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Q5(a)

Polygenic Inheritance

UPSC Civil Services Mains 2023 · Anthropology GS 1 · 10 marks · Mendelian genetics in man-family study, single factor, multifactor, lethal, sub-lethal and polygenic inheritance in man.

9.2 Mendelian genetics in man-family study, single factor, multifactor, lethal, sub-lethal and polygenic inheritance in man.

Core demand of the question

- Write a note on polygenic inheritance
- Keep the note to a 10-mark length of about 150 words

Revision summary

Polygenic traits are built by many loci of small effect.

Fisher joined Mendelism to Galton's continuous curves.

Nilsson-Ehle's wheat colour is the classic additive model.

Human stature and skin colour are standard anthropological examples.

GWAS still finds many tiny effects, not a racial master gene.

Introduction

Polygenic inheritance is the passing of a trait that many loci of small effect build together. The result is a curve of people, not a 3:1 garden of peas.

Body

The genetic idea

- **R. A. Fisher** showed that many Mendelian loci plus environment can produce the continuous distributions that **Francis Galton** had measured for stature.
- **Nilsson-Ehle's** wheat-kernel colour is the teaching plant model: add more contributing alleles and the colour darkens by steps that look smooth in a large sample.
- Human stature, skin colour, blood pressure, and many disease risks sit in this architecture, which is why they are also called multifactorial when environment is counted.

Anthropological use

- Skin colour is a polygenic cline with latitude and ultraviolet light, not a three-race switch, which is why **Livingstone** and later geneticists rejected racial typology for this trait.
- Twin and family studies estimate heritability, but a heritability figure is not a gene list and is not destiny across environments.
- Genome-wide association studies now name many loci of tiny effect, which confirms the old polygenic picture without restoring Mendelian race types.

Flow diagram

Many loci -> Quantitative trait
Environment -> Quantitative trait
Quantitative trait -> Height skin colour

Conclusion

Polygenic inheritance is many small loci making a quantitative trait. Anthropology needs it for stature, pigmentation, and complex disease, and it forbids treating those traits as single-gene races.

Facts & figures

R. A. Fisher

Showed that multiple Mendelian factors can generate the continuous variation measured in biometry.

Nilsson-Ehle

Wheat-kernel colour demonstrated additive polygenes as a plant model for quantitative inheritance.

Skin colour

A polygenic, environmentally sensitive cline, not a Mendelian mark of race.

Heritability

The fraction of variance in a given environment associated with genetic difference; it is not a fixed biological fate.