

PREPARING STUDENTS FOR THE “NEW GENETICS”

The current primary science syllabus stresses the importance and the need to equip students with the knowledge and tools necessary to enable them to become active participants in our scientific and technological society. The opportunity of revising and re-writing the curriculum presents the chance to further extend students’ experience of science in the classroom from an early age so as to foster understanding and interest. It is critical that students are given every opportunity to fully explore the world around them and be aware of issues that could potentially impact upon them later in their life. A comprehensive syllabus will shape students’ understanding of the world and their future and guide them in their decision-making.

Knowledge of human genetics and genetics technologies and their impact on the individual, families and society has increased rapidly in recent times and therefore are essential to be integrated into the primary science curriculum. It is important that students are aware that we are all made up of genes and that the information contained within them can interact with the physical and social environment in which we live to make us who we are. If students be aware of this from a young age they may begin to appreciate the relationship between biology and the world around them and allow them to form their own opinions about controversies such as recent advancements in genetic technologies that will directly affect them in their adult life. Children are growing in parallel with the expanding field of human genetics: everyday they are exposed to human genetics through the media – whether it be on television, in films or on posters – and so need to have the capacity to not only understand but also use the information available to them appropriately. Armed with this knowledge, students will become competent and active members of society and be able to contribute to the developments of science and technology in the future. Their education will help them to make the appropriate career choices as it becomes necessary.

Teaching human genetics in the primary classroom

The initiative of the Centre for Genetics Education of NSW Health to submit a proposal for the inclusion of studies in human genetics in the NSW Primary School’s

Science syllabus is a direct result of the need for student education to encompass all aspects of science most relevant to both the community and the individual.

The genetics in primary education package provided encompasses the specific, current observable indications of learning to be expected of students at each of Stages 1, 2 and 3 or K-2, 3-4 and 5-6 levels respectively. The worksheets compiled are an excellent point for teachers to start from to help introduce this new and exciting subject to their students in a means which is simple, involving and fun. Their development is based on teacher consultations and resources produced by the Murdoch Children's Research Institute.

Incorporating human genetics into the current curriculum domains

A (1) Knowledge and Understanding

Content Strands

Students will develop their knowledge and understanding of **living things**.

Stage 1, Years K-2:

Students will learn and appreciate that all living things are different.

This is the fundamental concept which is understood by the term human genetics.

Worksheets 1 and 2

Students begin to think about their own characteristics that make them special and how they are different to everyone else's. The term "genes" is introduced for the first time. Teachers, guided by the notes provided, can lead a discussion asking students to think about their physical characteristics (hair colour and type, eye colour) and how they suppose each person differs to everyone else, taking into account environmental influences also as contributing factors to shaping the individual as are diet and exercise. Teachers can also explain how genes are units in our bodies that give the instructions to make our hair brown or curly and to give our thumbs a particular shape. Students are encouraged to draw a picture of themselves to further reinforce in their mind that they are referring to physical characteristics.

Stage 2, Years 2-4:

Students will know and understand that change occurs throughout the lifetime of living things and that living things depend on other living things to survive.

Worksheet 3

The fill-in-the-gap exercise gives students the opportunity to demonstrate learning from the class discussion. Teachers lead discussion about genetics and the contributions from Mum and Dad and from the environment on how we look. We depend on the food we eat and the air we breathe to survive and these factors also impact upon how we look and how we behave. They also have the capacity to change certain traits over the lifetime on an individual.

Stage 3, Years 4-6:

Students will know and understand that living things show variation within a species.

Worksheet 4

By completing the class tally of whether or not students have a particular thumb shape (the hitchhiker's thumb) students will directly participate in an investigation of how one person can differ to another. The information in a particular gene that we inherit from our parents determines that some people can hyperextend their thumb whereas others cannot. The task will help students be aware of the fact that people differ in many ways despite the fact that we all have genes: the information in some people's genes is different to others.

A (2) Knowledge and Understanding

Learning Processes

Stage 1, Years K-2:

Students will state the purpose of an investigation and recognise that discoveries can be made through play, exploring and experimenting.

Worksheets 1 and 2

Students will realise that there are differences between people. They will be aware that these differences are due to genes within a person and to the environment

outside/around the person acting together. These ideas will be reinforced by drawing pictures of themselves – a creative way to learn - and recognising the differences in physical traits and by engaging with their peers in active investigation among class members into the presence of a hitchhiker's thumb or not. The class tally exercise is a fun way of learning and discovering.

Stage 2, Years 2-4:

Students will demonstrate that investigation can take many forms and recognise that the results of investigations can lead to more questions.

The process of discovery can take the form of both teacher-led and peer group discussion, active play and experimenting. Worksheets 1 and 2 give students the opportunity to learn and think about introductory ideas in genetics in a creative way. Worksheet 3 is conducive to peer discussion and students have the chance to learn from each other and test each others' ideas about genetics in a way that is stimulating and accessible to them. Every opportunity for class discussion will readily prompt new questions and thus develop and promote students' investigative capacities from an early age.

Worksheet 5

The word find activity gives students the chance to demonstrate learning and continue to investigate the topic of genetics by integrating new terms encountered with meaning.

Worksheet 6

Students show what they have learnt in a creative way by formulating a poem . Students may reflect upon what has been learnt and discuss with their peers, sharing ideas and developing their curiosity.

Stage 3, Years 4-6:

Students will identify investigations which involve discoveries leading to unexpected outcomes.

Worksheet 10

Students explore for the first time “how we look” at a cellular level. By actively searching for and colouring the appropriate pairs of chromosomes, students will discover one basis for the difference between boys and girls: boys have an X and a Y chromosome whereas girls have two X chromosomes.

Cross-curriculum activities

Human genetics could also be taught following the Primary Connections scheme devised by the Australian Academy of Science – integrating science with literacy. Students will have the opportunity to develop important problem-solving skills as are complex/lateral thinking and practical application of concepts learnt to the real world setting. For example, the worksheets provided could be used as a practical application of maths: making observations and recording data in tables (Worksheet 5 - tally of physical characteristics) as well as participating in counting exercises (of chromosomes for instance) in younger years (Worksheet 10 – Boy or Girl?).

Teaching human genetics to young children should not be avoided because it may be considered too difficult for them. Children do have the ability to make abstract inferences from their keen observations of the biological world around them and their innate curiosity and need for discovery and explanation (Solomon and Johnson, 2000). Primary school curricula need to take into account this capacity to consider and reflect upon the complexities of nature with theoretical insight.