healthy human cells from donors or other sources to rejuvenate and replenish diseased tissues? The history behind the development and therapeutic applications for adult stem cells includes that they:

- A. have been derived from every tissue type in the human body and have been shown to have equal developmental plasticity compared with hES cells
- B. have been shown to be more useful than embryonic stem cells for any applications, demonstrating the importance of hES cells
- C. have been used to reproductively clone primates an in one case an adult human being.
- D. have been used to treat leukemia using bone marrow since 1956 and have been used successfully without controversy for many years.
- E. in spite of their great promise, because of serious errors will never be successful in clinical trials to treat any disease and have resulted in many fatalities.

The control of gene expression is critical to all living organisms. The amino acid tryptophan is important for making many proteins. When there is plenty of tryptophan in a cell, a protein binds to the gene that codes for an enzyme that will make tryptophan. When there is no tryptophan present this protein falls off the DNA allowing the gene to be expressed so more tryptophan can be made. A protein that binds to a site on DNA next to a gene and blocks the transcription of that gene, thus preventing the synthesis of a protein that the gene prescribes is known as a:

- A. responder
- B. regurgitator
- C. repressor
- D. receptor
- E. promoter

Since human organs for transplantion is donor limited, one solution would be to use animal donors for human organ transplants. Pigs have been genetically modified and cloned to produce donor pigs that have had the major proteins removed that are responsible for immuno-rejection. The drawbacks or obstacles for xenotransplantion are:

- A. all of these answers apply
- B. it is a very expensive to create each transgenic pig and test them for safety in humans and public perception is negative.
- C. acute hyper-rejection of xenogenic tissue and rejection is a risk.
- D. transmission of animal viruses to human recipient and to the general population is possible.
- E. the making and cloning of transgenic animals is a long term project

Can we control the gene expression for insulin production, for example, in pancreatic cells, as a treatment for diabetes? The control of gene expression is critical to all living things. The ability to control gene expression in a target cell is of key interest to gene therapy. A protein that binds to a site on DNA next to a gene and blocks the transcription of that gene, thus preventing the synthesis of a protein that the gene prescribes is known as a repressor. The segment of DNA which precedes (upstream) the coding region of a gene is called a:

- A.
  DNA regurgitator for a genetic sequence
- B. Promoter region of a gene
- C.
  Signal receptor on a membrane
- D.
  RNA protagonist
- E.
  Protein responder to a signal

How can damaged populations of cells or tissues which cause disease be cured? Degenerative diseases that result in cell death or function, such as Parkinson's and Alzhiemer's, injuries that may result in damages cells and tissues, such as spinal cord injuries, and the lack of available human donor organs for transplant has motivated scientists to investigate new ways to replace the functions of diseased organs. Promising approaches to these problems that have received considerable research are

- A. creation of artificial biomedical devices.
- B. stem cells, IPCs cells and 'living' pharmaceuticals
- C. xenotransplantation and tissue engineering
- D. all of these approaches
- E. gene therapy and gene editing

Adult stem cells can be used for therapeutic applications. Adult stem cells are:

- A. an artifact that was famous for being fraudulently reported.
- B. banned in every country in the world as part of a wide ban on cloning.
- C. unable to be introduced back into a person the way hES cell can.
- D. from a small sub-population of specialized stem cells present within some adult organs and capable of self renewal and limited capacity to differentiate.
- E. cannot be genetically engineered and therefore not of significant importance to medical applications.

The technology to use animal cells or organs as donor tissues for human recipients is called Xenotransplantion. That is, the transplantation of organs/tissues/cells across species lines. The first attempts at xenotransplantion were conducted using the bone from dog to repair the skull of a Russian aristocrat

- A. 2005
- B. 1628
- C. 1967
- D. 1792
- E. 2017

Technology is now available to cut, edit, insert and delete genes for various basic and applied purposes in many organisms. This technology, largely referred to as gene editing, is an advancement in gene therapy. Gene therapy offers approaches:

- A. is a good idea from one funded research proposal to the National Institutes of health (NIH) for gene replacement that has never been reduced to practice
- B. that now have been approved for therapeutic treatments by the FDA for various diseases including hemophilia, SCID, and HIV/AIDS, and child leukemia
- C. may provide a method for replacement of mutant genes via lethal injection
- D. to replace all of your genes and fix all abnormalities
- E. is not considered controversial since it has been so widely applied since the 1990s

There are populations of cells which retain their ability to divide and differentiate. The defining characteristic(s) of adult stem cells are

- A. unable to divide indefinitely
- B. seen as a potential source of cells for therapeutic purposes that will not be controversial.
- C. all of these answers are appropriate
- D. they are pluripotent -they have a limited potential to differentiate to other cell types.
- E. can be genetically engineered to carry and express foreign genes.

The application of cell biology, molecular biology, genomics and gene editing has brought rapid and astounding new results. Medical Biotechnology Applications:

- A. have negatively affected the US economy causing the loss of thousand of jobs
- B. will be positively impacted by a reduction in federal funding that support this research
- C. All of these examples
- D. are increasing exponentially as according to Moore's Law
- E. have not occurred since the 1990s because of lack of federal funding

Cloned genes can be inserted into the genome of adult differentiated cells causing them to become undifferentiated and continue to divide. Induced Pluripotent Stem Cells (iPCs) are made by the introduction of genes that cause the normal cell cycle to remain in the cell division mode, ensuring that they will divide in culture indefinitely. These cells can then be triggered to become any adult cell type, thereby obviating the controversy about using cells derived from human embryos. The process of inserting genes into cells is called:

- A. idiomics
- B. immunogenomics
- C. carcinogenics
- D. pharmaceutical genetics
- E. transgenics

One of the hallmark characteristics of stem cells is a prolonged capacity for self-renewal. Stem cells give rise to specialized cells residing in organs. Another hallmark characteristic of stem cells is their

- A. inability to grow in culture
- B. origin exclusively in blastocyst embryos that are five days old
- C. their ability to differentiate into any cell type (developmental potential)
- D. inability to be genetically engineered
- E. ability to be cultured back to cloned human beings with all disease genes corrected.

Animals can be genetically engineered and those animals can be cloned or interbred with normal wild-type animals. Some examples of this approach have been used in fish, cattle goats, pigs and many other animals. Should we genetically engineer and clone animals? What would be some of the benefits?

- A. All of these answers are correct.
- B. To create new breeds for the consumer such as enhanced taste or nutritional value
- C. To introduce new traits important to the agricultural production of farm animal traits: such as high muscle mass; disease resistance; and lower inputs.
- D. For the commercial production of vaccines, antibodies, and other high value pharmaceuticals.
- E. To produce high value proteins such as spider silk in genetically engineered goat's milk.

Research and use of human embryonic stem cells (or hES Cells) is controversial because they are:

- A. made and personalized for each patient with a high efficiency at the Seoul National University in South Korea
- B. derived from adult bone marrow ass leukemia treatments
- C. derived from early (five day old) embryos (blastocysts)
- D. were funded through vast amount of Federal dollars in teh US from 2001-2008
- E. banned for research purposes in every country in the world

. Human cells can be grown in culture. The manipulation of cells in vitro (literally ‘in glass”- outside of the body in tissue or cell culture) in order to form replacement tissues/organs that can be transplanted into patient is called:

- A. tissue engineering
- B. transgenics and genomics
- C. xenotransplantation using animals as donors
- D. homeopathic medicine
- E. cancer engineering

How do microorganisms become resistant to antibiotics? Antibiotic Drug Resistance has become an increasingly growing concern. Organisms like MRSA; antibiotic resistant tuberculosis and pneumonia and now many others threaten public health worldwide. The control of the biological basis for genetic changes through modern biotechnology is of key interest to

- A. pharmaceutical biotechnology only
- B. the fields of gene therapy and genomics only.
- C. tissue or organ level in medical biotechnology for humans
- D. agricultural biotechnology only
- E. across the various applications in biotechnology