TRIATHLON

Research Project
For Teachers **p2&3**, for Students **p4**

HEALTH AND SAFETY

Students should be encouraged to make their own risk assessment before they carry out any activity, including surveys. In all circumstances this must be checked by a competent person.

For surveys and other activities on open water, the PE department or local water sports clubs may be able to help with risk assessments and ways to avoid risks. Students using specialised equipment should be supervised at all times.

Students may want to set up unorthodox experiments and you may need to seek specialist advice. In particular:

- Any investigations into the actual effect on real people of immersion in cool or cold water must only be done with medical supervision and appropriate medical resources on hand in case of emergency
- Any activity associated with open water will require specialised risk assessment.

Organisations such as CLEAPSS are able to help.

TRIATHLON:
Gold **Research** Project - For Teachers

Making every step count

A standard distance triathlon consists of a 1500 m swim in open water, followed by a 40 km cycle ride, then a 10 km run. World class athletes complete it in less than two hours. Ironman triathlons are even longer - 3.8 km swim, 180 km cycle ride and 42 km run!

By the time the athletes reach the run, even the very best will be feeling the effects of the swim and cycle. The right training and the right equipment can make the difference between winning and losing.

What is the science behind efficient running, and how can it be used to enhance performance?

What is it like to be in her shoes? Could she have won in anyone else's?

HAVE YOU EVER WONDERED?

… whether artificial limbs can ever mimic natural movement well enough to enable amputees to compete with able-bodied athletes?

You might like to imagine yourself in a situation such as…

The National Disability Triathlon Project has developed a BTF (British Triathlon Federation) classification system for disabled athletes, allowing a number of inclusive races throughout the country. Many of the disabled athletes are amputees; they wear prosthetic limbs. A young British triathlete - who recently lost a limb in a motorcycle accident - has asked you to help her find out about prosthetics.

She has asked you to **research information** to investigate:

- how prosthetic limbs are designed and built to mimic a natural limb as closely as possible
- the human factors that limit the type of artificial limb possible for an amputee.

Prompts

The **Student Brief** gives some triggers to start students thinking. They should realise that each trigger implies several items to research and compare. Encourage students to identify these themselves. However, if necessary, prompts such as those below might be given, to point students in suitable directions

- How much of the natural leg must be replaced by the prosthetic limb?
- How much sensitivity and control the amputee has in the remaining part of their leg?
  - How will the prosthetic limb attach to the remaining natural leg?
  - How much of a prosthetic limb can be 'mass-produced' and how much must be tailored to the individual user?
- The properties of the materials used to make prosthetic limbs
  - How have prosthetic limbs changed over time? What important properties does this highlight?
  - By imagining having to use an artificial limb, can you identify which properties matter most?
- The methods used to control a prosthetic limb
  - How, if at all, does the interface between the limb and the person using it, work?
  - What degree of learning is needed to use the prosthetic limb?
  - Does the design vary according to the activity an amputee wishes to do?

Suggestions for supporting students

Though primarily based on secondary data, the Research project is likely to provide a more meaningful experience if the student includes some practical work. One possibility is for two students to undertake their projects - one Research, the other Practical - working independently, but coming together to share mutually useful information and activities.

Gold Award students are required to have an external Mentor (normally a scientist or engineer) for their project. The Mentor's role is to provide guidance and support.

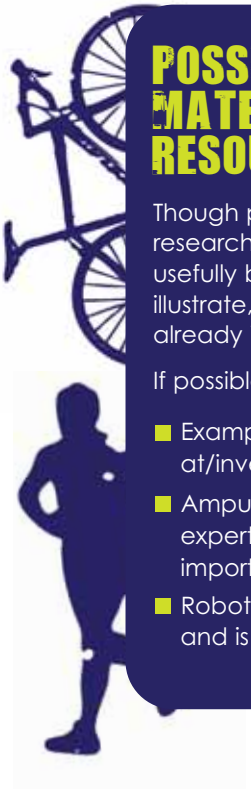
In this case, someone with knowledge and/or experience of prosthetic limbs would be ideal. The Mentor might be involved in…

- academic or industrial research into, for instance:
  - design of prosthetic limbs
  - development of new materials
  - robotics
- rehabilitation of amputees, particularly those with leg amputations
- electronic sensing and control
- working with users to trial new designs of prosthetic limb.

Internet search

Combine 'prosthetic leg' with terms such as: design, Olympics, building, research, sport, artificial limbs, technology or robotics

- Introduction to designing and building artificial limbs
  enotes.com/how-products-encyclopedia/artificial-limb
- Background to Oscar Pistorius' story
  nytimes.com/2007/05/15/sports/othersports/15runner.html
- Introduction to types of artificial limb
  en.wikipedia.org/wiki/Artificial_limb
- Project to develop a robotic ankle
  web.mit.edu/newsoffice/2007/robot-ankle-0723.html
- Using the brain to control artificial limbs
  news.bbc.co.uk/1/hi/sci/tech/7423184.stm



POSSIBLE EQUIPMENT, MATERIALS AND RESOURCES

Though primarily a 'theoretical' research project, 1-2 hours could usefully be spent in the laboratory - to illustrate, and explain or clarify, aspects already investigated theoretically.

If possible, access to:

- Examples of prosthetic limbs to look at/investigate
- Amputees and/or with medical experts to interview, to highlight important issues
- Robotic arms, to investigate what is, and is not, possible

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Some things to think about...

- How much of the natural leg must be replaced by the prosthetic limb
- How much sensitivity and control the amputee has in the remaining part of their leg
- The effort or energy required to 'use' the prosthetic leg.

Health and Safety

Before you carry out any experiment:

(a) find out if any of the substances, equipment or procedures are hazardous

(b) assess the risks (think about what could go wrong and how serious it might be)

(c) decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on)

(d) make sure your teacher agrees with your plan and risk assessment

NOTE: Your teacher will check that you can carry out your project safely your risk assessment against that of your school. If no risk assessment exists for the activity, your teacher may need to obtain special advice. This may take some time.

(e) if special tools or machines are needed, arrange to use them in a properly supervised design & technology workshop

(f) if an experiment involves physical activity, you may need the support and supervision of a P.E. teacher.