

Solutions

2.1 Allele – a version/form of a gene. Genotype – the alleles an organism has for a characteristic.

2.2 Gametes B, b and b, b $\rightarrow$ Bb, Bb, bb, bb; 1 tall : 1 dwarf (50 % each).

2.3 Polydactyly (dominant); cystic fibrosis (recessive).

3.1 Genotype is the alleles present, e.g. TT, Tt or tt; phenotype is the characteristic expressed – tall or dwarf; TT and Tt are different genotypes but both give the tall phenotype because T is dominant; only the homozygous tt gives the dwarf phenotype.

3.2 Parents Dd $\times$ Dd $\rightarrow$ gametes D and d from each; Punnett square: DD, Dd, Dd, dd; D is dominant, so DD and Dd have polydactyly – 3 of 4, probability 75 %; only dd (25 %) is unaffected.

3.3 Both are carriers (Ff), so each child has a 1 in 4 chance of cystic fibrosis; screening can identify embryos without the disorder before implantation, letting them avoid having an affected child / prepare treatment. Economic issue – screening and IVF are expensive for the family/health service. Ethical issue – embryos with the disorder may be destroyed, raising the right-to-life question; or false results could misinform the family's decision. Accept any justified informed judgement.