A Teacher Resource designed to engage young people: to think about, express and critically evaluate controversial science and social issues.

For teachers of:

Science • Citizenship • PSHE • Religious Studies

@Bristol's CitizenScience project is supported by the Wellcome Trust
www.at-brisol.org.uk/cz
WHAT’S IN THIS PACKAGE?

Lesson plans, guidelines and suggestions  Page 3

Information about IVF
You’ll find here information for teachers, handouts for students and sources of further information on the web.
You may wish to use some of the teacher information pages with older or higher attaining students; or adapt them for your own purposes.

Timeline of IVF events  Page 4
Web sources for further information  Page 4
Glossary of terms used in IVF and genetics  Page 5
IVF fact sheet – for students  Page 6
Genetic disorders fact sheet – for students  Page 7

Student worksheets
Who gets IVF? Our decisions  Page 8
Who gets IVF? Our criteria  Page 9

Case studies for Discussion
Six family cases – Who should get IVF on the NHS? (KS4)  Page 10
Six family cases – Who should get IVF with genetic screening? (KS4/Post-16)  Page 11

All materials can be photocopied. They can also be downloaded from the web at www.at-brisol.org.uk/cz

OVERALL LEARNING OUTCOMES

Activities using these materials can support students to:

• develop their ability to relate their understanding of science to scientific and technological developments in society and the issues these raise
• gain knowledge related to some of the ethical and social issues around IVF treatment
• research, analyse and evaluate information from different sources
• develop skills in presenting, explaining and critically evaluating their own views
• use their imagination to consider other people’s experiences
• develop skills involved in discussion and decision-making where opinions differ
• develop understanding of the use of criteria in decision-making.

Curriculum links (KS4)

Citizenship  1. a) f) g), 2. a) b) c), 3. a)
Science  3. a), 4. a) b), 5. e)
PSHE  3. g) h), 4. g)
Religious Studies  1. b

CitizenScience project is supported by the Wellcome Trust
www.at-brisol.org.uk/cz
WHO SHOULD GET IVF TREATMENT FROM THE NHS?

LESSON OUTLINE

STARTER ACTIVITY Whole Class
1. ASK What do students know about IVF?
2. CHECK understanding of processes, terms: List on board/chart.
3. ASK Where did they get that knowledge? School science? Media? Family/friends?
4. ASK What are they unsure about? List questions.
5. DISTRIBUTE IVF Fact Sheet – for students to individuals.

MAIN ACTIVITY Students in groups of up to 6
1. EXPLAIN Students are to act as an Advisory Group for the local Primary Care Trust. Their job is give advice about IVF treatment in the NHS. Resources and funding are limited so that not everyone who would like the treatment can have it. They have to decide as a group who gets the treatment.
2. DISTRIBUTE case cards to each group. Today there are six cases to consider. Only three can be accepted for treatment. Using what they know about IVF, groups must decide whom they will say ‘Yes’ to and who will be refused treatment. All decisions must be supported by reasons.
3. DISCUSS in groups.

PLENARY Whole class
1. REPORT BACK Decisions and reasons are recorded on board/flip chart.
2. CONSIDER TOGETHER similarities and differences between groups.
3. INTRODUCE idea of criterion-based decision-making. What criteria did we use? Eg Age of parents, chance of success, two parents, etc. list for discussion.

If preferred and time is available, groups can work on this together using the Worksheet: Who Gets IVF? Our Criteria. Groups then report back for recording and discussion.

ADAPTING THE RESOURCE FOR YOUR PURPOSES
• The material provided can be used flexibly to meet your needs.
• The activity, as described above, will fit into one lesson. However you could extend the activity by planning independent research beforehand in a lesson or for homework. The discussion of criterion-based decision-making could also be given more time in a follow-up.
• The materials provided also allow you to extend the topic to include screening for genetic disorders and embryo selection. These could be used with Post-16 groups or used to differentiate activity in KS4 for high achieving groups. To simplify the task, use fewer cases.
• The materials make an excellent basis for cross-curriculum collaborative activity. You may want to discuss using these ideas and resources with other subject teachers.

HELPING STUDENTS TO DISCUSS EFFECTIVELY
It is helpful to be explicit about the skills and behaviours involved in effective discussion: how to present your ideas, ask questions, provide or ask for evidence, challenge others, respect others, empathise, see alternative points of view, and attempt to achieve a consensus.

As a starter activity you could take time to discuss and agree a set of basic ground rules with your class about appropriate behaviour for the discussion of sensitive and controversial issues.
The science of reproductive technology has moved fast. The ability to have children is no longer dictated by nature. Since the first ‘test tube baby’ in 1978 more and more infertile couples have been able to have children.

In 2005, 27,800 infertile couples had IVF treatment. The treatment is not always successful, so several attempts are often necessary.


1955  Four successful pregnancies using previously frozen sperm.

1969  Human fertilisation in vitro is achieved for the first time.

1977  First IVF pregnancy - but it is ectopic (implanted outside the uterus).

1978  Birth of Louise Brown, the first ‘test tube’ baby born as a result of IVF.

1980  Two Australian teams succeed in IVF deliveries after drug-induced superovulation.

1990  Human Fertility and Embryology Act in the UK and the setting up of the Human Fertility and Embryology Authority.


1995  Human Fertilisation and Embryology Authority
Directory of local Primary Care Trusts
National Institute for Clinical Excellence (NICE)
Progress Educational Trust (PET)
Life: The UK’s leading Pro-Life charity
BBC
Beep: BioEthics Education Project

www.hfea.gov.uk
www.nice.org.uk
www.progress.org.uk
www.lifeuk.org
www.bbc.co.uk
www.beep.ac.uk

2000  The culture of embryonic stem cells, some from ‘spare’ embryos donated by couples who have had successful IVF treatment, opens the way to ‘made-to-order’ tissue for transplant surgery.

2005  UK Primary Care Trusts are advised by the Government to offer one free cycle of IVF to every couple requesting the treatment.

2006  The world’s first over-the-counter home fertility test for men has been developed by scientists at Birmingham University. Women are being offered a new test kit that allows them to estimate the rate at which their fertility is declining, and how long they can put off having children.

2008  First IVF pregnancy - but it is ectopic (implanted outside the uterus).

2009  First IVF pregnancy - but it is ectopic (implanted outside the uterus).
Underlined words can be found elsewhere in the glossary

**Allele:** A particular version of a certain gene. Humans have two alleles of each gene: one from their mother and one from their father.

**Carrier:** An individual who has a specified allele that is not expressed in the characteristics of the individual because the gene is recessive.

**Cells:** The tiny units that are the basic building blocks of living things. Each cell contains genetic material, for example, DNA, and is surrounded by a membrane.

**Chromosomes:** A bundled-up strand of DNA. Humans have 23 pairs of chromosomes, which are found in the nucleus of a cell. Each parent contributes one chromosome to each pair. The 23rd pair determines what sex the child is: female if they have two ‘X’ chromosomes and male if they have one ‘X’ chromosome and one ‘Y’ chromosome.

**Designer babies:** Popular press term for babies who have been selected for birth on the basis of their genetics.

**Double helix:** The coiled structure of double-stranded DNA.

**DNA:** Deoxyribonucleic acid. The chemical which carries our genetic code. DNA is divided into genes.

**Dominant Allele:** Expressed in the characteristics of an individual even if there is only one copy. It will overshadow the recessive allele.

**Egg cell:** A female sex cell or gamete.

**Embryo:** An organism at any time before full development, birth, or hatching.

**Gamete:** A mature sex cell that usually has one set of chromosomes and is capable of uniting with a gamete of the opposite sex to begin the development of a new embryo.

**Gene:** A section of DNA that codes for a specific protein. Every individual contains two alleles of each gene: one from their mother and one from their father.

**Genetic testing for disease:** Analysing an individual’s genetic material to determine predisposition to a particular health condition or to confirm diagnosis of a genetic disorder.

**Gene Therapy:** The introduction of a healthy allele of a gene which is not functioning fully into the cells.

**Implantation:** The process by which a fertilised embryo is attached to the lining of the uterus.

**Inheritance:** The process of genetic transmission of characteristics from parents to offspring.

**IVF:** In vitro fertilisation (literally “in glass”). Fertilisation takes place outside the body in a hospital laboratory. Sperm and egg cell are combined and viable embryos are implanted in the mother.

**Nucleus:** The central structure in a cell that houses the chromosomes.

**Recessive Allele:** An allele, which will be expressed in the characteristics of an individual only if there are 2 identical copies or, for a male, if one copy is present on the X chromosome; otherwise, its action will be overshadowed by the presence of a dominant allele.

**Saviour siblings:** Popular press term for embryos selected to be born to help save a sibling suffering from a particular disorder by being a suitable donor for the affected sibling.

**Sperm:** A sex cell (or gamete) produced by the male of an animal species which, when united with an egg (of the same species), results in conception and the development of an embryo.

**Vasectomy:** Male sterilisation. A minor surgical procedure to seal the tubes (called vas deferens) that carry sperm. This stops sperm getting into the ejaculated fluid.

‘X’ Linkage: A term used to describe genes that are found on the ‘X’ chromosome. These genes will be shown in the physical characteristics of males even if they are recessive. Since males only have one ‘X’ chromosome there would be no dominant allele to overshadow their action.
**Scientific**

- Infertility is the inability to get pregnant (conceive).
- One in seven couples in the UK has trouble conceiving.
- IVF is successful in only 22% of cases – the chance of conceiving increases with two or more cycles.
- A cycle of IVF involves:
  1. removing some of the woman’s egg cells
  2. fertilising them in a hospital laboratory with sperm to create embryos
  3. implanting the embryos in the woman to carry the pregnancy

**Legal**

- Clinics must decide if couples will be suitable parents before providing treatment.
- Choosing the sex of a baby using IVF is currently illegal.
- Since 2005, eggs and sperm cannot be donated anonymously.
- If one partner removes their consent to use their eggs/sperm, the embryos must be destroyed.

**Political**

- From April 2005, the UK Government advised that all eligible couples should receive one cycle of treatment on the NHS.
- Waiting times for treatment vary across the UK.
- In England and Wales, the suggested age limit for women receiving IVF is 40 years old.

**Economic**

- In 2005, the cost of one cycle of IVF was £2771.
- Drugs to support the treatment cost an extra £1000.
- In 2005, only 25% of IVF treatment was funded by the NHS.

**Social**

- Some pro-life supporters disagree with destroying embryos that are not used in treatment.
- Some religious leaders believe we shouldn’t interfere with natural reproduction.
- Many women are waiting until they are older to have children, when their fertility is lower, and it is more difficult to conceive.
- ‘Designer babies’ is a term used by the media. It describes an embryo chosen for specific characteristics or genetic traits.
Huntingdon’s Disease (Dominant)  

Huntingdon is a degenerative condition that affects the central nervous system. It causes increasing coordination and memory problems, mood changes and eventual death. Symptoms usually start around 30–50 years old, but this is variable. Death occurs on average about 17 years after the onset of symptoms but again this is variable. At present there is no known cure for Huntingdon’s disease.

Cystic Fibrosis (Recessive)  

Sufferers of Cystic Fibrosis have a reduced ability to regulate the passage of water and salt across their cell membranes. This causes thick salty mucus to build up in the pancreas, lungs and bowel. Problems include lung damage, infections, bowel blockage and digestion. Life expectancy depends on the symptoms, but on average, 25–30 years. There are a variety of treatments available, from physiotherapy to clear lungs to taking pancreatic enzymes to aid digestion. There is no known cure at present although gene therapy could be a possibility in the future.

Sanfilippo Syndrome (Recessive)  

Sufferers of Sanfilippo Syndrome have a decreased ability to clear waste products from their cells resulting in progressive cell damage as the waste builds up. Babies start with few or no symptoms but between 5 and 10 years, progressive mental deterioration occurs and children become hyperactive and disruptive. Eventually movement and speech are lost and death occurs in the mid teens. There is no treatment for this condition at present although gene therapy could be a possibility in the future.

Thalassaemia (Recessive)  

Thalassaemia is a disorder of the blood. Sufferers’ blood has a reduced ability to carry oxygen. In the worst cases untreated Thalassaemia can lead to death shortly after birth. However, with medication and regular blood transfusions, sufferers of Thalassaemia may be able to live a fairly normal life and their life expectancy shouldn’t be unduly affected. A successful bone marrow transplant can cure this condition and gene therapy could be a possibility in the future.

Achondroplasia (Dominant)  

Achondroplasia is Short-Limbed Dwarfism. The gene involved determines bone growth and so individuals with Achondroplasia have smaller bones and have an average adult height of four feet. They have normal IQ and lifespan though they may suffer some minor health problems such as backache or respiratory problems. Individuals who have identical alleles for this trait will be stillborn.

Duchenne Muscular Dystrophy (Recessive)  

An ‘X’ linkage disorder, where females can be carriers but males with the faulty gene always display symptoms. Symptoms usually develop when boys are between 1 and 3 years old. They may have difficulty walking and jumping. Sometimes they may have learning difficulties. By the age of 12, most boys with the disease have to use a wheelchair. The disease also affects heart and diaphragm muscles and average life expectancy of a boy with DMD is about 20 years. At present there is no cure for DMD, but medication can help alleviate the symptoms and gene therapy may be a possibility in the future.
WHO SHOULD RECEIVE IVF TREATMENT?
Our Decisions

Your role: You are members of an advisory group.

Issue: Resources are limited. You must prioritise who should receive IVF treatment on the NHS. You must consider the welfare of the child above all else.

What to do: Read through the family situation cards. You must choose THREE families who will receive treatment. You must reject three and give your reasons why. You might like to list the cases in order of priority.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Family Letter</th>
<th>Explain why you made this decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WHO SHOULD RECEIVE IVF TREATMENT?
Our Criteria

Your role: You are members of an advisory group.

Issue: You have chosen who should receive IVF treatment on the NHS.

What to do: Look at the decisions you have made and give the reasons behind each.

What criteria did you use when making your decision? Write your criteria below:

Our criteria:

1.

2.

3.

4.

5.
These families would all like IVF treatment on the NHS

Family A
- Mr and Mrs A are in their mid thirties and are unemployed.
- They come from large families and desperately want children of their own.
- They received one cycle of IVF on the NHS and spent their life savings on a second cycle. Both were unsuccessful.
- They cannot afford to pay for this treatment privately again.

Family B
- Miss B is single and in her late forties.
- She is a successful businesswoman.
- She always intended to have children, but never met the right man.
- She has tried insemination with donor sperm but did not conceive.
- Miss B would like to try IVF treatment again with donated sperm.

Family C
- Mr and Mrs C have been married for two years.
- Mr C is in his mid forties. Mrs C is thirty.
- He has one son from a previous marriage who lives with them.
- They have been trying for a child for three years, but with no success.

Family D
- Mr and Mrs D are in their early twenties and have been married for five years.
- Mr D previously decided he did not want any children, so he had a vasectomy which prevents him having children.
- They now both want children.
- Mr D has tried, unsuccessfully, to have the vasectomy reversed.
- They would now like to have IVF treatment using donor sperm.

Family E
- Mrs E is a 35 year old widow.
- Mr E died of cancer, but froze a sample of his sperm before he died.
- Mrs E has a good job that pays well.
- She is a smoker.
- Mrs E would like to have IVF with her husband’s frozen sperm to have the baby she has always wanted.

Family F
- Mrs F and Mrs F are a gay couple and have been together for ten years.
- They are in their mid thirties.
- Mrs F’s male friend has offered to donate sperm so the couple can have a child.
- They would like to use IVF treatment to fertilise their eggs before implantation of embryos into one of them.
FAMILY SCENARIOS - IVF AND GENETIC SCREENING

These families would all like IVF treatment and genetic screening on the NHS

- Cut out the boxes

Family A
- Mr and Mrs A have a son who suffers from a blood disorder called Thalassaemia.
- Their son must receive blood transfusions every 4 to 6 weeks for life.
- One cure would be to have a bone marrow transplant from a sibling donor.
- Using IVF they could select a child who would then be a suitable donor.

Family B
- Miss B and Mr B have lived together for ten years, but never married.
- They both carry the gene for a genetic condition known as Sanfilippo syndrome.
- There is no cure for this disorder.
- Using IVF they could select a healthy embryo and have the child they both want.

Family C
- Mr and Mrs C have wanted a family for three years. They have no children.
- Mr C has just been diagnosed with the genetic disease Huntingdon’s.
- They desperately want a child.
- Using IVF they could select a healthy embryo so the gene for the disease is not passed onto their child.

Family D
- Mr and Mrs D both have achondroplasia.
- Achondroplasia is short-limb dwarfism.
- The average adult height is about four foot.
- Mr and Mrs D would like to use IVF techniques to select an embryo with achondroplasia so they could have a child like themselves.

Family E
- Mrs E and Mr E have been married 2 years
- They already have a child who suffers from Cystic Fibrosis.
- They have spent a lot of money on a variety of treatments for their child.
- They want to ensure their next child does not have the disorder.

Family F
- Mr and Mrs F have an adopted son.
- Mrs F carries the gene for Duchenne Muscular Dystrophy.
- The traits of the disorder are only shown in males.
- Mr F and Mrs F want to use IVF to select a female embryo who will not have the disorder, but could be a carrier.
The Citizen Science Project at Bristol is designed to be instrumental in engaging young people in debate and discussion about contemporary bio-medical issues. Working with partner schools and external professionals, the project has delivered over 70 special events for young people to trial new debating formats and resources. Citizen Science aims to build on young people’s knowledge and understanding of contemporary science issues and aid in developing key skills including communication, team-work and problem solving.

at Bristol

at Bristol is one of the UK’s most successful science and discovery centres. By motivating interest and feeding curiosity about science, technology, natural history and the environment, at Bristol has firmly established itself as a leading provider of first-class informal education.

Over 500,000 pupils from across the country have enjoyed stimulating and unique visits to its three attractions - Explore at Bristol, Wildwalk at Bristol and the IMAX Theatre at Bristol - since opening in 2000.

For more information about at Bristol’s programme of schools workshops, events and teacher resources visit www.at-brisol.org.uk or call 0117 915 5000.

Citizen Science is kindly supported by the Wellcome Trust.

Let us know what you think

Was this resource useful to you? Would you like to see more? Proposed future topics include Drugs/Alcohol, Nanotechnology, and Rainforest Medicines; let us know if you would like to receive these.

To feed back, and for further information on Citizen Science’s free online resources and upcoming Discover Debate Decide: Exploring Ethical Issues lesson resources, please visit www.at-brisol.org.uk/cz, email citizenscience@at-brisol.org.uk or call at Bristol on 0117 915 7134.

at Bristol’s Citizen Science project is supported by the Wellcome Trust www.at-brisol.org.uk/cz