UNIVERSITY OF TECHNOLOGY SYDNEY

ASSIGNMENT COVER SHEET

FASS: EDUCATION

SUBJECT NUMBER & NAME	013404 Inclusive education
NAME OF STUDENT (PRINT CLEARLY - SURNAME, FIRST NAME)	CHIPMAN, Michael
STUDENT ID NUMBER	95093744
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STUDENT CONTACT NUMBER	0415 312 759
NAME OF TUTOR	Kathryn Kent
DUE DATE	3 November 2017
ASSESSMENT ITEM NUMBER/TITLE	Assessment 1

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. I have attached a stamped self-addressed envelope for the assignment to be returned to me if this is the **final** assessment item for the subject.

. If this assignment is submitted after the due date I understand that it will incur a penalty for lateness unless I have previously had an extension of time approved and have attached the written confirmation of this extension. Please provide details of extensions granted here if applicable _____

_____

Signature of Student: _____ **Date:** __03_/_11_ /_17_

If submitted electronically tick here to indicate you agree with the above ☑

This lesson plan introduces Year 10 science students to DNA mutations and their role in human disease. It follows earlier lessons on DNA structure and the processes of DNA transcription and translation. The three main parts of the lesson are denoted Task A, B and C in the lesson plan. Task A involves a short video presentation on sickle cell anaemia and its genetic basis, while Task B introduces six simple types of mutation delivered as PowerPoint slides and corresponding student handouts. Task C is an interactive simulation of DNA mutation intended to consolidate student learning.

Electronic copies of worksheets, teacher slides and the lesson glossary are made accessible to students before the lesson. In this way, *Student 1* can optionally use a laptop to access these materials with a text-to-speech program. Speech-to-text translation can also be used by *Student 1* to compose answers to questions like those in Task C. Supports for *Student 2* come with explicit instruction throughout, the adoption of an "I Do, We Do, You Do" strategy in Task B, and the student pair work in tasks A and C. *Student 3* requires a combination of adjustments made for *Student 1* and *Student 2*, with specific adjustments including permission to work alone instead of with peers, and other measures described below.

A primary goal in producing this lesson plan was to support *all* students to work at a high level – that is, "to have high expectations for all children and encourage them to achieve" (UNESCO, as cited in Dempsey, 2014, p. 50). To assist this, multiple means of representation, engagement and expression – the fundamental universal design for learning (UDL) principles (Gargiulo & Metcalf, 2013) – are used throughout the lesson.

The lesson outline for students is presented as a picture schedule and displayed at the front of the classroom. This is specifically intended to help *Student 3* by addressing the problematic nature of switching between tasks as the lesson progresses (Harrower & Dunlap, 2001, p. 767). Providing copies of the lesson glossary, on the other hand, is an aid to all three students with special needs, and indeed to all students in the class. Kim et al. (as cited in Roberts, Torgesen, Boardman, & Scammacca, 2008, p. 66) note that "new and challenging vocabulary … may be best facilitated by providing direct instruction that focuses on simple definitions", the glossary being a useful tool in this instruction.

S. Shaywitz, Morris, and B. Shaywitz (2008) describe how accommodations for students with dyslexia include giving information aurally, using "compensatory assistive technologies", and providing additional time for students to demonstrate learning (p. 466). An instance of each type of accommodation features in this lesson, with the video providing auditory information, online-copies of printed lesson materials allowing for text-to-speech translation, and the simulation activity intended to be completed in students' own time.

Graphic organizers such as the concept map produced in Task A help students to learn and remember important ideas (Roberts et al., p. 67). As W. Wellington and J. Wellington (2002) note, "ordering and sequencing are … an essential skill in understanding 'cause and effect' relationships", and crucially important in science (p. 84). For a pupil with a language disorder, such as *Student 2*, graphic organizers become even more important (p 88).

In Task A, *Student 2* should be paired with another pupil happy to offer patient and ongoing assistance. The peer tutoring that results from measures like this are often helpful for students with learning disabilities (Mastropieri, Scruggs, & Graetz, 2005, p. 101). Likewise, pairing *Student 1* with a more able reader has been found to give similar benefits to students with dyslexia (Smith & Sensenbaugh, as cited in Rowcliffe, 2002, p. 94).

A further important accommodation in Task A is dividing the video into small chunks of 10 – 15 seconds. This gives time for *Student 2* to process the language in the video, with video images functioning as a visual aid to *Student 2*'s reduced auditory memory (W. Wellington & J. Wellington, 2002, p. 88).

Task B integrates several accommodations. Clearly, strings of letters defining sections of DNA could present a significant challenge to *Student 1* and *Student 2*. However, by making the annotations given in the appendix to the lesson plan, all students should be better able to distinguish codons and their corresponding amino acids. Harrower and Dunlap (2001, p. 776) report studies confirming the use of purposeful modelling as a helpful strategy to assist children like *Student 3* in general education classrooms. In Task B, the explicit modelling that occurs as the teacher demonstrates how to annotate worksheets is a simple example of this.

Importantly, the explicit instructions given in Task B need to be sufficiently simple and brief (W. Wellington & J. Wellington, 2002, p. 84) to accommodate the difficulty *Student 2* has in recalling more than one instruction at a time. In the "We Do" phase of this task, the teacher

gives a direction coincident with performing the annotation, before observing successful completion of the task in students, and then giving the next instruction.

Rowcliffe (2002, p.95) describes the benefits of diagrams for dyslexic students (p. 95) over large blocks of text. The annotated diagrams for the six mutation types, as well as the concept map produced in Task A, summarise relevant information concisely, and, consistent with UDL, in a way that helps all students. Getting students to repeat aloud each mutation type as it is introduced helps recall of new terms (Oakland, as cited in Rowcliffe, 2002, p. 96). This “speak and repeat” strategy, like the use of diagrams for developing understanding, is also beneficial for all student learning.

Having students work with the online simulation in Task C after learning about mutation types in Task B ensures that students have recent know-how to apply to the more difficult simulation activity, and can work with the simulation in a more directed fashion. Moreover, student success in the earlier task constitutes a type of “pre-task sequencing” (Harrower & Dunlap, 2001, p. 776), where the confidence students acquire repeating the annotations in Task B “builds momentum” for successful completion of the later task (Mace et al., Singer et al., as cited in Harrower & Dunlap, 2001, p. 776).

As a learning tool, the online simulation is very effective in quickly showing students the results of the mutations they induce. For *Student 1* and *Student 3* especially, an online activity like this also serves to help increase self-confidence and self-esteem (Keates, as cited in Rowcliffe, 2002, p. 96). Notably, the simulation’s shape and colour-coding of nucleotides should permit its effective use by all students outside of the classroom, important for maximising total student engagement with the subject.

References

Dempsey, I. (2014). Legislation, policies and inclusive practices. In P. Foreman & M. Arthur-Kelly (Eds.), *Inclusion in action* (pp. 48-72). Cengage Learning Australia.

Gargiulo, R. M., & Metcalf, D. (2013). *Teaching in today's inclusive classrooms: A universal design for learning approach* (2nd ed). Cengage Learning.

Harrower, J. K., & Dunlap, G. (2001). Including children with autism in general education classrooms: A review of effective strategies. *Behavior modification*, *25*(5), 762-784.

Mastropieri, M. A., Scruggs, T. E., & Graetz, J. E. (2005). Cognition and learning in inclusive high school chemistry classes. In *Cognition and Learning in Diverse Settings* (pp. 99-110). Emerald Group Publishing Limited.

Roberts, G., Torgesen, J. K., Boardman, A., & Scammacca, N. (2008). Evidence-based strategies for reading instruction of older students with learning disabilities. *Learning Disabilities Research & Practice, 23*(2), 63-69.

Rowcliffe, S. (2002). Catering for dyslexia-how others benefit. *School science review, 83*, 93-100.

Shaywitz, S. E., Morris, R., & Shaywitz, B. A. (2008). The education of dyslexic children from childhood to young adulthood. *Annu. Rev. Psychol., 59*, 451-475.

Wellington, W., & Wellington, J. (2002). Children with communication difficulties in mainstream science classrooms. *School science review, 83*, 81-92.

Name: Michael Chipman			Date: 13/09/17
Subject: Science	Class: 10S1	Period: 3 (Rm 302)	
Topic: DNA – Mutation			
Period Begins: 12:12	Period Ends: 1:26	No. of Students: 25	

Syllabus outcomes addressed:

SC5.LW3 d) Students outline how the Watson-Crick model of DNA explains changes in genes (mutations)

Lesson outcomes:

At the end of this lesson, students will have:

- Produced a concept map describing the genetic basis for sickle cell anaemia
- Learnt about DNA substitution mutations: missense, nonsense and silent mutations
- Appreciated how insertion and deletion mutations can lead to frameshift mutations
- Used a mutation simulator and observed how DNA mutations affect protein manufacture

Links to previous lesson:

Question students on DNA transcription and translation, covered previously

Assessment for learning:

- Student concept map for sickle cell anaemia
- Annotation of mutation handouts
- Q&A during simulation demonstration and student answers to simulation activity

Are there students with special needs that need to be catered for? If so how?

Student 1 is diagnosed with dyslexia. All printed materials in this lesson are available on-line, allowing text-to-speech reader use by the student. All work can be completed and submitted electronically.

Student 2 is diagnosed with a mild intellectual disability. Explicit instructions in each lesson phase are given to this student, and the class as a whole.

Student 3 is diagnosed with ASD. A picture schedule for the lesson is displayed, and explicit instructions are given in each lesson phase. All work can be completed and submitted electronically. This student is not required to work in a pair grouping; additional teacher assistance is given as required.

Equipment/resources required:

- Picture schedule with lesson outline for display on side wall
- Presentation, worksheets and glossary uploaded to Edmodo for student access during lesson
- USB with all required lesson materials
- Printouts of concept map sheets, mutation worksheets, and simulation questions
- Scissors and glue for concept map activity

Safety: N/A

Links to next lesson & Follow-up activities/homework:

Mutagens and mutation rates, plus junk and non-coding DNA. Students should complete the mutation simulation activity at home if not finished in class.

Time:	Teacher activities	Student activities…
12:10	Place picture schedule on side wall with the plan for today's activities.	
12:12	Settle class, take roll and refer students to lesson schedule.	Respond to roll call. Get out equipment for lesson.
12:15	Review translation and transcription ideas from the previous lesson by asking students some key questions: • What is transcription? • Can you produce a simple diagram showing transcription? What is the input? What is the output? • What is translation? • Can you produce a simple diagram showing transcription? What is the input? What is the output? • Where does translation occur? • Where does transcription occur?	Recall content from previous lesson and contribute to Q&A. Recognise DNA and mRNA as transcription input and output. Recognise mRNA and protein (polypeptide) as translation input and output.
12:20	**Distribute Sheet A.** Remind students of the following terms, "smallest" term first: • nucleotides • codons • genes • chromosomes • genome	Review revision material:**Sheet A**.
	Present to students this ananlogy • nucleotides = letters (A, C, T, G) • codons = words (TLAs!) • genes = sentences • chromosomes = chapters • genome = genetic autobiography	Pay attention as analogy introduced.
	Invite students to record this information on their copy of **Sheet A** (written or electronic). Model this for students using the IWB.	Markup revision sheet as instructed.
12:25	**<u>Task A (Video and concept map).</u>** Show the class the 1 minute sickle cell anaemia video from DNALC: (https://www.dnalc.org/resources/3d/17-sickle-cell.html) This video describes the genetic origin of sickle cell anaemia and how it affects people with this condition. Play the video once through, then play it a second time, bracketing the video into 4 separate grabs (as indicated by the transcript below). Have students complete a concept map (**Sheets 1, 2**) for the disease. Students have three choices for doing this: 1. Fill in the map "by hand" with nouns and verbs taken from **Sheet 1** 2. Cut out nouns and verbs from **Sheet 1** and paste these into the concept map	Watch the video on sickle cell anaemia. Pay particular attention as short grabs are replayed.

	3. With online copy, drag text boxes and connecting verbs to their correct positions	
	Students should work together with a partner.	Work with partner to build understanding and agree on next changes to concept map.
	After each "grab", give students time to complete the next portion of the map. If filling in by hand, suggest that students might like to use pencil first, so that corrections can be easily made. After a short time, call for suggestions from students and, with copy shown on the IWB, build up a class map.	Using preferred method, add to concept map. Check with class map as this is updated by the teacher.
	Impress upon students that there is not one correct way to draw a concept map - just that it needs to fit the information presented. Also, indicate to students that, for this exercise, the bold circles indicate the "cause and effect" pathway. That is, reading along this pathway (in the direction of the arrows) provides an explanation of the processes that lead to the disease.	Pay particular attention to the "cause and effect" pathway.
	Video transcipt *0:00 Sickle cell anaemia is a genetic disease that affects haemoglobin, the oxygen transport molecule in the blood.* *0:09 The disease gets its name from the shape of the red blood cells under certain conditions. Some red blood cells become sickle shaped and these elongated cells get stuck in small blood vessels so that parts of the body don't get the oxygen that they need.* *0:26 Sickle cell anaemia is caused by a single code letter change in the DNA. This in turn alters one of the amino acids in the haemoglobin protein. Valine (val) sits in the position where glutamic acid (glu) should be.* *0:47 The valine make the haemoglobin molecules stick together forming long fibres that distort the shape of the red blood cells, and this brings on an attack.*	
12:40	**<u>Task B (Understandingn mutation types).</u>**	
	Show introductory slide which categorises substitution mutation types, along with insertion, deletion and frameshift mutations.	If taking written notes, record mutation categories in workbook.
	Distribute mutation worksheets	
	Distribute the six slide copies to students who prefer to work with paper, with other students directed to the Edmodo copy.	Follow teacher instructions for marking up mutation worksheets. Ensure that features of each diagram are well understood, and ask questions if unclear.
	Explain to students that the bottom DNA strands in these sheets represent either: a) a copy of the top strand (with a change - the mutation), or b) the same strand as the top strand, but at a later time (after a spontaneous mutation has occurred). In other words, make sure that students understand that the two strands are NOT complementary DNA strands.	

	On the IWB, using drawing tools and the PowerPoint laser pointer, show the corespondence between nucleotides in the strands by drawing a series of light vertical lines from the top strand to the bottom. Circle the mismatched nucleotides (**AnnotatedSlide 1**). If students understand this, erase these annotations, and then do the following (**I Do**).	Watch as the teacher illustrates the relationhip between nucelotides in the top and bottom DNA strands.
	Draw arrows from top sense strand to the bottom sense strand to indicate that the top strand 'mutates', or changes, to the bottom strand. **Speak** the mutation type and have students **repeat**/echo it. Using the highlighter tool, highlight corresponding codon triplets, in turn, from the top and bottom strands. Underline mismatched nucleotides in red, along with resulting amino acids (**AnnotatedSlide 2**).	Observe additional teacher annotations highlighlighting coding framing and any mismatched nucelotides / amino acids.
	Now have students make the equivalent annotations on their copies.	Markup slides, then highlight codon divisions in both DNA strands.
12:45	Work together on remaining substitution sheets (**We Do**). Discuss with the class the salient features of each mutation type. Invite students to visualise overlaying the bottom strand on the top. '**Speak and repeat**' each new mutation type.	
12:50	Get students to annotate their insertion and deletion sheets (**You Do**). For the frameshift mutation, invite students to look at their addition and deletion diagrams. Highlight for students how the addition and substitution mutations in each case produce a frameshift. Add additional slide notation to show this.	For insertion and deletion mutations, in particular, note of where nucleotides do not match. If unclear, ask questions.
1:00	**Task C (Online simulation).** http://lab.concord.org/embeddable.html#interactives/sam/DNA-to-proteins/4-mutations.json	
	Launch the interactive mutation model. Demonstrate how the model works for students. Provide **explicit instruction** on how to pause, continue and single-step the simulation. Provide **explicit instruction** on how to induce mutations and how to quickly flip between DNA and protein views.	Pay close attention as the simulation is demonstrated.
	Ask students: • Which is the sense strand? • What is the "hamburger" object at the translation stage? • Did the mRNA move out of the cell's nucleus? Look closely!	Answer questions when asked.
1:10	Finally, get students in pairs to experiment with the simulation, and to consider the questions on **Sheet 4**. Assist students as neeeded.	Experiment with the simulation in pairs. Work cooperatively on answering problems posed on **Sheet 4**. Complete any unanswered questions for homework.
1:20	*Recap main content from lesson: sickle cell anaemia, mutation types, mutation simulation*.	

Evaluation
(Aspects targeting for improvement and/or)

	Strongly Agree	Agree	Neutral	Disagree
• T & L strategies were effectively implemented	❑	❑	❑	❑
• I was able to generate a sense of purpose	❑	❑	❑	❑
• A high level of student participation was achieved	❑	❑	❑	❑
• My questioning was clear, concise and logically sequenced	❑	❑	❑	❑
• Pupils were interested and self disciplined	❑	❑	❑	❑
• Instructions were clear and easily understood by students	❑	❑	❑	❑
• I recognised and catered for individual differences	❑	❑	❑	❑
• I established and maintained and effective learning environment	❑	❑	❑	❑
• ……	❑	❑	❑	❑
• ……	❑	❑	❑	❑
• ……	❑	❑	❑	❑

What were the most effective elements of the lesson? Why?

What were the least effective elements of the lesson? Why?

If I were to repeat the lesson what would I change? How could I improve?

DNA mutation

Types of gene mutations

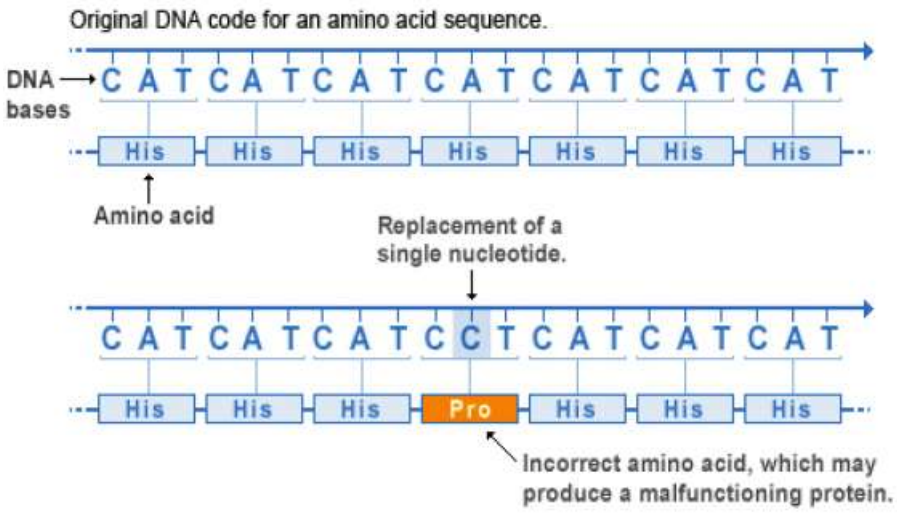
- Missense
- Nonsense
- Silent

} Substitution mutations

- Insertion
- Deletion
- Frameshift

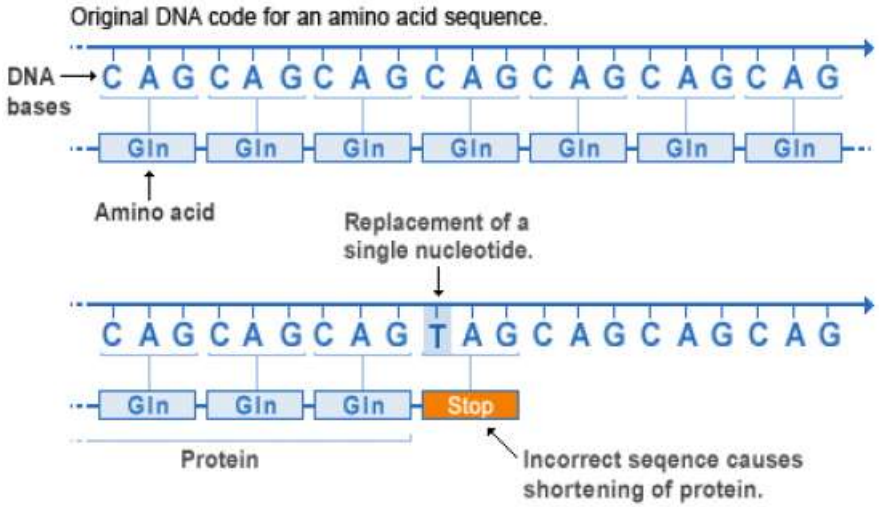
Missense mutation

e.g. Sickle cell anaemia

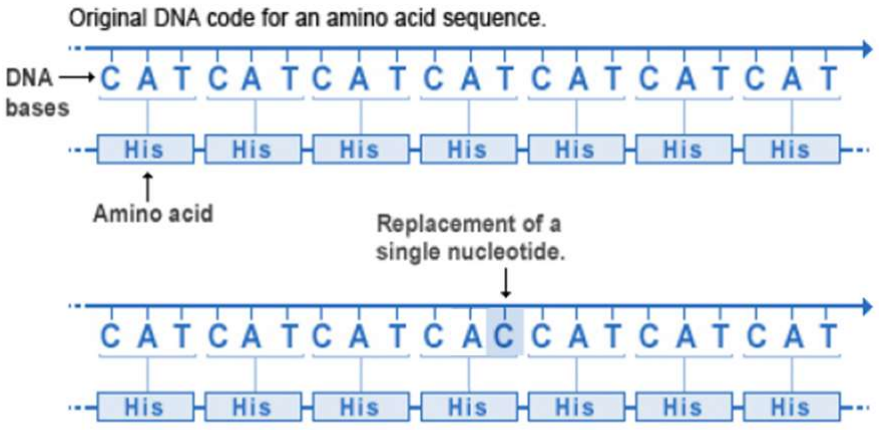


e.g. Cystic fibrosis

Nonsense mutation

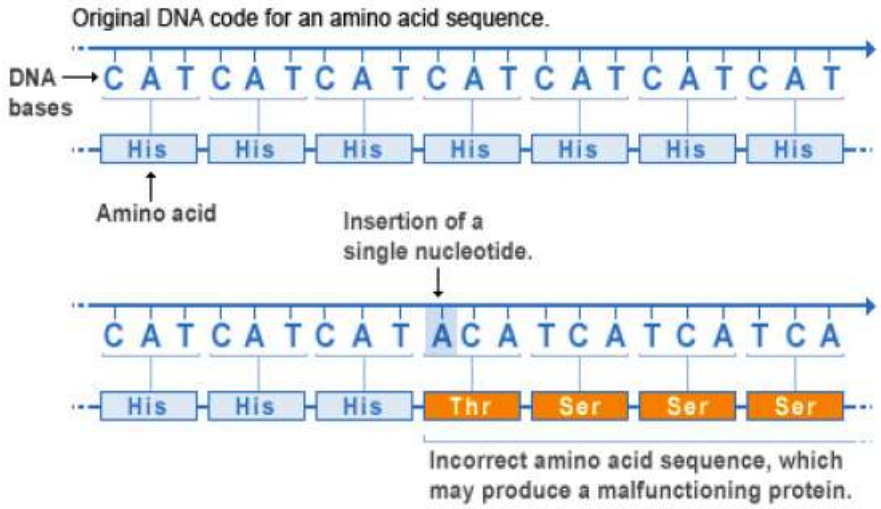


Silent mutation

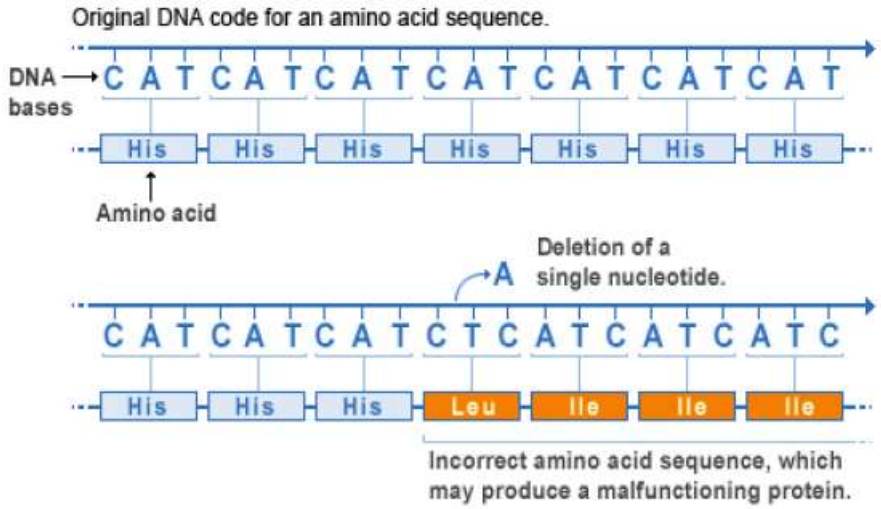


A substitution mutation with no effect

Insertion mutation

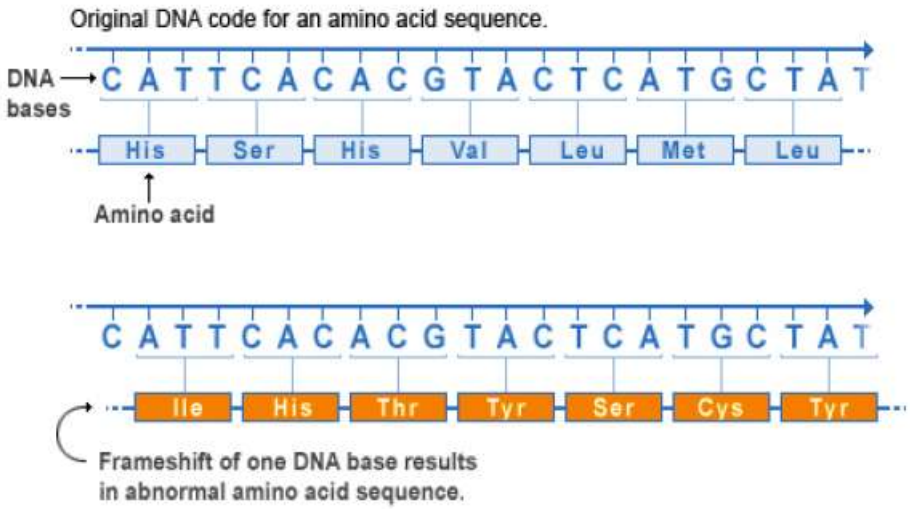


Deletion mutation



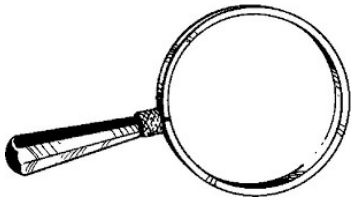
Frameshift mutation

May result from additions & deletions

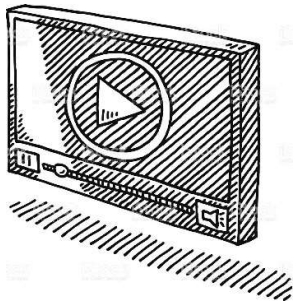


Interactive mutations!

http://lab.concord.org/embeddable.html#interactives/sam/DNA-to-proteins/4-mutations.json

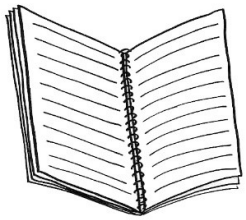


Review



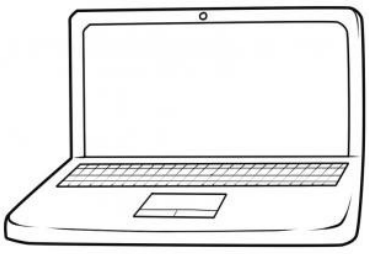
Video

Concept map

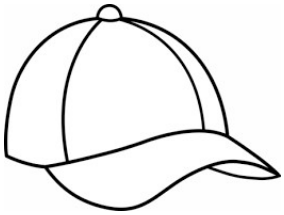


Mutation types

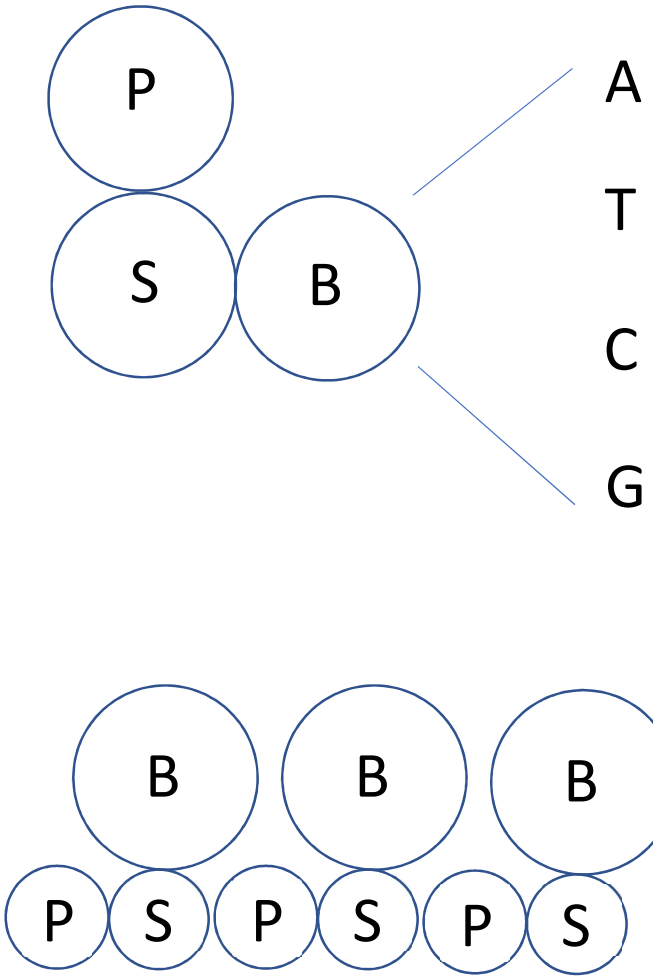
Worksheets



DNA mutation simulation



Lesson recap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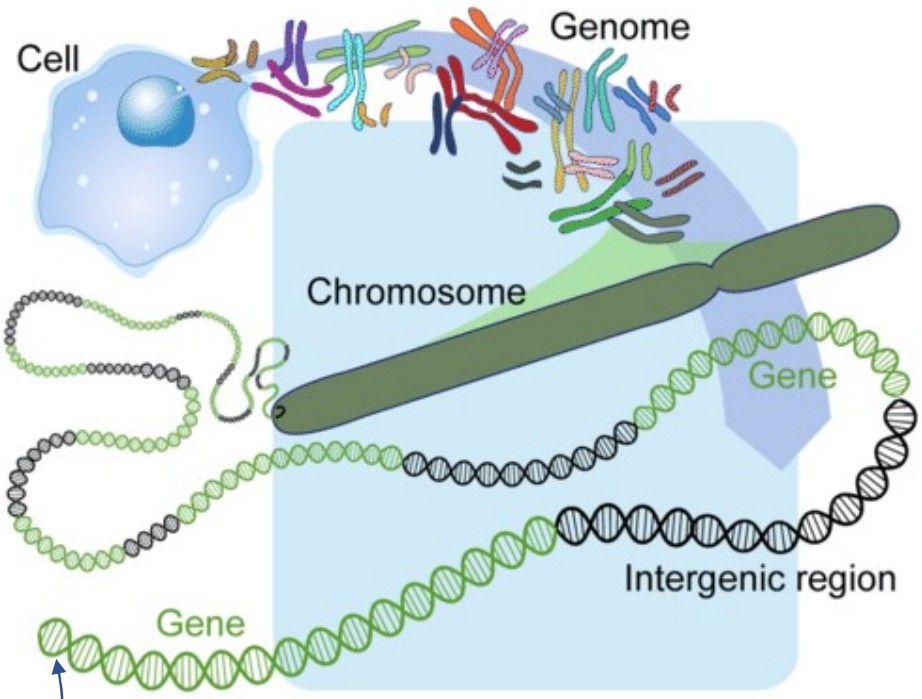

Cell
Genome
Chromosome
Gene
Intergenic region
Gene

Small blood vessels

Valine (val)

Long fibres of haemoglobin

Oxygen transport molecule

Sickle cell anaemia

Red blood cells

Sickle shaped cells

One code letter change

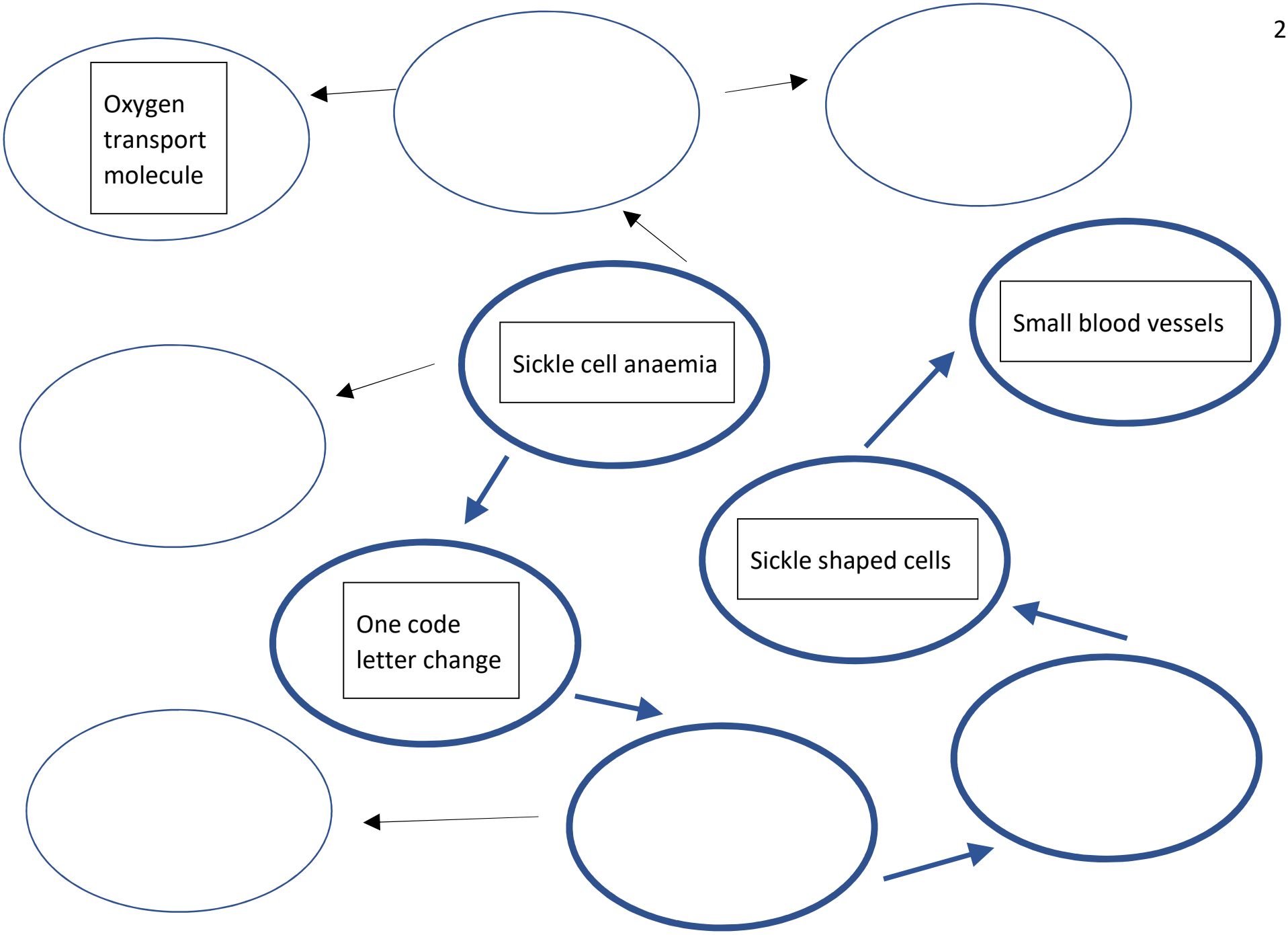
Haemoglobin

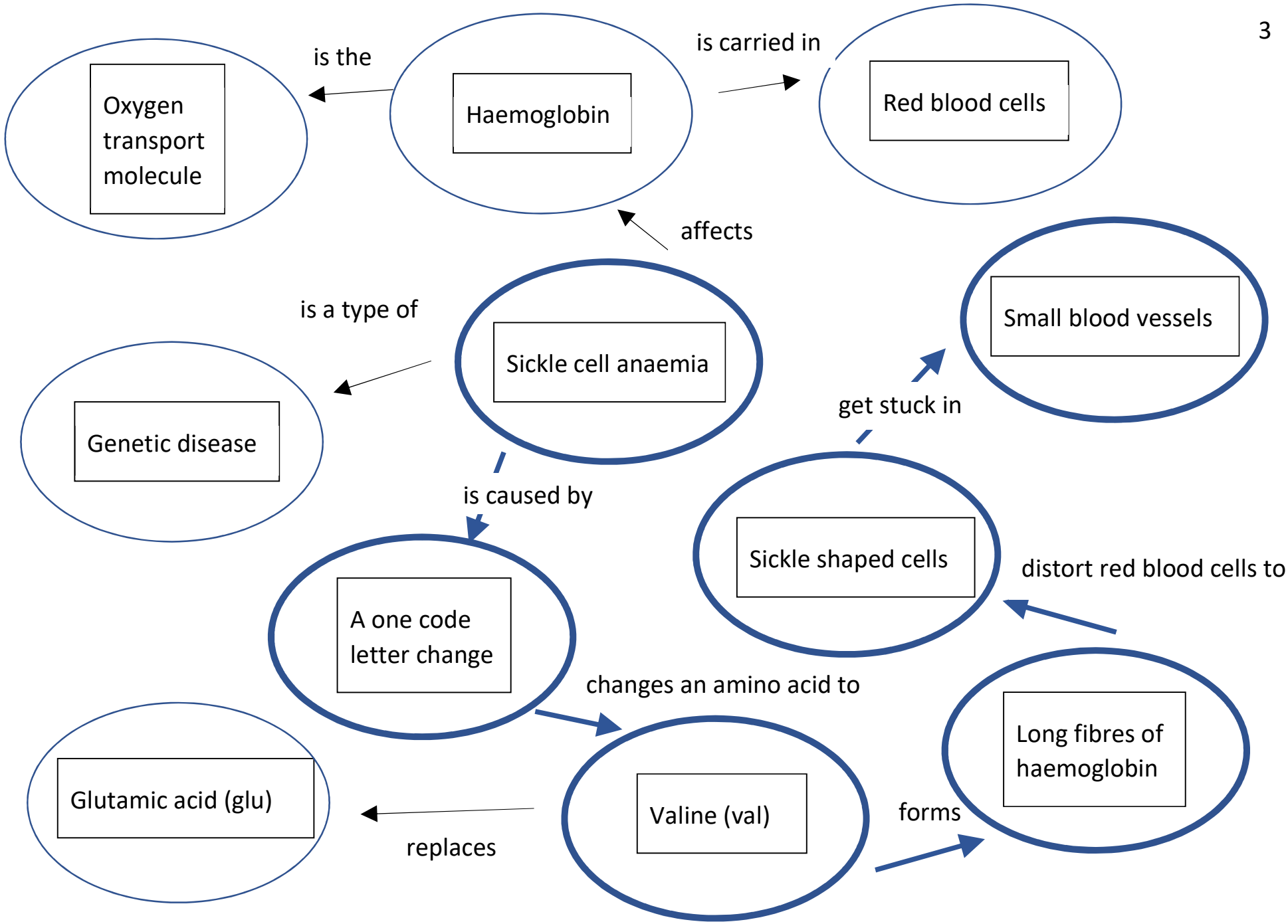
Genetic disease

Glutamic acid (glu)

forms | is carried in | is a type of | affects | changes an amino acid to

replaces | is the | is caused by | get stuck in | distort red blood cells to


Oxygen transport molecule
Sickle cell anaemia
Small blood vessels
Sickle shaped cells
One code letter change


Oxygen transport molecule
is the
Haemoglobin
is carried in
Red blood cells
affects
is a type of
Genetic disease
Sickle cell anaemia
Small blood vessels
get stuck in
is caused by
Sickle shaped cells
distort red blood cells to
A one code letter change
changes an amino acid to
Long fibres of haemoglobin
Glutamic acid (glu)
replaces
Valine (val)
forms

Simulation questions

1. Using the default DNA string (Hit 'Reset' on the simulation), can you produce a single **missense** mutation to give valine instead of glutamic acid in the final protein? This models what happens in sickle cell anaemia. Save a screen shot of your protein OR draw it below OR make a model of it if you wish.

2. Using the default DNA string (Hit 'Reset' on the simulation), what is the shortest protein you can make by introducing a single **nonsense** (substitution) mutation? What is the resultant protein? Save a screenshot OR draw it below, OR make a model of it if you wish.

3.Using the default DNA string (Hit 'Reset' on the simulation), what is the shortest protein you can make by introducing a single **deletion** mutation? Save a screenshot OR draw the protein below, OR else make a model of it.

4. Using the default DNA string (Hit 'Reset' on the simulation), what is the shortest protein you can make by introducing a single **insertion** mutation? Save a screenshot OR draw the protein below, OR else make a model of it.

Glossary

Anaemia - A condition where the blood has insufficient healthy red blood cells

Elongated - Lengthened, stretched out

Frameshift mutation - A DNA mutation caused by nucleotide insertions or deletions that cause a framing error

Haemoglobin - Oxygen carrying protein, found in red blood cells

Missense mutation - A substitution mutation that causes one amino acid to be swapped for another in a protein coding segment of DNA

Nonsense mutation - A substitution mutation that causes shortening of the protein chain produced by the DNA segment

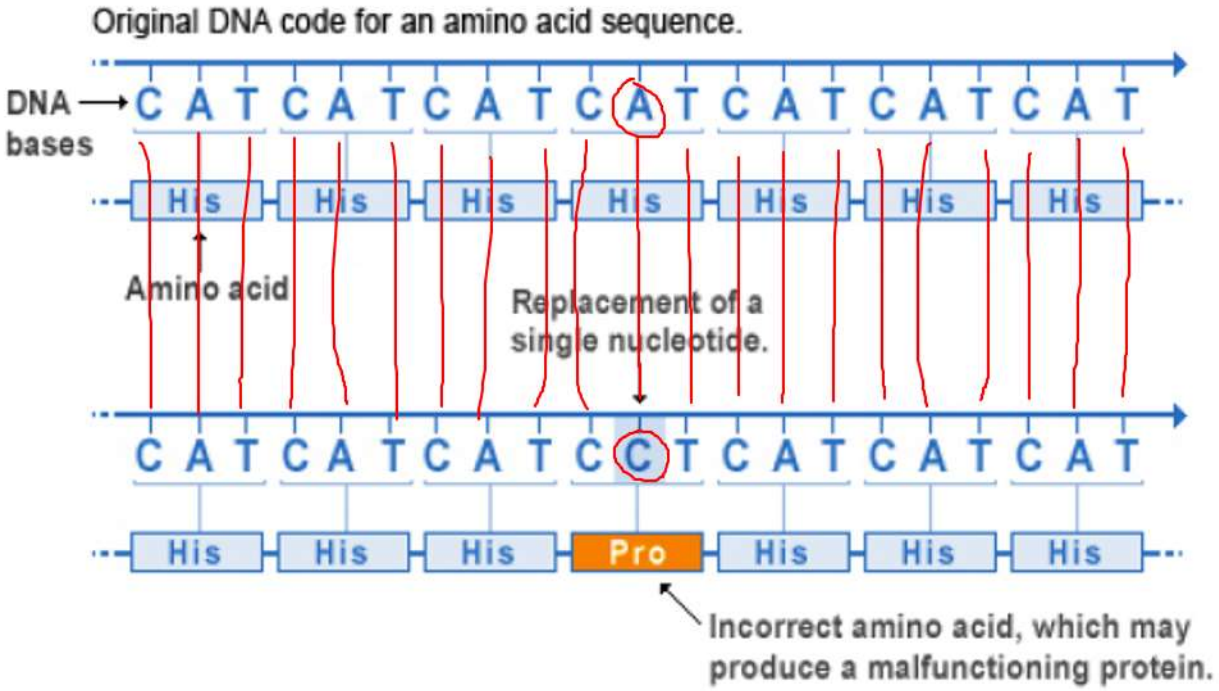
Sickle cell - A group of disorders that cause red blood cells to become misshapen and break down

Silent mutation - A substitution mutation with no effect

Substitution mutation - Results when one nucleotide replaces the original nucleotide in a DNA strand (during DNA replication)

e.g. Sickle cell anaemia

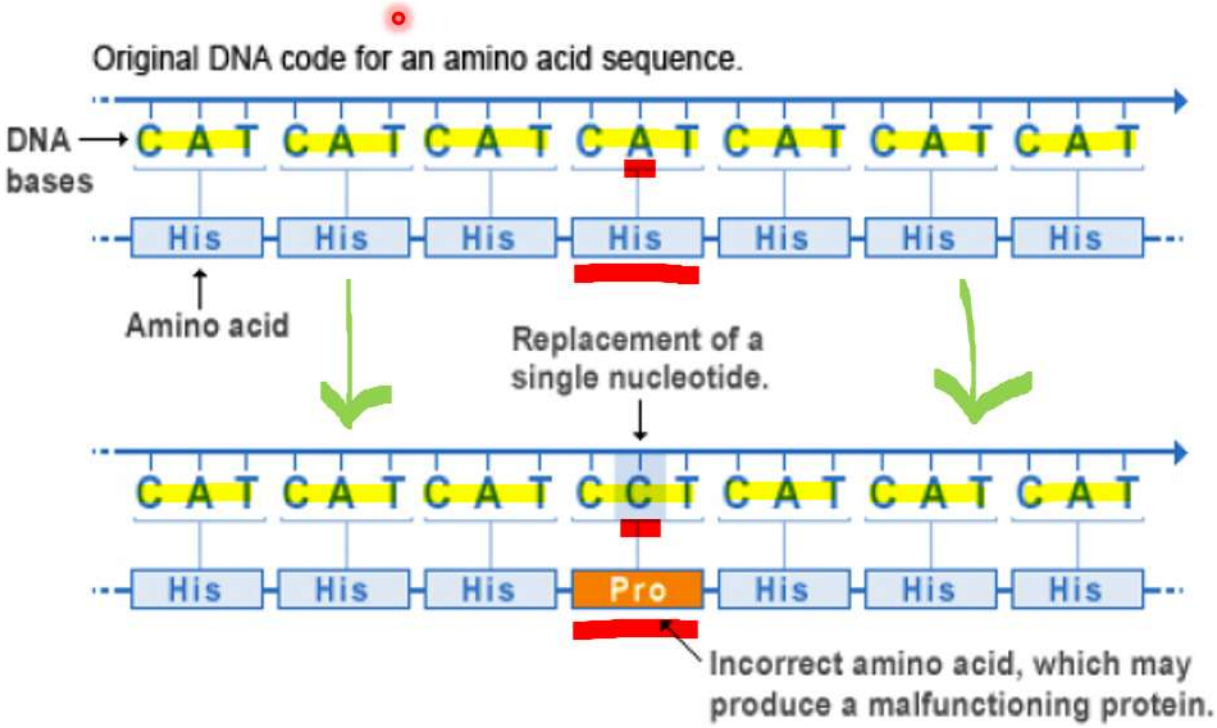
Missense mutation



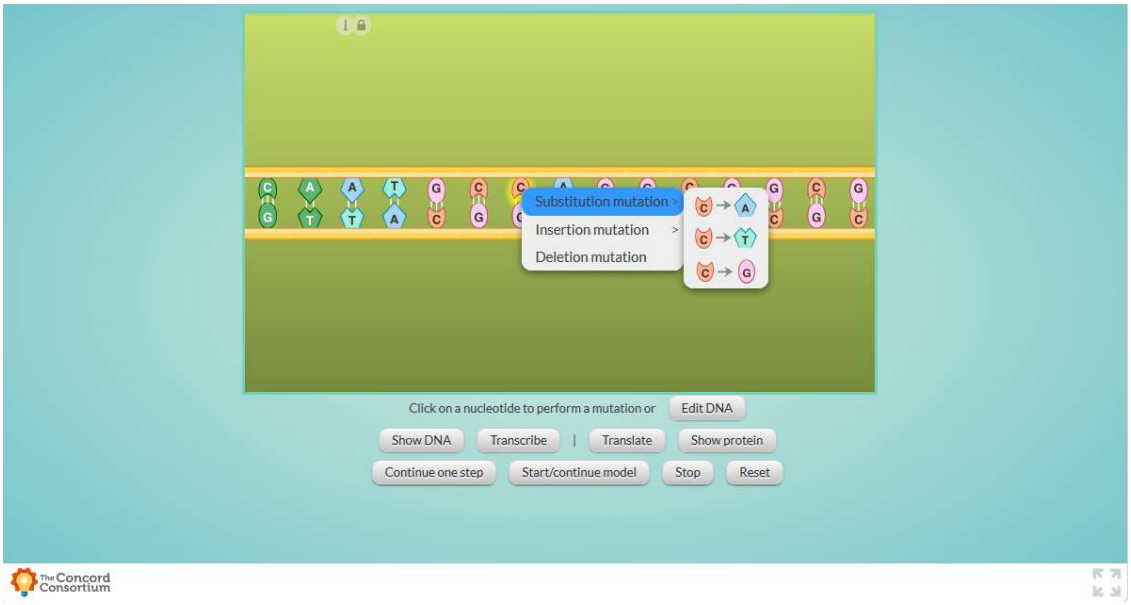
Annotated Slide1

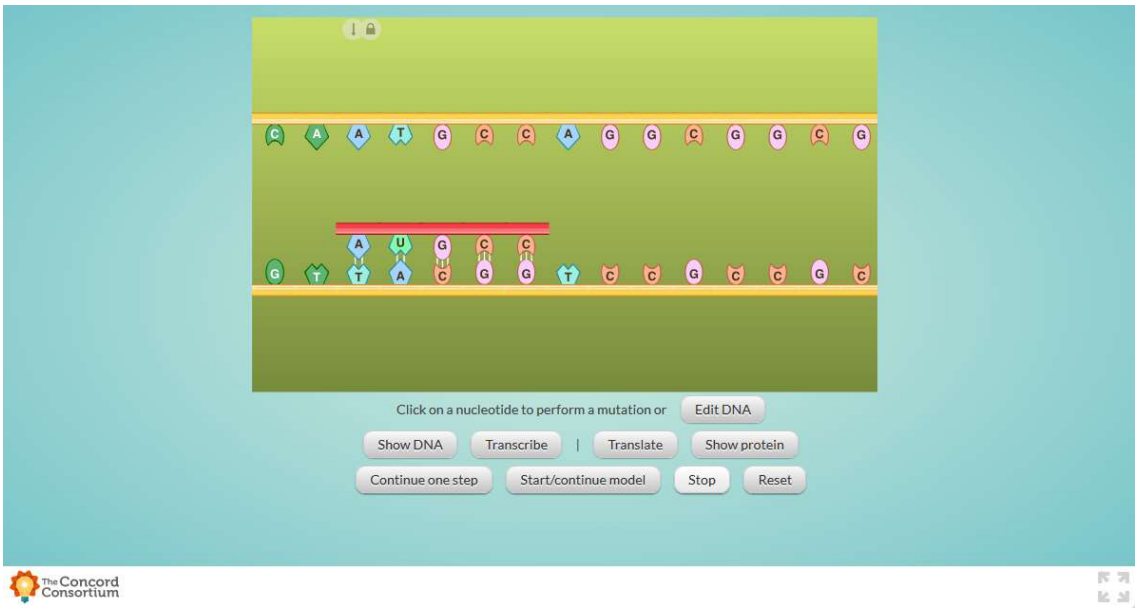
e.g. Sickle cell anaemia

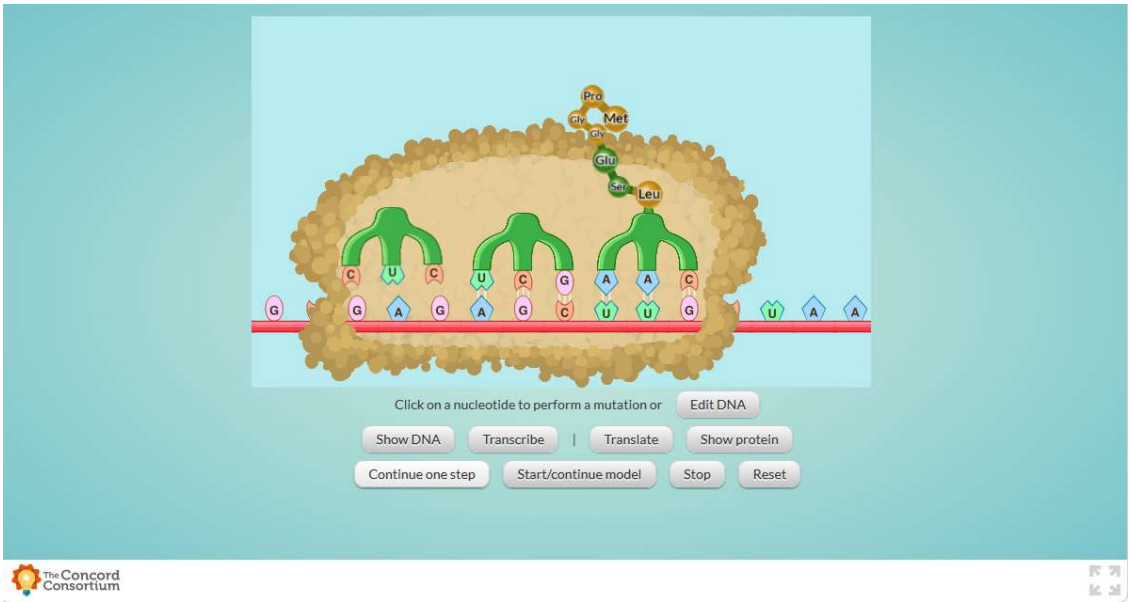
Missense mutation



Annotated Slide2


Substitution mutation
Insertion mutation
Deletion mutation
Click on a nucleotide to perform a mutation or
Edit DNA
Show DNA
Transcribe
Translate
Show protein
Continue one step
Start/continue model
Stop
Reset
The Concord Consortium


Click on a nucleotide to perform a mutation or
Edit DNA
Show DNA
Transcribe
Translate
Show protein
Continue one step
Start/continue model
Stop
Reset
The Concord Consortium


Pro
Met
Glu
Leu
Click on a nucleotide to perform a mutation or
Edit DNA
Show DNA
Transcribe
Translate
Show protein
Continue one step
Start/continue model
Stop
Reset
The Concord Consortium