KESTEVEN AND SLEAFORD HIGH SCHOOL

Biology Scheme of Learning

Year 11 – Term 1/Unit 13 Reproduction

Intent – Rationale

Reproduction includes some content for students studying GCSE Biology only, as well as some higher-tier content. All students should be able to outline asexual and sexual reproduction, and should be aware of the importance of meiosis, fertilisation, and variation in sexual reproduction. They should link this with work on chromosomes and mitosis and the cell cycle in B2 *Cell division*. *AQA GCSE Biology* students should be able to compare the advantages of each type of reproduction.

GCSE Biology students should recall that fungi, plants, and malaria parasites are able to use both types of reproduction. They should link this with work on the life cycle of the malarial protist in B5.8 *Diseases caused by fungi and protists*. All students have studied DNA and its role in inheritance. They should be aware of the genetic code and genomes, including how the data produced by genome research can be used. *GCSE Biology* students should be able to outline DNA structure, with higher-tier students recalling the detailed structure of DNA and also studying protein synthesis, including how the genetic code is used to assemble amino acids into proteins. Another higher-tier *GCSE Biology* topic is different types of mutation and their consequences.

All students have studied inheritance, and should be able to use genetic terms and set out a genetic cross with the use of a Punnett square. They should be able to predict ratios of different phenotypes, and apply this to sex determination and family trees. Students should be able to describe the inheritance of genetic disorders as applied to polydactyly and cystic fibrosis. They should be aware of developments in genetic engineering with the aim of curing genetic disorders.

Finally, students should be able to discuss screening for genetic disorders and the implications of using this technology. This links in with the *GCSE Biology* topic of monoclonal antibodies in B6 *Preventing and treating disease*.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
Topic B7.1 Cells and Tissues **Topic B8.10 Inheritance and Evolution** **GCSE B1 Cells and their specialisation, diffusion, osmosis and active transport.** **GCSE B2 Cell division** **GCSE B5 Diseases caused by fungi and protists.** **GCSE B6 Preventing and treating disease.**	• A level Unit 2 Nucleic Acids • A level Unit 5 Cell recognition and the immune system • A level Unit 8 DNA, genes and protein synthesis • A level Unit 9 Genetic diversity and adaptations • A level Unit 17 Inherited Change
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Mathematics probability and ratio • EP ethical issues surrounding embryo screening	• SMSC M1 M2 M3 • BV 2,3,4 and 5 • GB4 a) and e) All of the above can be explored when discussing and debating the inheritance of genetic disorders and the possibility of carrying out genetic screening and its consequences for individuals and society.
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**

FROM THE LIBRARY *Fertility and Reproduction-176* *Making Life-612* *Cells, Division and Genetics-571.84* *Celle and Systems-574*	• Calculating probabilities and ratios

Biology Scheme of Learning

Year 11 – Term 1/Unit 13 Reproduction

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

The differences between sexual reproduction. The advantages and disadvantages of sexual and asexual reproduction.
Describe the processes of meiosis and mitosis. Explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number.
Describe how malarial parasites and fungi reproduce both asexually and sexually.
List the ways in which plants can reproduce asexually. Describe the relationship between DNA, genes, and chromosomes. Explain why genome projects are costly and take a long time.
Describe how the four bases make up a code. Explain why the correct folding of a protein is important to its function. Describe what a mutation is.
Explain why the correct folding of a protein is important to its function. Recognise examples of inherited traits. Recognise a genotype and a phenotype.
Name examples of inherited disorders, such as cystic fibrosis and polydactyly. Outline the methods used to screen embryos. List advantages and disadvantages of embryo screening.

Apply

Solve simple probability questions. Use a simple diagram to state how offspring have inherited traits.
Carry out a genetic cross to show sex inheritance. Use direct proportion and simple ratios to express the outcome of a genetic cross. Use a genetic cross to explain how inherited disorders are passed on. **Use a Punnett square diagram to predict the outcome of a monohybrid cross using the theory of probability.**

Extend

Compare and contrast sexual and asexual reproduction. Explain in detail why meiosis is important for sexual reproduction. Compare and contrast mitosis and meiosis.

Explain in detail why gametes are all genetically different to each other.
Suggest and explain the advantages and disadvantages of using both asexual and sexual methods of reproduction. Explain in detail how plants reproduce sexually.
Explain why the cost of genome sequencing has reduced since it was started. Discuss possible issues surrounding genome sequencing.

Explain why knowledge of the genomes of other species is useful. Discuss possible issues surrounding genome sequencing.
Describe the steps involved in producing a protein inside the cell. Explain how the order of bases determines the type of protein made. Outline the reasons why most mutations are harmless.
Explain in detail how a mutation can affect the function of a protein.
Use the terms allele, dominant, recessive, homozygous, and heterozygous correctly. Describe a phenotype when given the genotype. Explain why you only get the expected ratios in a genetic cross if there are large numbers of offspring. Use a family tree to work out whether an individual is likely to be homozygous or heterozygous for particular alleles. Use a genetic cross to predict the probability of a child inheriting a genetic disorder.

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Evaluate in detail the use of genetic engineering to cure inherited disorders. Explain how screening shows whether an embryo has a genetic disorder. Make an informed judgement about embryo screening by evaluating in detail the economic, social, and ethical issues.

What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?
alleles different forms of the same gene sometimes referred to as variants **asexual reproduction** involves only one individual and the offspring is identical to the parent. There is no fusion of gametes or mixing of genetic information **bases (DNA)** nitrogenous compounds that make up part of the structure of DNA and RNA. They are represented by the letters A, T, C, and G **carriers** individuals who are heterozygous for a recessive allele linked to a genetic disorder. Carriers have one healthy allele so are not affected themselves but they can pass on the affected allele to their offspring **cystic fibrosis** an inherited disorder that affects the lungs, digestive, and reproductive system and is inherited through a recessive allele **dominant allele** the phenotype will be apparent in the offspring even if only one of the alleles is inherited **genetic engineering** the process by which scientists can manipulate and change the genotype of an organism **genotype** the genetic makeup of an individual for a particular characteristic, for example hair or eye colour **heterozygote** individual with different alleles for a characteristic **homozygote** individual with two identical alleles for a characteristic **meiosis** two stage process of cell division that reduces the chromosome number of daughter cells. It is involved in making gametes for sexual reproduction **mutation** a change in the genetic material of an organism **natural selection** the process by which evolution takes place. Organisms produce more offspring than the environment can support. Only those that are most suited to their environment will survive to breed and pass on their useful characteristics to their offspring **nucleotide** a molecule made up of a sugar, a phosphate group, and one of four different bases. They are key units in the structure of DNA and RNA **phenotype**	• **LAQ lesson 3 (triple only)** • **LAQ lesson 5 (triple only)** • **LAQ lesson 6** • **Mid topic test for triple only after lesson 5** • **End of topic test B13**

the physical appearance / biochemistry of an individual for a particular characteristic **polydactyly** a dominant inherited disorder that results in babies born with extra fingers and/or toes **Punnett square diagram** a way of modelling a genetic cross and predicting the outcome using probability **recessive** a phenotype that will only show up in the offspring if both of the alleles coding for that characteristic are inherited **sex chromosomes** carry the information that determines the sex of an individual **sexual reproduction** involves the joining (fusion) of male and female gametes producing genetic variation in the offspring	

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Intent – Concepts

Lesson title	Learning challenge I can/know	Higher level challenge I can	Suggested activities and resources
B13 L1 Types of reproduction	The main differences between asexual and sexual reproduction	Compare and contrast sexual and asexual reproduction. Explain in detail why meiosis is important for sexual reproduction.	
B13 L2 Cell division in sexual reproduction	a) How cells divide by meiosis to form gametes b) How meiosis halves the number of chromosomes in gametes and fertilisation restores the full number **c)** How sexual reproduction gives rise to variation	Compare and contrast mitosis and meiosis. Explain in detail why gametes are all genetically different to each other. Solve complex calculations to determine the number of possible gametes formed during meiosis.	
B13 L3 The best of both worlds (triple only)	a) The advantages and disadvantages of asexual and sexual reproduction b) How some organisms reproduce both asexually and sexually depending on the circumstances.	Suggest and explain the advantages and disadvantages of using both asexual and sexual methods of reproduction. Explain in detail how plants reproduce sexually.	
B13 L4 DNA and the genome	a) That DNA is the material of inheritance b) What a genome is c) Some of the benefits of studying the human genome	Explain why the cost of genome sequencing has reduced since it was started. Explain why knowledge of the genomes of other species is useful. Discuss possible issues surrounding genome sequencing.	
B13 L5 DNA structure and protein synthesis (triple only)	a) What a nucleotide is b) How the structure of DNA relates to its function c) How DNA controls protein synthesis	Describe the steps involved in producing a protein inside the cell. Discuss possible issues surrounding genome sequencing. Explain how the order of bases determines the type of protein made	
B13 L6 Gene expression and mutation (triple only)	a) What happens in mutations b) How genes are expressed	Outline the reasons why most mutations are harmless. Explain in detail how a mutation can affect the function of a protein.	
B13 L7 Inheritance in action	a) Different forms of genes called alleles can be either dominant or recessive b) How to predict results from genetic crosses when a characteristic is controlled by a single gene c) How to interpret Punnet square diagrams **d)** How to construct Punnet square diagrams	Use the terms allele, dominant, recessive, homozygous, and heterozygous correctly. Describe a phenotype when given the genotype. **Use a Punnett square diagram to predict the outcome of a monohybrid cross using the theory of probability.**	
B13 L8 More about genetics	a) How to use proportion and ratio to express the outcome of a genetic cross b) How sex is inherited c) How to use family trees	Explain why you only get the expected ratios in a genetic cross if there are large numbers of offspring.	

		Use a family tree to work out whether an individual is likely to be homozygous or heterozygous for particular alleles.	
B13 L9 Inherited disorders	How the human genetic disorders polydactyly and cystic fibrosis are inherited	Evaluate in detail the use of genetic engineering to cure inherited disorders. Use a genetic cross to predict the probability of a child inheriting a genetic disorder.	
B13 L10 Screening for genetic disorders	a) That embryos can be screened for some of the alleles that cause genetic disorders b) Some of the concerns and issues associated with these screening processes	Explain how screening shows whether an embryo has a genetic disorder. Make an informed judgement about embryo screening by evaluating in detail the economic, social, and ethical issues.	
B13 L11 Test			