OPINION BASED ANSWERS, FOR EACH QUESTIONS!

KAVERI'S IAS TEST SERIES

UPSC ANSWER BOOKLET: GENERAL STUDIES

UPSC MAINS ANTHRO TEST SERIES

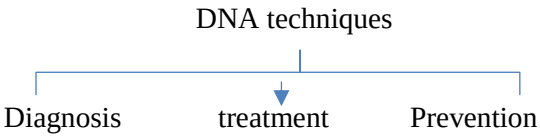
RESEARCH BASED Q & A:

1. Discuss the DNA Technology in Diseases & medicine. 15 marks.

DNA techniques have been a revolution in every field of science from computer Science to store the huge amounts of data of DNA to medical sciences in creating whole new Organisms.

DNA Technology is the method of manipulating genes to get the desired results. It is done with genetic scissors and additions.

In disease and medicine field, DNA techniques basically are used in all three of medical sciences



- In diagnosis these are used in production of monoclonal antibodies and DNA probes, to diagnose the diseases
- Mono clonal antibodies itself are used in all three fields of diagnoses treatment and prevention.

  In treatment, DNA techniques are used in treating various genetic diseases using gene therapy. i.e. the introduction or amplification of a low occurred gene into human body, and in treating various diseases by production of synthetic hormones an medicines
- There are mainly used in the production of various hormones like insulin to treat diabetes mellitus tyrosine to treat hypo thyroidises etc.
- In the prevention side monoclonal antibodies can be engineered to produce specific antibodies to kill viruses and diseases so as to develop resistance against diseases like Kala-azar, plasmodium caused malaria etc.

DNA Technology can used in

1. DNA probe: By probing the DNA samples, one can identify the paternity, it is also used for personal identification.
2. Synthetic Vaccines: DNA Technology can be used for manufacturing vaccines in the laboratory.
3. Derived commercial products: It is used for manufacturing products like insulin rich milk, pest resistance crops, soya rich milk etc.
4. Designer body / Dream child: Offspring of superior quality can be developed with help of DNA Technology.

Thus, DNA Technology is progressive technology which needs to be promoted by keeping the Bio-ethical issues.

2. What is Cytogenetic Analysis? Discuss the importance and Techniques of cytogenetic. 15 marks.

Ans. Cytogenetics is the study of chromosomal structure, location and function in cell. It includes the study of chromosome number and appearance (Karyotyping), the physical locations of genes on chromosomes and chromosomal behaviour in processes.

It consists of several techniques to visualize different aspects of chromosomes.

1. G-banding: it is obtained with Giemsa stain following digestion of chromosomes with trypsin. It yields a series of lightly and darkly stained bands – dark regions (heterochromatic), light regions (euchromatic).
2. R-banding: it is reverse of G-banding. Dark region (euchromatic) and lighter regions (heterochromatic).
3. C-banding: Giemsa binds to constitutive heterochromatic, so it stains centromeres. It is useful for the identification of chromosomes based on position of centromere.
4. Q-banding: it is a fluorescent pattern in UV light.
5. T-banding: Visualize telomeres.
6. N-banding: Silver nitrate stains the nucleolar organization region – associated protein.

Classic karyotype cytogenetics

Often a dye called Giemsa is used to stain bands on chromosomes. Each chromosome has a characteristic banding pattern that helps to identity them and both chromosomes in pair will have same banding pattern.

Karyotypes are arranged with the short arm of chromosome on top, and the long arm on bottom.

Spectral Karyogram of human female

It is a molecular cytogenetic technique used to visualize all pair of chromosomes in an organism in different colours.

Spectral human karyotype

This technique is used to identify structural chromosome aberrations in cancer cells and other diseases when Giemsa banding and other techniques are not accurate enough.

Chromosomal abnormalities

- Numerical aberration
- Structural aberration
- Sex chromosomal aberration
- Autosomal aberration

Numerical aberration: caused by the failure of chromosome division resulting in cells with extra chromosome or deficiency in chromosomes.

Structural aberration: deletion, addition or duplication, inversion and translocation of genes.

Sex aberration: Which effects sex chromosomes.

Autosomal aberration: Which effects chromosome no. 1 to 22.

Chromosomal abnormalities which leads to disease in human

- Turner's syndrome
- Klinefelter's syndrome
- Edwards syndrome
- Down syndrome
- Patau syndrome

Disorders arise from loss of part of one chromosome

- Cri du chat syndrome
- Deletion syndrome
- Angel mass syndrome

3. What you understand by forensic reconstruction? Discuss the important methods and techniques, approaches and theories of personal identification. 20 marks.

Ans. Forensic reconstruction

It refers to the reconstruction of gene sequence, bones, structure of objects which are found incomplete with their size, shape they are reconstructed and forensic scientists try to make it the way it would have looked.

Usually, when the dead body are found, to create the structure of the body forensic reconstruction method is used. For solving criminal cases, sometimes foot prints, shoe print, face reconstruction by skull is also done.

Personal identification

Generally personal identification is done with 2 types of people i.e. dead or alive. Alive people are generally criminals whose identification is done by finger printing or DNA finger printing. Dead bodies can be identified by various methods like DNA finger printing, determination of teeth, determination of bone etc.

Personal identification	
Alive People	**Dead People**
✓ Finger printing	✓ DNA finger printing

✓ DNA finger printing	✓ Determination by teeth
✓ Blood group	✓ Determination by bone
	✓ Blood group

Alive people

Criminals who do not wear gloves at the time of crime leaves fingerprints on the objects they touch. Simple fingerprints can be photographed easily. Plastic fingerprints are photographed by using different lights while latent fingerprints are photographed by using carbon powder on the object.

The fingerprints of culprit, criminals and people involved in crime are matched with the collected fingerprint. The all India Applied human genetic congress has given 8 characteristics of fingerprints that need to be matched which includes arches, loops, lakes, palm etc.

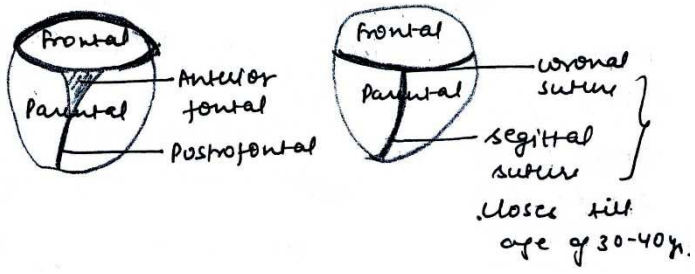
The finger prints testing can also be used in solving rape cases.

Dead people

1. **Determination of age –** age of the dead body can be determined by various methods like.
   a. Determination of age by the fall off or emergence of milk or permanent teeth.

Type	Emergence of teeth	Fall of teeth
Central incisor	6-8 months	6-9 years
Lateral incisor	8-11 months	7-8 years
First pre molar	7-8 months	9-11 years
Molars	9-11 months	11-12 years

   b. Determination of age by epiphyseal fusion of long bones: by bones like distal radius, distal ural, proximal radius, proximal ural, distal tibia, distal tibia can be determined
   c. Determination of age by fontanelles and suture.



   d. Determination of age by dental profile
      - ✓ Attrition (wear and tear of teeth surface)
      - ✓ Periodontosis (loosening of gums)
      - ✓ Formation of second dentative
      - ✓ Cementum around teeth

2. **Identification based on sex/gender**
   - ✓ General characteristics of skeleton

	Male	Female
Skull	Large	Small
Shaft	Prominent	Less prominent
Muscles	Strong	Soft
Depression	More	less

- ✓ General character of skull

Features	Male	Female
Capacity	10% longer than females	10% lesser than males
Size	Large	Small
Teeth	Large	Small
Chin	In V-shave	In U-shape

- ✓ **Pelvic girdle:** Shape of pelvic girdle is circular in females for carrying baby and the shape of pelvic girdle is in heart shape in males.
- ✓ **Thoracic cavity:** Ribs are thick and large in males as compared to females.

3. Identification based on race

Feature	Caucasoid	Mongloid	Negroid
Nasal index	< 0.48	0.48-0.53	> 0.53
Nasal spine	Prominent	Prominent	Not much
Nasal siling	Sharp	Not much sharp	Not present
Shape of nasal	Square	Round	Rectangular

4. Identification based on suture

Suture = maximum length of bone X multiplication factor of that bone.

5. Identification based on modern techniques

Blood Test

Blood test can be done from the blood present in the dead body of a person and can be matched with the profile.

DNA finger printing

Cells can be taken from the skin, hair root, blood of a dead body and it DNA finger printing can be done in which sequence of DNA is matched.

All these methods and techniques help in the personal identification of a dead as well as alive person.

Other Topics:

4. What is meant by senescence? Discuss the important mechanisms that changes during the process of programmed cell death in living beings. 12.5 marks.

Senescence is the mechanism where the cell dies gradually, and the replacing capacity of the cell diminishes with gradual increase in the susceptibility to death.

In simple words it is the process of ageing where age refer to biological longevity and not chronological longevity.

The process involves various stage.

- Death of intracellular organelles of cells
- Lack of proper functioning of tissues organ failures
- System failures increased susceptibility to death

This is a natural process found in almost every organism.

The signs and symptoms include

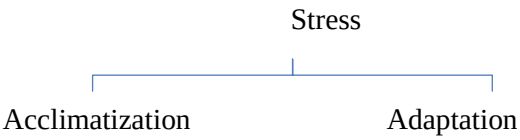
1. The initial symptoms would be greying/ white ken of hair in dark hair individuals. This starts almost at 30 years and stops when all the hair turns grey.
2. Loss of elasticity of skin, this is more prominently seen in females than males.
3. Brattling of nails
4. Laxity of muscles
5. Drop in immunity increasing the body's susceptibility to diseases
6. Reduction in vision
7. Reduction metabolism
8. Due to the weakening of genes the teeth start to fall off etc.

Though these symptoms are not uniform, the time, order of occurrence and intensity of occurrence are largely variable on the impact of heredity and environment.

5. What you understand by stress physiology? Discuss the imp types of stress that prevalent among human behavior in ecology. 15 marks.

Stress physiology refers to the study of human physiology at extreme stressful environments.

- Human body is susceptible to stress due to various factors of environment or due to high altitude, or due to extreme heat and cold or due to lack of nutrition and water.
- The study of these stresses on human body and the changes that occur in the individual and its affects on various functions of humans including the reproductive capabilities is called stress physiology.
- The human body reacts to stresses in two ways.



- Acclimatization refers to the whole body changes in the systems of functioning
- It is a temporary change and reverts back once the stress is removed.
- For example, the increase in breathing rate at high altitudes, shivering to produce heat in cold atmospheres etc.
- While adaptation refers to the change in a few genes to adapt to such stresses.
- This is a permanent change and is a very slow process, generally a few generations together.
- The presence of a specific gene in fishes to produce anti cold proteins, increase in chest size of the individuals in high altitudes etc. are examples of adaptation.

6. Write an account on Forensic anthropology

Forensic anthropology is application of scientific methods on skeletonised fossil remains to investigate the crime or criminal scenes.

According to the snow forensic anthropology is the broader concept "It is medical problem of medical jurisprudence".

According to T.D. Stewart – forensic anthropology deals with legal-medical problems. It helps low enforcement agencies with expert advises.

Forensic anthropology modern use are like personal identification with help of finger prints, tooth and dentine analysis, bone analysis and blood related investigation.

- It also helps in identification of remains, whether, it belongs to an animal or a human. It is used to provide input in criminal investigation.
- It is as useful in identification of skeleton wither it belongs to male, female and also to identify the age of fossil remains like the fossil belongs to old, children or young age.
- It is useful in documentation of criminal investigation.
- It also provide input to identification of missing persons by helping Interpol in **redising** yellow notice.

"Kewal Krishnan" is the notable Indian forensic anthropology. Who contribute to the development of forensic anthropology.

Therefore, forensic anthropology is sub-division of physical anthropology which helps, low enforcement agencies to reach conclusion.

7. DNA Technology in Human disease Management

DNA Technology is related to altering the sequence of base pairs for the welfare of mankind.

Various approaches for DNA Technology

1. Gene Therapy

   It refers to insertion of a nucleotide base pair sequence into a cell so that a non-functional gene can be activated.

2. Recombinant DNA Technology

   It refers to altering the gene sequence of any cell artificially so that proteins can be synthesized extremely.

For example, insulin can be synthesised using R-DNA bacteria.

3. Gene Mapping to know the location and sequence of base pairs of all functional genes in human.
4. DNA profiling

   To know the differences within people by hypervariable VNTR sequence. It is used in applications like paternity determination, forensic diagnosis.

Thus DNA technology is highly significant considering its wide ranging applications.

JAI HIND

KAVERIS IAS