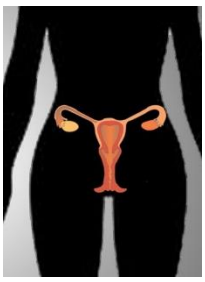
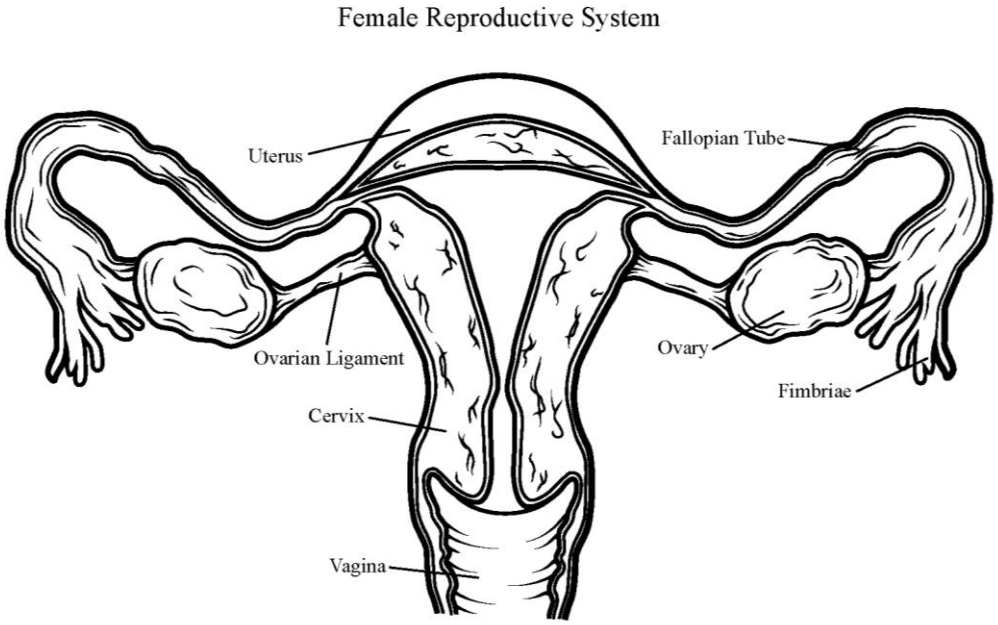
ROSWELL PARK COMPREHENSIVE CANCER CENTER | PATIENT EDUCATION

Preserving Fertility for the Future

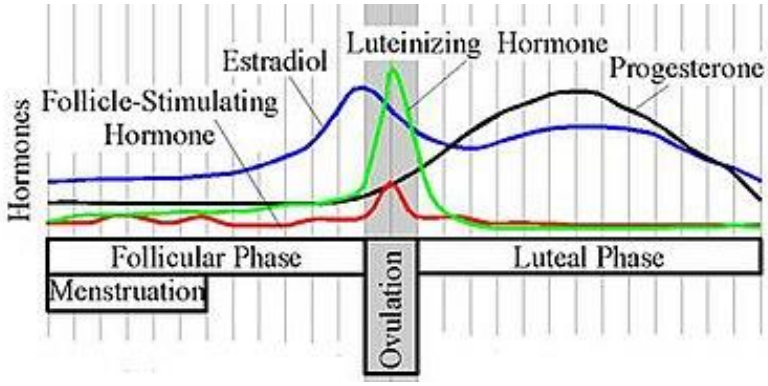
Basics of the Female Reproductive System



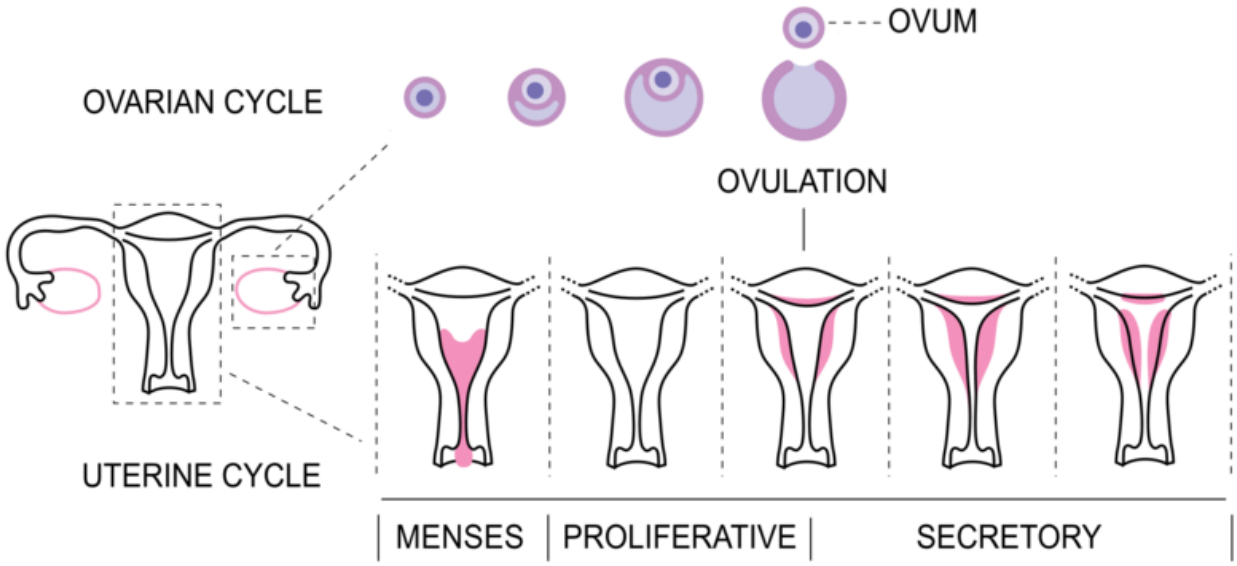


When you are born, your ovaries already contains 1- 7 million eggs (called oocytes). These egg cells are the largest cells in the body. They start to break down/die off immediately and by the time puberty starts, there are about 700,000 egg cells remaining. During puberty, Estrogen is one of two main sex hormones in women. the hormone estrogen spikes, which causes the breasts and public hair to grow. It also starts the monthly release of eggs from the ovary (ovulation) and the menstrual cycle.

A menstrual cycle begins with the first day of your period, or menstruation (MEN-stroo-AY-shuhn) and starts over again when the next period begins. A typical cycle lasts between 24 and 38 days. (as you age, the length of your cycle may change.) Throughout this monthly cycle, your body makes different amounts of hormones and the lining of the uterus (endometrium) builds up to prepare for pregnancy.



Hormone fluctuation during the menstrual cycle. (Estradiol is a form of estrogen.)



About 2-3 weeks into your cycle, in response to hormonal changes, an egg is released by your ovary. The egg is swept up into the fallopian and it travels towards the uterus. An egg lives only 12-24 hours after being released from the ovary. Sperm can live in the woman's reproductive system for 3 to 5 days. If fertilized by sperm, it becomes a zygote and implants in the endometrium of the uterus. A pregnancy has begun. (Note: if a zygote implants in the fallopian tube, it's called an ectopic pregnancy. It must be removed or it will burst the fallopian tube. Currently, there is no way to say an ectopic pregnancy.)

If you do not get pregnant, estrogen and progesterone hormone levels begin falling. When they fall low enough, your body discards the monthly buildup of the lining of your uterus, which is your period. The menstrual blood and tissue flows from your uterus through the cervix and passes out of your body through your vagina.

The changing hormone levels and shedding of the endometrium can cause menstrual symptoms such as premenstrual syndrome (PMD), digestive problems, and mood changes. Try to avoid foods high in fat, sugar, and/or salt as these can increase water retention (bloating) and weight gain. Focus on healthy eating throughout your cycle: lean meats, complex carbohydrates, whole grains, and fresh fruits and vegetables. Regular exercise/activity can also help with symptoms.

How cancer treatments may affect your fertility

Cancer treatments can affect fertility. Your doctor may talk with you about whether or not cancer treatment may lower your fertility or cause infertility. If your doctor doesn't discuss fertility with you before treatment begins, you may need to start the conversation.

It is important to learn how your cancer treatment(s) may affect your fertility before you start treatment, if possible.

Whether your fertility will be affected by cancer treatment may depend on multiple factors such as:

- ✓ your age
- ✓ your current and past medical history
- ✓ your current fertility (before treatment)
- ✓ the type of cancer you have and the treatment(s) you will receive
- ✓ the amount (dose) of your treatment and how long you are in treatment
- ✓ if you've completed treatment, the amount of time since your cancer treatment

Cancer treatments are important for your future health, but they may harm reproductive organs and glands that control fertility. Changes to your fertility may be temporary or permanent. Talk with your health care team to learn what to expect, based on your treatment.

Treatment	Effect in Females
Chemotherapy: especially alkylating agents such as cisplatin (Platinol®), cyclophosphamide (Cytoxan®), and dacarbazine (DTIC-Dome®)	Can cause ovaries to stop releasing eggs and estrogen (called primary ovarian insufficiency or POI.) POI may be temporary or permanent. Chemo can also lower the number of healthy eggs in the ovaries. Women nearer to natural menopause may have a greater risk of infertility.
Hormone therapy (endocrine therapy) such as goserelin (Zoladex®), leuprolide (Lupron®), progesterone, letrozole (Femara®), anastrozole (Arimidex®), exemestane (Aromasin®), tamoxifen (Nolvadex®), fulvestrant (Faslodex®)	Can disrupt the menstrual cycle. Side effects may include hot flashes, night sweats, and vaginal dryness.
Radiation therapy to or near the abdomen, pelvis, reproductive organs, or spine. Radiation dose and body part radiated can play a role in whether fertility is affected.	Some organs, such as the ovaries, may be protected by shielding or by oophoropexy (surgically moving the ovaries away from the area being radiated). Radiation to the brain can damage the pituitary gland and decrease production of hormones such as estrogen that are needed for ovulation.
Surgery	Surgery for cancers of the reproductive system and for cancers in the pelvis region can damage organs or nearby nerves and lymph nodes, and /or cause scarring, which can affect fertility. The size and location of the tumor are important factors in whether or not fertility is affected
Bone marrow transplants, stem cell transplants	Involves receiving high doses of chemotherapy and/or radiation. These treatments can damage the ovaries.
Other treatments	Talk with your doctor to learn whether or not other types of treatment such as immunotherapy and targeted cancer therapy may affect your fertility.

Questions for your doctor

- Could treatment cause or increase my risk of infertility?
- Could treatment make it difficult to become pregnant or carry a pregnancy in the future?
- Are there other recommended treatments that might not cause fertility problems?
- Which fertility option(s) would you advise for me?
- What fertility preservation options are available here? At a fertility clinic?
- Is birth control recommended? Is condom use advised?
- After treatment, what are the chances my fertility will return? How long might it take?

Coping and Support

For some people, infertility can be one of the most difficult aspects of their cancer treatment, but it may not affect you right away. The diagnosis and fear about treatments and the outcome may be more concerning. If you may want children at some point in the future, **it is important to discuss it with your doctor before you start treatment because you may need to act before treatment begins.** Talking about it and learning about your options may help you feel better. If you want support or want to talk to others facing the same challenges, Roswell Park has multiple options:

- professionally-led support groups such as the Young Adult Workshops, for those aged 18 to 39 who have cancer. For more information call 716-845-1664 or email Ashley.King@RoswellPark.org.
- online community https://community.roswellpark.org
- cancer coach program: https://www.roswellpark.org/cancer-care/support/resource-center/cancer-coach
- survivorship program: https://www.roswellpark.org/survivorship
- AYA fertility preservation program (collaborative with Buffalo IVF Associates): https://www.roswellpark.org/young-adult-cancer/fertility-preservation

What are the options to preserve fertility for females?

If you decide to try and preserve your fertility, there are options available. Talk with your doctor about the best option(s) for you. When possible, your doctor will work with a fertility specialist to develop a treatment plan for you that includes preserving your fertility. Discuss success rates, cost, and availability of the procedures listed below. The details can vary widely.

- Egg freezing (egg or oocyte cryopreservation): Eggs are removed from the ovary and frozen. In the future, the eggs can be thawed and fertilized with sperm (in a lab). The fertilized egg (embryo) is placed in a woman's uterus. This is a newer procedure than embryo freezing.
- Embryo freezing (embryo banking or embryo cryopreservation): Eggs are removed from the ovary, fertilized with sperm (in the lab), and then the embryo is frozen for use in the future.
- Ovarian shielding (gonadal shielding) is a procedure in which a protective shield (cover) is placed on the outside of your body covering the ovaries fallopian tubes, uterus, cervix, and vagina to protect them from radiation.

- Ovarian transposition (oophoropexy) is a surgical procedure that moves the ovaries away from the part of the body receiving radiation. It may be done during surgery you're having to remove a cancer or through laparoscopic surgery (surgery without any large incision(s); instruments are inserted through ½-1 inch incisions).
- Radical trachelectomy (radical cervicectomy) is surgery used to treat women with early-stage cervical cancer who would like to have children. The operation removes the cervix, nearby lymph nodes, and the upper part of the vagina. The uterus is then attached to the remaining part of the vagina, with a special band that serves as the cervix.
- Ovarian tissue freezing (ovarian tissue cryopreservation) is still considered an experimental procedure, for young girls who haven't gone through puberty and don't have mature eggs. It this procedure, part of all of an ovary (which contains eggs) is surgically removed and frozen. In the future, the tissue is thawed and placed back in the woman. This is only an option for women with certain types of cancer.
- Treatment with gonadotropin-releasing hormone agonist (GnRHa), which causes the ovaries to stop making the hormones estrogen and progesterone. This treatment is being researched to see if it is effective in protecting the ovaries.

Resources and additional information

- **American Society for Reproductive Medicine**: https://www.reproductivefacts.org
  Reproductive medical information as well as educational videos
- **Buffalo Infertility & IVF Associates:** https://www.buffaloivf.com
- **LIVESTRONG Fertility:** Understand your fertility risks and options, and get access to fertility preservation discounts. https://www.livestrong.org/what-we-do/program/fertility
- **Oncofertility Consortium:** Learn more about fertility preservation options, connect with a patient navigator and search a database of providers. https://oncofertility.msu.edu
- **Resolve: The National Infertility Association:** https://resolve.org
- **Society for Assisted Reproductive Technology**: https://www.sart.org
- **Sam Fund:** Support for young adult cancer survivors: http://www.thesamfund.org
- **ReproTech Limited:** Cryostorage: https://www.reprotech.com

Terms

Assisted Reproductive Technology (ART): All interventions that include the in vitro handling of both human oocytes and sperm or of embryos for the purpose of reproduction. This includes, but is not limited to, IVF and embryo transfer ET, intracytoplasmic sperm injection ICSI, embryo biopsy, preimplantation genetic testing PGT, assisted hatching, gamete intrafallopian transfer GIFT, zygote intrafallopian transfer, gamete and embryo cryopreservation, semen, oocyte and embryo donation, and gestational carrier cycles. Thus, ART does not, and ART-only registries do not, include assisted insemination using sperm from either a woman's partner or a sperm donor.

blastocyst: The stage of preimplantation embryo development that occurs around day 5–6 after insemination or ICSI. The blastocyst contains a fluid filled central cavity (blastocoele), an outer layer of cells (trophectoderm) and an inner group of cells (inner cell mass).

cryopreservation: Using very low temperatures to preserve biological material such as. gametes, zygotes, cleavage-stage embryos, blastocysts, or gonadal tissue.

diminished ovarian reserve: A term generally used to indicate a reduced number and/or reduced quality of oocytes, such that the ability to reproduce is decreased.

donor insemination: The process of placing laboratory processed sperm or semen from a man into the reproductive tract of a woman who is not his intimate sexual partner, for the purpose of initiating a pregnancy.

ectopic pregnancy (tubal pregnancy): A pregnancy outside the uterus, often in the fallopian tubes. A fertilized egg cannot survive outside the uterus and there is no procedure that can transfer the embryo into the uterus. If this type of pregnancy is allowed to continue, the embryo's growth will burst the fallopian tube and put the mother's life at risk.

embryo: The biological organism resulting from the development of the zygote, until eight completed weeks after fertilization, equivalent to 10 weeks of gestational age.

epididymis: A convoluted, highly coiled duct in males where sperm matures and are stored. The mature sperm travels from the testicles (where sperm is made) through the vas deferens, gets mixed with seminal fluid from the seminal vesicle, and goes into the urethra. Semen is ejaculated from the penis through the urethra.

erectile dysfunction: Inability to have and/or sustain an erection sufficient for intercourse

fetus: The stages of development of an organism from eight completed weeks of fertilization (about 10 weeks of pregnancy) until the end of pregnancy

fertility: The ability to produce children.

fertility preservation: A type of procedure used to help keep a person's ability to have children. A fertility preservation procedure is done before a medical treatment that may cause infertility, such as radiation therapy or chemotherapy.

gonads: Organs that produce gametes (reproductive cells) such as a testicle or an ovary.

hypo: Prefix meaning low/under

hyper: Prefix meaning high/excess

infertility: The inability to produce children.

implantation: The attachment and subsequent penetration by a fertilized egg into the endometrium of the uterus. This process starts 5 to 7 days after fertilization of the egg.
In Vitro Fertilization (IVF): A sequence of procedures that involves extracorporeal fertilization of gametes. It includes conventional in vitro insemination and ICSI.
In Vitro Maturation (IVM): A sequence of laboratory procedures that enable extracorporeal maturation of immature oocytes into fully mature oocytes that are capable of being fertilized with potential to develop into embryos.
IntraCytoplasmic Sperm Injection (ICSI): A procedure in which a single spermatozoon is injected into the oocyte cytoplasm.
luteal phase defect: A poorly defined abnormality of the endometrium presumably due to abnormally low progesterone secretion or action on the endometrium.
Medically assisted reproduction (MAR): Reproduction brought about through various interventions, procedures, surgeries and technologies to treat different forms of fertility impairment and infertility. These include ovulation induction, ovarian stimulation, ovulation triggering, all ART procedures, uterine transplantation and intra-uterine, intracervical and intravaginal insemination with semen of husband/partner or donor.
pre-implantation embryo: An embryo at a stage of development beginning with division of the zygote into two cells and ending just prior to implantation into a uterus.
salpingectomy: The surgical removal of an entire Fallopian tube.
oocyte: The female egg
semen analysis: A description of the ejaculate to assess function of the male reproductive tract. Characteristic parameters include volume, pH, concentration, motility, vitality, morphology of spermatozoa and presence of other cells.
sperm: The male reproductive cell.
sperm motility: The percentage of moving spermatozoa relative to the total number of spermatozoa.
spontaneous abortion: The spontaneous loss of an intra-uterine pregnancy prior to 22 completed weeks of gestational age. (May be called a miscarriage)
testicular sperm aspiration/extraction (TESA/TESE): A surgical procedure involving one or more testicular biopsies or needle aspirations to obtain sperm for use in IVF and/or ICSI.
total sperm count: The calculated total number of sperm in the ejaculate (semen volume multiplied by the sperm concentration determined from an aliquot of semen).
zygote: A single cell resulting from fertilization of a mature oocyte by a spermatozoon and before completion of the first mitotic division.