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LIFE SCIENCES PRELIMINARY EXAMINATION PAPER 2 GRADE 12

Examiner(s) & Moderator(s): ASSA

Date: 06 / 09 / 2024

Time: 2 h

Total: 100

QUESTION PAPER AND ANSWER BOOK

Student's name and surname:

Student number:

S

Total number of pages
to be submitted:

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- Use the following settings when you scan your Answer Book:
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		Marker	Internal Moderator	External Moderator
		Mark 1	Mark 2	Mark 3
1	30			
2	30			
3	40			
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- This assessment must be downloaded, completed, scanned and uploaded to brainONLINE while being invigilated. **Failure to do so will be regarded as an irregularity and a mark of zero will be awarded for the assessment.**
- This Question Paper consists of **three** questions. It must be accompanied by the following document:
 - Source Booklet
- Use the total marks that can be awarded for each question as an indication of the detail required.
- It is in your own interest to write legibly and to present your work neatly.
- Answers written on paper other than the Answer Book, as well as typed answers, will not be marked.
- If you need more pages, additional copies of the last lined page in the Answer Book may be made.
- Follow the instructions on the Answer Book carefully.
- A non-programmable calculator may be used unless otherwise indicated.
- Show all calculations and steps. Marks will not necessarily be awarded for answers only.
- Units need not be shown in the calculation steps but must be shown in the answers.

QUESTION 1

The following questions refer to **Question 1, Sources 1 – 4** in the Source Booklet. Use the information in the sources as well as your own knowledge to answer the following questions.

- 1.1 Using the information provided, state whether the following statements are TRUE or FALSE.
- 1.1.1 Future male pregnancies can be achieved via uterus transplants. _____ (1)
- 1.1.2 Abdominal pregnancies require the typical caesarean that is used in uterine pregnancies. _____ (1)
- 1.1.3 Artificial wombs are developed mainly for foetuses (babies born prematurely). _____ (1)
- 1.2 Use information from the sources to give THREE reasons why a naturally born female is a more biologically compatible recipient for a donated uterus than someone who is born male or is transgender. (3)
1. _____
2. _____
3. _____
- 1.3 The following questions refer to the graph on page 2 of the Source Booklet.
- 1.3.1 Name ONE hormone, NOT shown in the graph that initiates (starts) labour. (1)
- _____
- 1.3.2 Using your knowledge of the negative feedback mechanism, explain in detail how high levels of progesterone ensure that a pregnant woman cannot conceive and get pregnant again if she is already pregnant. (5)
- _____
- _____
- _____
- _____
- _____
- _____

- 1.3.3 What do you think happens to the level of prolactin after childbirth? Explain your answer using your knowledge on the function of prolactin. (3)
- _____
- _____
- _____
- 1.3.4 Identify the independent variable in the graph. (2)
- _____
- 1.4 The sources state that an embryo can implant itself into almost any living tissue that it happens to land on.
- 1.4.1 Name the tissue in the uterus where implantation takes place in a normal pregnancy. (1)
- _____
- 1.4.2 Give THREE reasons why implantation into abdominal tissue is a problem during childbirth by caesarean. (3)
1. _____
2. _____
3. _____
- 1.4.3 Which temporary organ will be absent in an artificial womb that is present in a pregnant female? (1)
- _____
- 1.5
- 1.5.1 Using the two drawings on page 3 of the Source Booklet, tabulate TWO visible differences between an abdominal pregnancy and normal uterine pregnancy. (4)
- Note:** You cannot use the upward/downward position of the foetus as a difference.

- 1.5.2 After careful consideration of the pros and cons of a man becoming pregnant, would you recommend this procedure? Justify your answer using evidence from the sources (4)

TOTAL QUESTION 1: [30]

QUESTION 2

The following questions refer to **Question 2, Sources 1 – 3** in the Source Booklet. Use the information in the sources as well as your own knowledge to answer the following questions.

- 2.1 Can strawberry poison-dart frogs be described as oviparous, ovoviviparous, or viviparous? (1)
- _____
- 2.2 Many plants below the canopy in the rainforest reproduce asexually. List THREE benefits of asexual reproduction in plants. (3)
1. _____
2. _____
3. _____
- 2.3 Bromeliads provide an important habitat for the strawberry poison-dart frogs. Quote a term from the source material relating to each statement below:
- 2.3.1 Structure necessary to produce male gametes in Bromeliads. (1)
- _____
- 2.3.2 Result of asexual reproduction in Bromeliads. (1)
- _____
- 2.3.3 The site of pollination in Bromeliads. (1)
- _____
- 2.3.4 The site of fertilization in Bromeliads. (1)
- _____

- 2.4 State ONE advantage and ONE disadvantage of parental care shown by the strawberry poison-dart frog. (2)

Advantage _____

Disadvantage _____

- 2.5 Provide suitable descriptions for **numbers 1, 2 and 3** from the colour diagram on the top of page 5 in the Source Booklet, showing the life cycle of the strawberry poison-dart frog. (5)

1. _____

2. _____

3. _____

- 2.6 Reproductive strategies often vary between different species.

- 2.6.1 Compare the reproductive strategy of the poison-dart frog with the common frog as visible in the photographs in the Source Booklet. (2)

- 2.6.2 With the goal of reproduction in mind, which frog has the better strategy? Justify your choice. (2)

- 2.7 Draw a simple line graph showing the expected survival numbers for the common frog over time. You must include the axis headings. (3)

- 2.8 What structure in flowering plants is equivalent to the fertilized frog eggs? (1)

- 2.9 Draw up a comparative table of TWO differences in embryonic/foetal development between the strawberry poison-dart frog and humans in the space below. Provide your table with a suitable heading. (7)

TOTAL QUESTION 2: [30]

QUESTION 3

This essay refers to the Sources on pages 7 – 11 in the Source Booklet.

Testosterone, growth hormone, and thyroxin are hormones that are manufactured by pharmaceutical companies. While the natural production of each hormone is vital to a fully functional endocrine system, excess can be used for other purposes. Depression, anxiety, weight related issues and reaching goals in fitness and sport are common problems plaguing teenagers. The use and abuse of these hormones by teenagers for purposes other than those that are medically prescribed is a controversial topic.

Consider the following statement:

Hormone therapies should be offered by doctors as a form of treatment for common teenage problems.

Using the source material provided as well as your own knowledge, discuss your opinion on the above statement in the form of a **2½–3-page essay**.

To answer this question, you are expected to:

- Read the source material carefully and present a debated argument to present your point of view.
- Select relevant information from Sources A to H in the Source Booklet. Do not attempt to use all the detail provided.
- Integrate your own relevant biological knowledge. However, do not write an essay based solely on your own knowledge.
- Take a definite stand on the question and arrange the information to best develop your argument.
- Write in a way that is scientifically appropriate and communicates your point of view clearly.
- **Provide a clear plan of your essay** before you start writing. Note that the plan will be marked as part of the assessment of this question. Do not cross out your plan.

TOTAL QUESTION 3: [40]

TOTAL QUESTION PAPER: [100]

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SOURCE BOOKLET

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QUESTION 1

1. Male pregnancy may be closer than you think.

If you could have one science fiction idea come to realisation in the next 5 to 10 years, would male pregnancy be on the list? The 1994 film “Junior” starring Arnold Schwarzenegger certainly imagined the possibility.

In Junior, Schwarzenegger played a character called Dr Alex Hesse. Dr Hesse is a scientist who made himself the subject of a medical experiment aimed at achieving pregnancy by way of hormone therapy. As a man he lacked a uterus, so the embryo was implanted into the abdomen (a cavity inside in the body that contains your organs).

In real-life, however, this is not how it would be done. Instead, the man would be given a uterus of his own, or her own - the first uterine transplants to enable ‘male’ pregnancy will most likely be performed on transgender people.

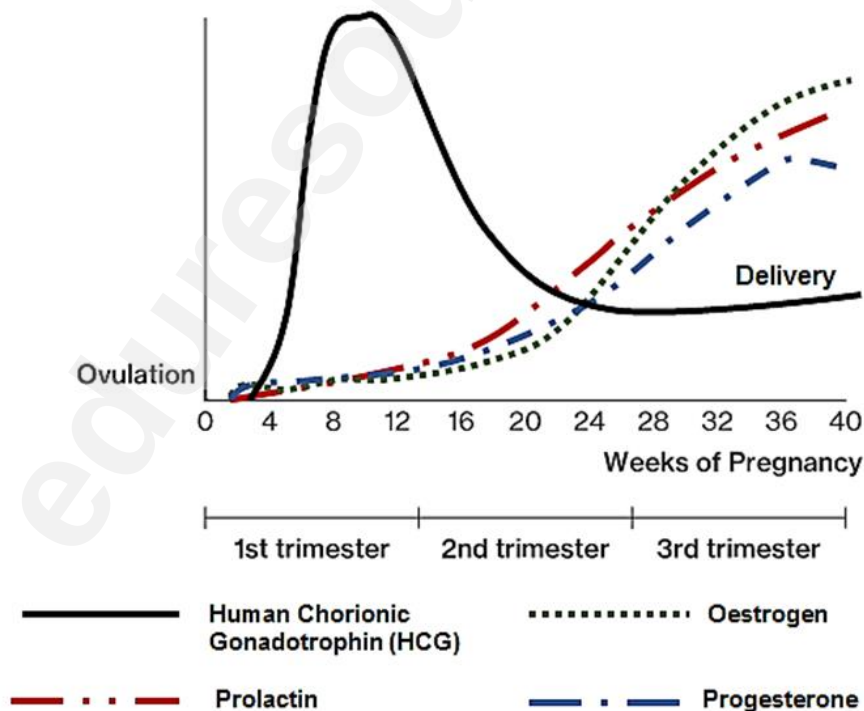
The logical progression before one transplants a uterus into a man is to transplant one into a woman. The Cleveland Clinic has successfully transplanted a uterus in women who were either born without a uterus, or their uterus had been removed (hysterectomy), due to a disease or malformation. Uterine transplants are challenging, because on top of the surgery, organ transplants require medical therapy to prevent a patient’s immune system from rejecting the organ.

A female recipient who has a hysterectomy still has the uterine artery and veins that can be connected to the donated uterus to give it a blood supply. The uterus needs to be supported with pelvic ligaments and needs to be attached to the vagina. These structures are not present in men and transgender women.

Adapted from: <https://geneticliteracyproject.org/2018/01/05/male-pregnancy-may-closer-think/>.

The Genetic literacy project is a project by scientists to aid the public, media, and policymakers in understanding the science and implications of human and agricultural genetics and biotech.

2. Graph showing hormones secreted during pregnancy.



Adapted from: <https://www.coursehero.com/sg/anatomy-and-physiology/pregnancy>.

Course Hero is an American education technology website company based in Redwood City, California which operates an online learning platform for students to access course-specific study resources and online tutors.

3. Can a man really get pregnant? Sure, but it might kill him.

For every one pregnancy out of 10 000, the fertilized egg does not make it to the uterus and ends up in the abdomen. This results in an abdominal pregnancy.

Since the abdomen is filled with all sorts of tissues, at the right time of development, an embryo can implant itself into almost any living tissue that it happens to land on. With successful implantation and sufficient placental formation, the embryo can develop normally into a foetus that can be carried through a full nine months of pregnancy in the abdomen. At the end, of course, it has nowhere to go unless it is delivered by a modified Caesarean Section.

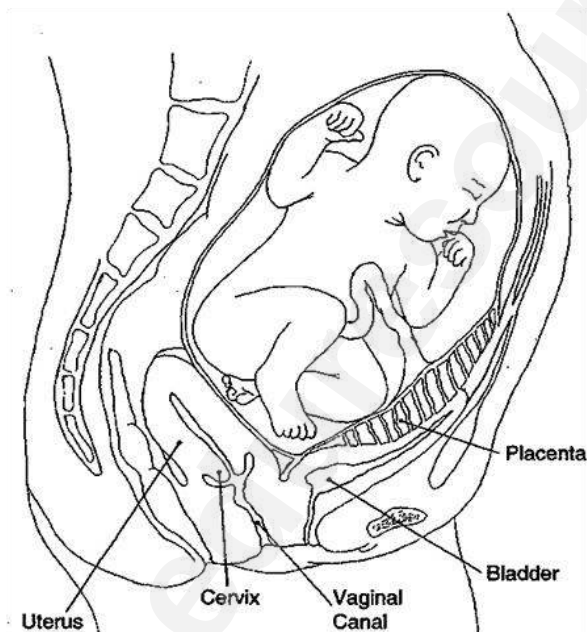
If a woman's abdomen can act as womb, a man's abdomen could do just as well. However, medical experts agree that an abdominal pregnancy is rare, and it is also a life-threatening condition. There is a high incidence of illness and mortality for both the foetus and the mother.

The problem with the embryo implanting into abdominal tissue is that the development of the placenta can cause complete intermixing between embryonic tissue and host tissue so that there is no clean boundary between the two. The physician must cut between the placental tissue, and the intermingled 'placental-maternal' tissue. Large blood vessels must be severed, and consequently, internal bleeding that is difficult to control can occur.

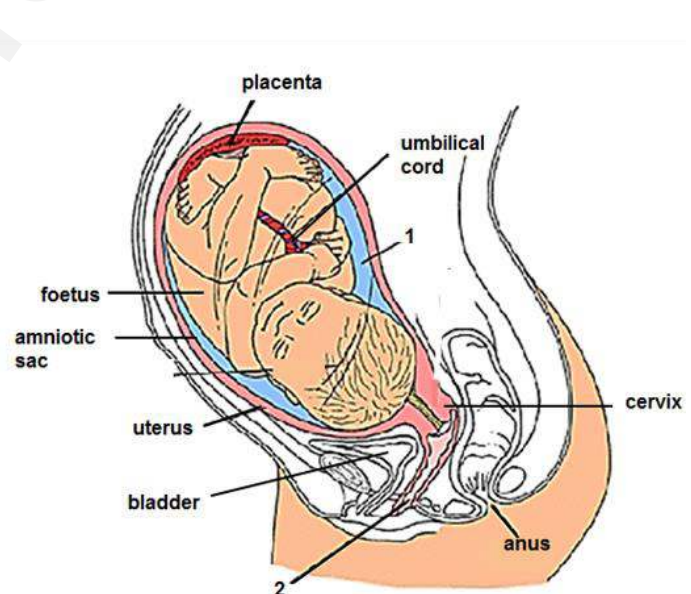
Adapted from: https://www.science20.com/challenging_nature/a_real_pregnant_man_almost_certainly_possible_but_it_might_kill_him.

Challenging Nature is the title of a column on Scientific Blogging.

Abdominal pregnancy



Normal pregnancy



Adapted from: <http://www.womans.org/our-services/mother-and-baby/pregnancy-and-childbirth/3rd-trimester/fetus-in-utero><https://obgynkey.com/abdominal-pregnancy/>.

4. How an artificial womb can work.

Artificial wombs are expected to be ready for human trials within the next five years. The ground-breaking aspect of artificial wombs is that rather than acting as a form of emergency life support for a newborn, they treat the newborn as a foetus that has not yet been born. Artificial wombs will be able to be used with premature foetuses that are between 23-24 weeks gestation (pregnancy) onward.



Source: <https://www.tue.nl/en/storage/biomedische-technologie/de-faculteit/news-and-events/news-overview/07-04-2022-without-gasping-for-air-safely-in-the-artificial-womb>.
TUE is among the leading universities in science and technology.

QUESTION 2

1. Strawberry poison-dart frog (*Oophaga pumilio*).

Another super parent pair of the animal world is the diminutive strawberry poison dart frog.

After females lay their eggs on the rainforest floor, the finger-nail-sized male frogs keep guard against predators and urinate on tadpoles daily to keep them moist.

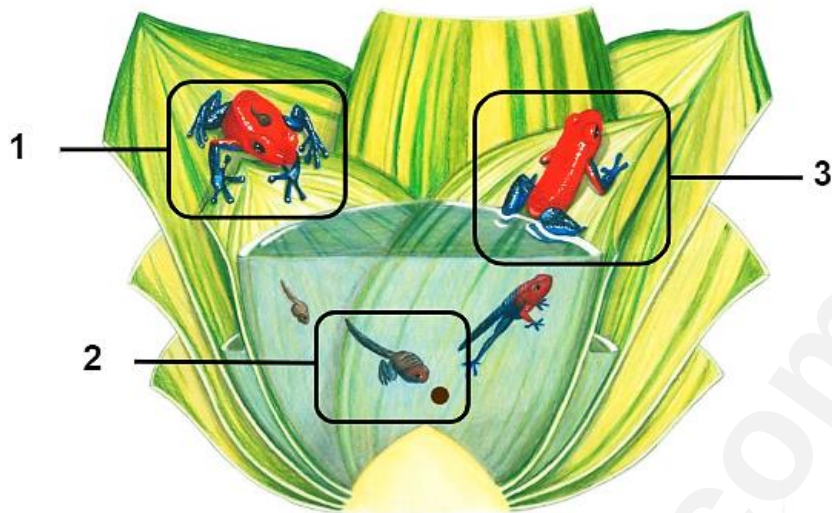
But the action really starts when the clutch hatches into tiny tadpoles. If they are left together the tadpoles will eat each other. So, to keep them all safe, the female frogs transport every tadpole, individually, on her back up into trees to find a safe pool of water in a bromeliad plant, in which to deposit them separately.

She then visits each individual nursery pool every day for about 50 days to lay an unfertilised egg in the pools to keep her offspring fed. Meanwhile, the male frogs continuously guard the territory to stop predators from finding the tadpoles.

Adapted from: <http://www.bbc.com/earth/story/20150723-10-astonishing-animal-parents>.

The BBC Studios Earth Stories is a department of BBC Studios that produces television, radio and online content with a natural history or wildlife theme.

2. The life cycle of the strawberry poison-dart frog.



Source: <https://za.pinterest.com/pin/562527809681346983/>.

A photograph of a strawberry poison-dart frog with fertilized eggs.



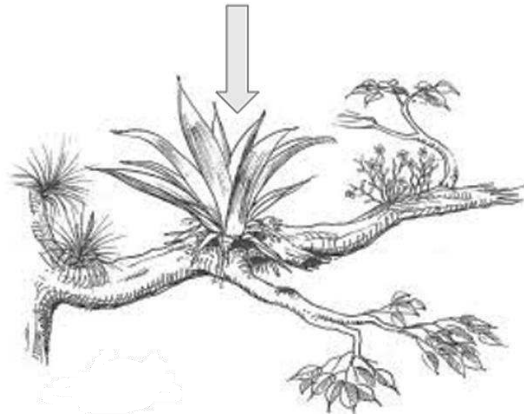
Source: <https://peteoxford.photoshelter.com/image/I0000umCIHsXdeIY>.

A photograph of the common frog (*Rana temporaria*) with fertilized eggs.



Source: <https://www.amphibianlife.com/why-do-frogs-release-such-a-large-number-of-eggs/>.

3. Bromeliad growing on a tree branch in the rainforest.



All of the almost 3,000 members of the tropical plant family Bromeliad belong to the family called Bromeliaceae. They are almost exclusively grown in the tropics and subtropics of Central and South America, where growing conditions are ideal.

Many mature Bromeliads only bloom once but there are occasional exceptions. Typically, when the plant no longer makes leaves, it flowers for a few months (some up to six years) and then dies. Bromeliads do not have just one main flower, but a cluster of flowers that are bright and tall and form a rosette shape. Each individual flower contains several parts including three sepals, three petals, six stamens and a carpel consisting of a stigma, style, ovary, and ovules.

While the plant is maturing, new leaves will continue to grow from the centre of the plant. Because of the shape of the leaves, most Bromeliads can hold a lot of rainfall. Because of the constant moisture, a food chain is created with the growth of algae, making them a small self-contained ecosystem. Tree frogs, worms, snails, and other tiny insects will often make a Bromeliad their home for their entire life.

Before the plant dies, pups, or new offshoots, are produced which feed off the original plant until they are large enough to produce their own roots. They will one day become mature and flower as well.

Adapted from: <https://tropical-rainforest-facts.com/Tropical-Rainforest-Plant-Facts/Bromeliad-Facts.shtml>.
Tropical-rainforest-facts.com is a scientific research site that publish research on tropical rainforests, and it is peer reviewed.



Source: <https://www.sciencephoto.com/media/990066/view/bromeliads-and-epiphytes-in-tropical-mountain-forest>.

QUESTION 3**SOURCE A****Definition of drug abuse**

Drug abuse is the excessive, maladaptive, or addictive use of drugs for nonmedical purposes despite social, psychological, and physical problems that may arise from such use.

Abused substances include such agents as anabolic steroids, which are used by some athletes to accelerate muscular development and increase strength, and which can cause heart disease, liver damage, and other physical problems; they also include psychotropic agents, substances that affect the user's mental state and are used to produce changes in mood, feeling, and perception.

The latter category, which has a much longer history of abuse, includes opium (and such derivatives as heroin), hallucinogens, barbiturates, cocaine, amphetamines, tranquilizers, the several forms of cannabis, and alcohol.

Adapted from: <https://www.britannica.com/science/drug-abuse>,

SOURCE B**Common reasons why teenagers abuse drugs**

- To fit in. Social status is very important to teens. Your teen may do drugs to fit in with friends or impress a new group of kids.
- To be social. Some teens use drugs because it lowers their inhibitions and makes them more comfortable socially.
- To deal with life changes. Change is not easy for anyone.
- To ease stress, pain, and anxiety.

Adapted from: <https://www.britannica.com/science/drug-abuse>.

Britannica.com is the online version of the Encyclopaedia Britannica. The website contains fact-checked articles, biographies, videos, and images from experts and is peer reviewed.



Source: <https://www.transformationsnetwork.com/post/anxiety-and-stress-management-for-teenagers-a-detailed-guide>.

SOURCE C**The abuse of anabolic steroids**

The anabolic actions of human growth hormone (HGH) have been used effectively since 1985. Because of the action of this hormone, it would certainly promote athletic ability. For this reason, HGH has been used by teenagers, especially for those engaged in high levels of competitive sports.

The classic forms of “abuse” of HGH are bodybuilders who use it to gain an unfair advantage over their competitors. While the use of HGH is banned in sport, its use is promoted by the fact that as yet, no practical method exists to detect its use in competition.

Adapted from: www.ncbi.nlm.nih.gov/pmc/articles.

PubMed Central @ (PMC) is a free full-text archive of biomedical and life sciences journal literature at the U.S. National Institutes of Health's National Library of Medicine which is peer reviewed.

SOURCE D**Study to show the use of teenagers using HGH**

A study done by the Partnership for Drug-Free Kids in Florida, found that a growing number of U.S. teens are using synthetic growth hormone to boost muscles and athletic ability. The researchers surveyed more than 3,700 high school students over a 6-year period.

Year	Teenagers admit to using HGH (%)
2012	5
2014	11
2016	18

Steve Pasierb, president of the Partnership for Drug-Free Kids in Florida reported the following:

- Teens use synthetic HGH -- and supplements that contain HGH -- hoping to improve athletic performance or body appearance without really knowing the potential risks. Reported side effects, although reversible, include fluid retention, joint and muscle pain, and high blood pressure.
- Teenagers of both genders are increasingly using HGH to maximize muscle mass and minimize body-fat composition. I strongly suspect that the rising 'selfie culture' among young people -- who increasingly rely on social media to project their body image -- is influencing these disturbing new statistics.

Adapted from: <https://www.webmd.com/news/default.htm>.

Daily health news is from WebMD's team of award-winning journalists. WebMD is the destination for trustworthy and timely medical and health news and information.

SOURCE E**Testosterone**

Testosterone is essential to fertility, in terms of sex drive and sperm count. Testosterone levels in the blood peaks during adolescence and early adulthood. After that the testosterone levels gradually decline. It is important to determine if a low testosterone level is within the normal range or if it is due to hypogonadism.

Hypogonadism is a disease in which the body is unable to produce normal amounts of testosterone. While symptoms can suggest a low testosterone level, diagnosis of hypogonadism must be confirmed by a blood test.

Testosterone replacement therapy can improve the signs and symptoms of low testosterone in these men. A doctor may prescribe testosterone as injections, pellets, patches, or gels. The possibilities of testosterone therapy are enticing – increased muscle mass, sharpened memory/concentration, boosted sex drive as well as energy levels.

Abuse of testosterone can result in fluid retention leading to ankle and leg swelling, worsening of high blood pressure and heart failure, liver toxicity and problems with fertility.

If testosterone is given artificially, the testes will stop producing their own testosterone and this will shut down sperm production.

Adapted from: <http://www.mayoclinic.com>.

The Mayo Clinic is a nonprofit American academic medical centre focused on integrated clinical practice, education, and research in the USA.

SOURCE F**Low testosterone levels in men**

In recent years, researchers have focused on the effects of testosterone deficiency, especially among men. One interesting symptom in people with low testosterone levels, is that of irritability, osteoporosis, poor concentration and depression.



Testosterone plays a role in certain behaviours, including aggression and dominance. It also helps to spark competitiveness and boost self-esteem. Low testosterone may result in a loss of confidence and lack of motivation. It can also lower a man's ability to concentrate or cause feelings of sadness. Low testosterone can cause sleep disturbances and lack of energy.

Adapted from: www.healthline.com/health/low-testosterone/effects-on-body.

Healthline Media, Inc. is an American website and provider of health information headquartered in San Francisco, California.

SOURCE G**Side effects and expected time course for testosterone use**

Physical effect	Reversibility	Onset of physical effect (months)
Skin oiliness/Acne.	Reversible	1 to 6
Decrease in body fat.	Reversible	3 to 6
Increased muscle strength.	Reversible	6 to 12
Facial and body hair growth.	Irreversible	3 to 6
Scalp hair loss.	Irreversible	Variable
Stopping of menses.	Reversible	2 to 6
Deepening of voice.	Irreversible	3 to 6
Infertility.	Irreversible	Variable

Onset of physical effect is the time it takes for a drug's effects to start working from the time a person starts taking the drug/hormone.

Adapted from: <https://www.rainbowhealthontario.ca/>.

Rainbow Health Ontario creates opportunities for the healthcare system to better serve communities by posting scientific, peer reviewed information.

SOURCE H**Medication**

Prescription and over-the-counter medicines must go through rigorous testing to be proven safe before being sold, but supplement products appear on store shelves without regulation from the Food and Drug Administration and must be proven unsafe before being removed from sale. This creates a false perception of safety, driving impressionable teens to risk their health with potentially dangerous products, many containing hormones, that are untested.



Given the number of products being marketed and sold online, it is difficult to know what exactly is contained in these products teens are consuming. Young people who do not see these substances as risky are more likely to use them.

The concentrations of HGH and testosterone in readily available supplements is significantly lower than that which would be provided for a diagnosed medical condition.

Adapted from: <https://pubmed.ncbi.nlm.nih.gov/23900472/>

Image: <https://health.ucdavis.edu/blog/cultivating-health/the-truth-about-supplements-for-athletes-and-whether-you-should-be-using-them/2023/05>

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<http://www.womans.org/our-services/mother-and-baby/pregnancy-and-childbirth/3rd-trimester/fetus-in-uteroh>
<https://obgynkey.com/abdominal-pregnancy/>.
<https://www.tue.nl/en/storage/biomedische-technologie/de-faculteit/news-and-events/news-overview/07-04-2022-without-gasping-for-air-safely-in-the-artificial-womb>.

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<https://www.sciencephoto.com/media/990066/view/bromeliads-and-epiphytes-in-tropical-mountain-forest>

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<https://www.webmd.com/news/default.htm>.
<http://www.mayoclinic.com>.
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<https://www.rainbowhealthontario.ca/>.
<https://pubmed.ncbi.nlm.nih.gov/23900472/>.
<https://www.dansa.org/blog/2021/04/22/over-the-counter-medications>.