INVICTUS
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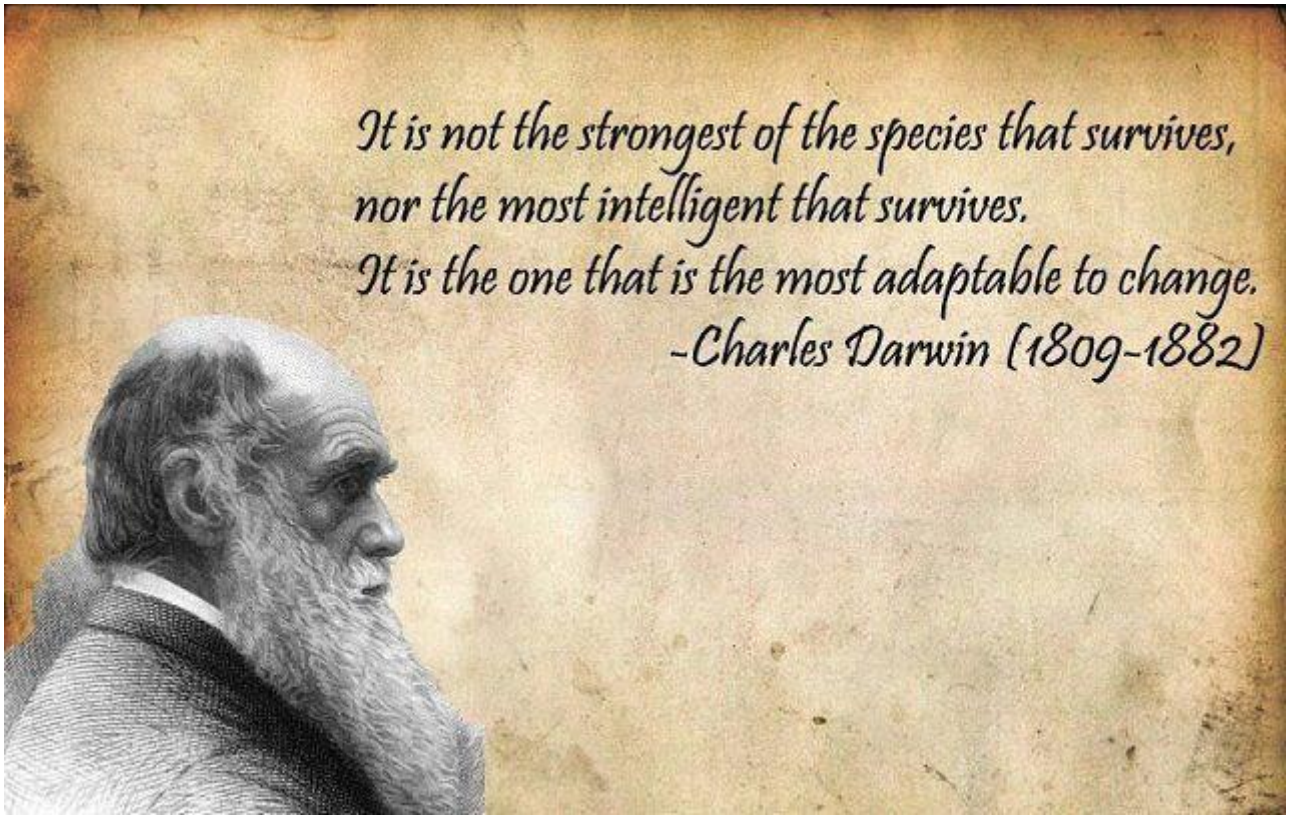
Wombourne High School

Advanced Level

Biology

@ Invictus Sixth Form



Welcome to A Level Biology. In this booklet you will be given an overview of what A Level Biology involves and some introductory tasks for you to get back into the swing of things!

What is the subject about?

Biology is the study of living things, but not just animals and plants. You'll also learn about the molecules that make living things work, the cells that they're made from, the systems within plants and animals, and the interconnections between organisms.
Biology is different from physics and chemistry, in that living things don't always do what you expect them to do. You can't test one organism and assume all the rest will be the same, so you'll learn about the statistical analysis behind making claims.
At first, you may find the jump in demand from GCSE a little daunting, but if you follow the tips and advice in this guide, you'll soon adapt.

What skills will I need and develop in this course?

You will need numerical, problem solving and communication skills, which you will develop further. You will also develop your practical and research skills – i.e. how to find relevant scientific information and how to analyse and evaluate scientific data.
You will also need to have a good work ethic, determination and perseverance. Biology A level is HARD! But if you LOVE Biology and finding out how your AMAZING body works – it is a fascinating subject 😊

What can the course lead to in terms of higher education and future careers?

Studying Biology at A-level or degree opens up all sorts of career opportunities.

- Doctor
- Clinical molecular geneticist
- Nature conservation officer
- Pharmacologist
- Research scientist
- Vet
- Secondary school teacher
- Marine biologist
- Dentist.
- Microbiologist.
- Nanotechnologist.
- Nature conservation
- Sport and fitness
- Agriculture
- Healthcare
- Biochemist
- Botanist
- Forensic scientist
- Physiotherapist

Plus, SO many more!

What we do in Year 12 Biology

Content Overview

Module 1 Development of practical skills in Biology
Practical Skills assessed throughout the year and examined in a written examination

Module 2 Foundations in Biology
- Cell structure
- Biological molecules
- Nucleotides and nuclei acids
- Enzymes
- Biological membranes
- Cell division

Module 3 Exchange and transport
- Exchange surfaces
- Transport in animals
- Transport in plants

Module 4 Biodiversity, evolution and disease
- Communicable diseases, prevention and immunity
- Biodiversity
- Classification and evolution

Assessment Overview

External Examination Paper 1 – Breadth in Biology
This examination is split into two sections and assesses content from all teaching modules, 1 to 4 (70 marks).
Section A – multiple choice questions worth 20 marks
Section B – short answer question styles (structured questions, problem solving, calculations, practical) and extended response questions. This is worth 50 marks.
1 hour 30 minutes
50% of the total AS Level
Examined in Summer 2017

External Examination Paper 1 – Depth in Biology
This examination assesses content from all teaching modules, 1 to 4.
Question styles include short answer (structured questions, problem solving, calculations, practical) and extended response questions. This is worth 70 marks.
1 hour 30 minutes
50% of the total AS Level
Examined in Summer 2017

Extra-Curricular Activities

Birmingham University lectures, STEM, revision classes and A level live lecture.

Biology Advanced Level Useful Information

Equipment

Below are the minimum stationery requirements to successfully cater for your A-level Biology course:

- 2 x A4 folders – for copied up notes
- 2 x Dividers - 12 sections
- Calculator – does not need to be scientific
- Pens – at least 2 black, 1 green, 1 purple
- Pencils
- Ruler
- Rubber
- 3 Highlighters

You will be provided with classwork book. This book will contain your written class notes. The expectation is that every week you write up your class notes in a format that aids your understanding and revision style

Websites

These are websites that you should bookmark. They are extremely useful to either help you do additional research, explain a topic you are finding difficult or support your revision program.

1. OCR website www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015

You will find:

- The specification – this explains exactly what you need to learn for your exams.
- Practice exam papers
- Lists of command words and subject specific vocabulary – so you understand the words to use in exams
- Past papers from the old specification. Some questions won't be relevant to the new AS and A-level so please check with your teacher.
- Maths skills support.

2. Royal Society of Biology www.rcb.co.uk

3. The student room www.thestudentroom.co.uk
Join the A-level Biology forums and share thoughts and idea with other students if you're stuck with your homework.

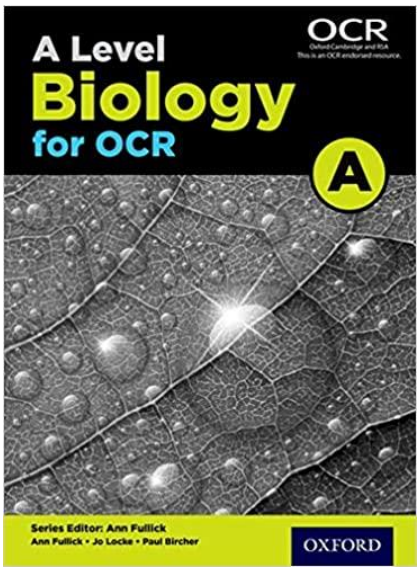
4. Youtube
YouTube has thousands of Biology videos. Just be careful to look at who produced the video and why because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable. If in doubt, ask your teacher

Magazines/Articles

You may want to subscribe to:

Focus, New Scientist or Philip Allan updates can help you put the biology you're learning in context.

Textbooks



You will be given a copy of:

A level Biology for OCR. Ann Fullick Oxford Press

This text book does not have to be brought to every lesson

It is an excellent resource book

Homework will be set from it most weeks

To supplement your learning, you may want to purchase:

CGP OCR A AS/A2 level Biology – Student book
CGP OCR A AS/A2 level Biology – Complete Revision & Practice

Hodder Education OCR Biology A Student Guide 1: Development of practical skills and Foundations in Biology

Hodder Education OCR Biology A Student Guide 2: Biology – exchange, transport, biodiversity, evolution and disease.

Introductory Tasks.

SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or °C). Sometimes, there are different units available for the same type of measurement. For example ounces, pounds, kilograms and tonnes are all used as units for mass.
To reduce confusion, and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.
These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation
mass	*m*	kilogram	kg
length	*l or x*	metre	m
time	*t*	second	s
electric current	*I*	ampere	A
temperature	*T*	kelvin	K
amount of substance	*N*	mole	mol
luminous intensity	*(not used at A-level)*	candela	cd

All other units can be derived from the SI base units.
For example area is measured in square metres (written as m^2) and speed is measured in metres per second (written as ms^{-1}).

It is not always appropriate to use a full unit.
For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.
Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33 000 m would be quoted as 33 km.
The most common prefixes you will encounter are:

Prefix	Symbol	Multiply Base Unit by	Example
tera	T	1,000,000,000,000	teragram = Tg = 10^{12} g
giga	G	1,000,000,000	gigaliter = GL = 10^{9}L
mega	M	1,000,000	megagram = Mg = 10^{6} g
kilo	k	1,000	kilogram = kg = 10^{3} g
hecto	h	100	hectogram = hm = 10^{2} m
deka	da	10	decagram = dag = 10 g
deci	d	1/10	deciliter = dL = 10^{-1} L
centi	c	1/100	centimeter = cm = 10^{-2} g
milli	m	1/1000	millimeter = mm = 10^{-3} m
micro	μ	1/1,000,000	microgram = μg = 10^{-6} g
nano	n	1/1,000,000,000	nanoliter = nL = 10^{-9} L
pico	p	1/1,000,000,000,000	picogram = pg = 10^{-12}g
femto	f	1/1,000,000,000,000,000	femtomole = fmol= 10^{-15} mol

Activity 1

Which SI unit and prefix would you use for the following quantities?

1. The time between heart beats
2. The length of a leaf
3. The distance that a migratory bird travelled each year
4. The width of a cheek cell
5. The mass of a rabbit
6. The mass of iron in the body
7. The volume of the trunk of a large tree

Sometimes, there are units that are used that are not combinations of SI units and prefixes.
These are often multiples of units that are helpful to use. For example, one litre is 0.001 m3, or one day is 86 400 seconds.

Activity 2

Choose the most appropriate unit, and estimate the size of each of the following.

1. The mass of an elephant

2. The mass of an earthworm

3. The volume of water in a teardrop

4. The volume of water in a pond

5. The time taken for a sunflower to grow

6. The temperature difference between the blood in the heart and in the ear on a cold day

7. The width of a hair

8. The length that your fingernails grow each day

9. The total length of each of the hairs on your head

Activity 3

Put the following in order of size:

height of an elephant; length of DNA strand; width of a hair; height of a tree; width of a sodium ion; length of a nerve cell; length of a heart; width of a red blood cell; size of a virus; length of a finger; length of a mosquito; length of a human digestive system; width of a field; length of a water molecule.

Important vocabulary for practical work

There are many words used in practical work. You will have come across most of these words in your GCSE studies. It is important you are using the right definition for each word.

Activity 4

1	Uncertainty	A	A proposal intended to explain certain facts or observations.
2	Anomalies	B	The variable for which values are changed or selected by the investigator
3	Hypothesis	C	These are values in a set of results which are judged not to be part of the variation caused by random uncertainty.
4	Prediction	D	This variable is one which may, in addition to the independent variable, affect the outcome of the investigation and therefore has to be kept constant or at least monitored.
5	Reproducible	E	A statement suggesting what will happen in the future, based on observation, experience or a hypothesis.
6	Independent Variable	F	These cause readings to differ from the true value by a consistent amount each time a measurement is made.
7	Systematic error	G	The interval within which the true value can be expected to lie.
8	Dependent Variable	H	These variables have values that are labels, eg names of plants or types of material
9	Categoric Variable	I	This variable is the variable of which the value is measured for each and every change in the independent variable
10	Control Variable	J	A measurement is this if the investigation is repeated by another person, or by using different equipment or techniques, and the same results are obtained. Previously known as reliable.

Match the specific scientific vocabulary to the definition

1 = 2 = 3 = ` 4 = 5 =

6 = 7 = 8 = 9 = 10 =

Cells

All life on Earth exists as cells. These have basic features in common.

Activity 5

Complete the table.

Structure	Function
Cell-surface membrane	
Chloroplast	
Cell vacuole	
Mitochondria	
Nucleus	
Cell wall	
Chromosomes	
Ribosomes	

Draw the structure of a plant cell and an animal cell.

On each cell, add labels showing each of the structures in the table, if they exist.

Principles of moving across boundaries

In biology, many of processes involve moving substances across boundaries.

Activity 6

Match the examples to the principle(s) involved. For each, give a brief description of why it is relevant.

Osmosis
Diffusion
Active transport
Changing surface area or length

Examples

- Drinking a sports drink after exercise
- Gas exchange in the lungs
- Absorbing nutrients from food into the body
- Moving ions into cells
- The effect of salt on slugs
- Penguins huddling together to keep warm
- Potato pieces get heavier when put in pure water
- Potato pieces get lighter when put in very salty water
- Cacti do not have thin, large leaves.

Activity 7

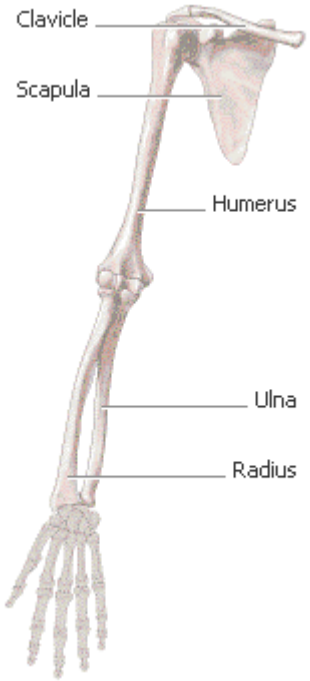
Chicken Wing Dissection

How do the muscles, bones, and tendons work together to move a joint of a chicken wing and how do they compare to a human arm?

Although many differences exist between the anatomy of humans and chickens, one structure that shows similarities in muscle pairing and range of motion is a bird's wing. In this activity you will study chicken wing structure and function, which is comparable to that of the human arm.

Bones of the Human Arm

The arm reaches from the shoulder to the wrist. It consists of two basic parts:
(1) the **upper arm**, which extends between the shoulder and the elbow, and
(2) the **forearm**, which extends between the elbow and the wrist.

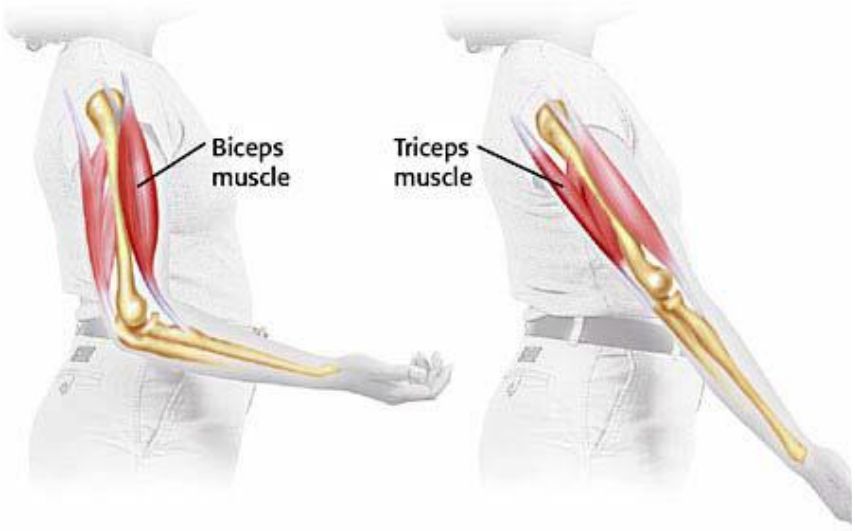


The upper arm is formed by one long bone, the **humerus**. The top end of the humerus is rounded and fits into a cup-shaped depression in the scapula, or shoulder bone, forming a ball-and socket joint. Ball-and-socket joints allow for circular movement.

The two bones of the forearm are the **radius** and the **ulna**. The ulna is fixed in position, but the radius can rotate over the ulna. This makes rotation of the forearm possible in motions such as twisting a screwdriver.

Skeletal Muscles of the Human Arm

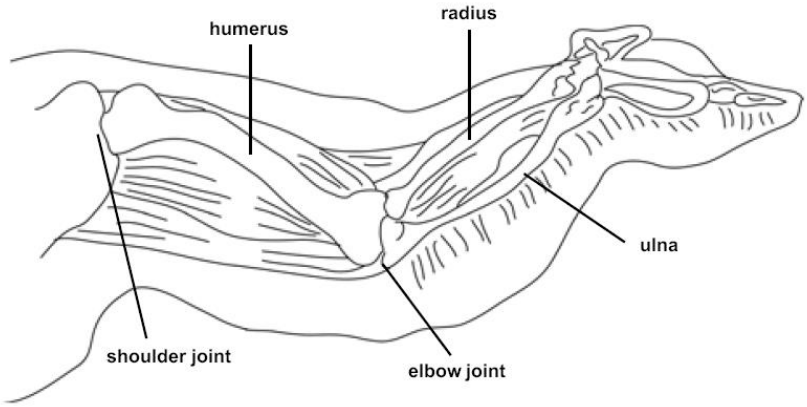
Skeletal muscles are responsible for hundreds of movements.
When an organism wants to move, signals travel from the brain to the skeletal muscle cells. The muscle cells then contract, or get shorter.



Strands of tough **connective tissue** connect the skeletal muscles to bones. These strands of tissue are called **tendon***s.*
When a muscle that connects two bones gets shorter, the bones are pulled closer to each other. For example, tendons attach the biceps muscle to a bone in your shoulder and to a bone in your forearm.
When the biceps muscle shortens, your forearm bends toward your shoulder.
The skeletal muscles often **work in pairs** to produce smooth, controlled motions by pulling, or contracting. When one muscle in the pair bends part of the body, the other muscle **extends** or straightens part of the body.

Bones of the Chicken

The **upper wing** consists of a **humerus,** which is at one end, and the **ulna** and the **radius** at the **lower wing**. These bones connect at the **elbow joint**. The rest of the wing is composed of modified hand bones.



Dissection – obtain a chicken wing (available from all butchers/supermarkets)

Watch this video before you start:
https://www.youtube.com/watch?v=XLUAqZ93QFk

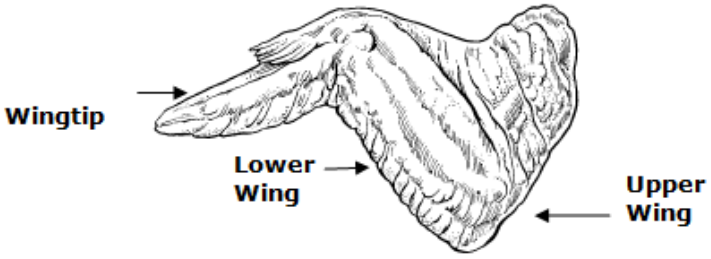
Materials

- fresh chicken wing
- Knife
- Chopping board
- Scissors

Getting Under the Skin

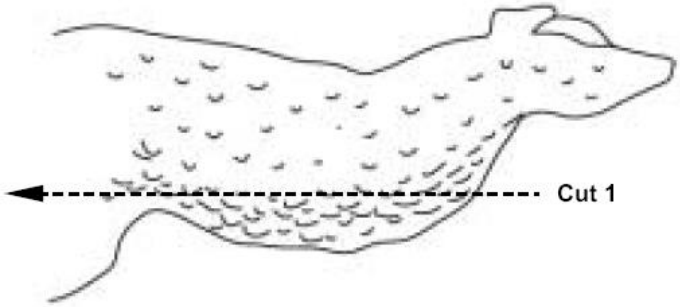
a. Examine the chicken wing, and compare it with the Figure to the right.

b. Identify the upper wing, the lower wing, and the wingtip.

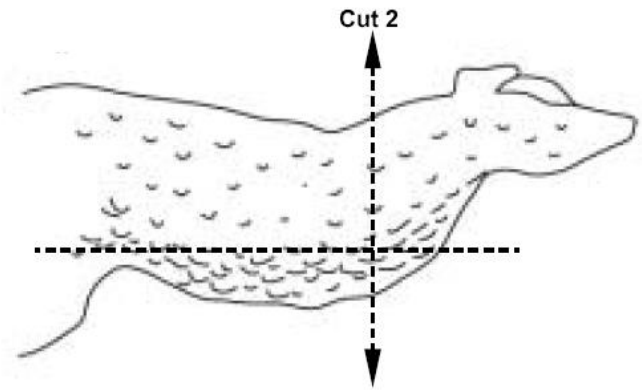


c. Examine the wing at the point where it was removed from the body. Depending on the way the wing is cut, you might see cartilage and bone marrow.

d. Using the scissors, cut down the middle of the skin, starting at the top end of the upper wing. Try not to cut through the muscles below the skin. Do this by piercing the skin and then slipping the scissors between the skin layer and the muscle. Cut until you reach the shoulder joint. (See cut 1.)



e. Cut down the sides of the skin to make a T shaped cut. Start at the first cut and cut away from it in both directions. Peel the skin and cut to loosen it. (Note: the chicken skin can be very difficult to remove. Take your time peeling it back so as not to damage the tissues underlying it. (See cut 2.)



Observations

Complete **Table 1, Observation Table,** as you complete your dissection and **Analysis Questions** as you complete the dissection.

Fat Look for yellowish tissue clumped together beneath the skin. This is fat tissue, made of fat cells.

Muscles
a. Observe the muscles in the wing. They look like bundles of pale pink tissue.
b. Find two muscles in the wing that bend and straighten the elbow joint. Each muscle pulls on the lower wing bones in one direction (the flexor bends the joint). Since the flexor cannot lengthen by itself to push the bone back to straighten the joint, another muscle pulls the bone in the opposite direction (extensor).
c. Hold the wing down at the shoulder and alternately pull on each muscle. Observe what happens.

Tendons
a. Tendons are shiny white tissues at the ends of the muscles that attach muscles to bones. Find as many tendons as you can on the chicken wing.
b. Pull on a tendon to see how it helps the chicken move its wing.

Joints and Ligaments
a. Two bones come together at a joint. Bend and straighten the elbow joint and observe how the bones fit together.
b. Ligaments connect bones to other bones at joints. They look like a shiny white covering of the joint surfaces.
c. Closely examine the elbow joint between the upper wing and the lower wing and identify the ligaments.

Cartilage
Between the bones is another shiny white material that is slippery. This is cartilage, which helps the bones move without grinding against one another, or without causing trauma.

Wing
a. Move the wing again. Explore how the muscles, tendons, ligaments, and cartilage play roles in the wing's movement.
b. Complete the Observation Table. When you have finished observing the wing and writing your notes, throw the chicken remains away. Wash all equipment in hot, soapy water.

Observations

Table 1 Observation Table

Tissue	Description (color, texture, etc.)	Tissue it attaches to
Skin	**1.**	**2.**
Fat	**3.**	**4.**
Muscle	**5.**	**6.**
Tendon	**7.**	**8.**
Ligament	**9.**	**10.**
Cartilage	**11.**	**12.**

Analysis (You do NOT need to write in complete sentences.)

1. What purpose does the connective tissue serve?

_____

2. What type of tissue actually moves the chicken wing? _____

3. Why are tendons important to a muscle's ability to make the body move?

_____

_____

4. What tissue of the chicken wing is commonly referred to as the "meat"? _____

Making the Human Connection

With your **left-hand** grasp something with weight such as a heavy textbook or pencil pouch and hold it at your side. Place your **right hand** on your **upper left arm** so that you can feel your muscles move. Slowly bend your left arm to raise the weight. Then slowly straighten your left arm to lower it. Repeat this motion a few times until you can feel and see what is happening.

5. What joint did you use to lift the weight?

_____

6. Explain which **muscle contracted** and which muscle **extended** as you raised the weight.

_____

_____

7. Then explain what happened to each muscle as you lowered the weight.

_____

_____

8. Which bone(s) in the arm moved?

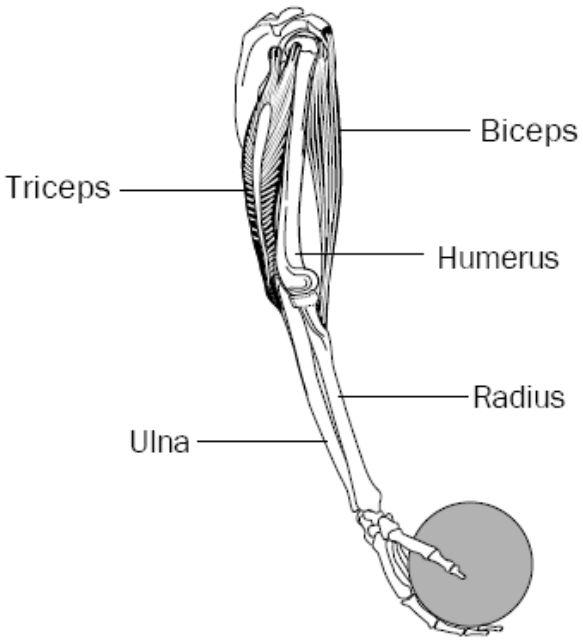
_____

_____

9. Which bone(s) in the arm didn't move?

_____

_____



10. Write the definition of each of the following terms. Use bullet points

- Brain _____
- Muscle _____
- Tendon _____
- Ligament _____
- Bone _____
- Joint _____
- Nerve _____

11. Then, based upon your observations in this activity, explain either how the chicken wing or the human arm moves using all of the above terms in your answer.

_____

_____

_____

_____

_____

_____

_____

You have now finished this Enrolment Task

Well done 😊

Don’t forget to bring it to your First Biology lesson in September!

We look forward to working with you