**Class 3** - Anatomy and Physiology of Pregnancy

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# Anatomical and Physiological Changes During Pregnancy

*An interactive anatomical comparison between a pregnant and nonpregnant woman:
https://ubeclass.injoyonlineeducation.com/pregnancy/anatomy/

## Weight gain

The average healthy pregnant woman gains between **25-35lbs** during the course of their pregnancy. This extra weight is contributed to by the woman's growing uterus and its contents (**baby, amniotic fluid, placenta**), as well as increased body fat, increased blood and cellular water volume, and breast tissue.

**Metabolic demands** increase as a pregnant woman's body is working hard to grow its baby! Eating for **two is not recommended**, however. Pregnant women need approximately an extra 100 calories per day in their first trimester, and approximately an extra 300 calories per day beginning in the second and continuing into the third trimester.

**Not gaining enough weight** during pregnancy can place a baby at risk for severe complications such as premature birth, which can cause lung and heart problems. Fat storage is necessary in a healthy pregnancy; that storage is used as **energy during labour and breastfeeding.**

**Gaining more than the healthy amount of weight** during pregnancy comes with its own risks, such as Gestational Diabetes (GD), Pregnancy Induced Hypertension (PIH), stress on the mother's body and the baby, increased stress on the mother's joints, difficulties during labour and recovery as well.

## Blood Volume

In the first trimester, a pregnant woman's blood volume increases by **10-15%** and continues to increase into the third trimester totaling a **30-50%** increase in blood volume compared to a nonpregnant woman. A greater volume of blood is needed for extra blood flow to the uterus, to facilitate mother and baby exchanges of oxygen, carbon dioxide and nutrients, as well as to compensate for maternal blood loss at delivery. This quick increase is **mainly plasma volume**, and not an increase in the number of red blood cells (which are responsible for carrying oxygen to the rest of your body, put simply); this essentially results in women becoming anemic during pregnancy until the body is able to build up enough red blood cells for the amount of blood plasma it has produced.

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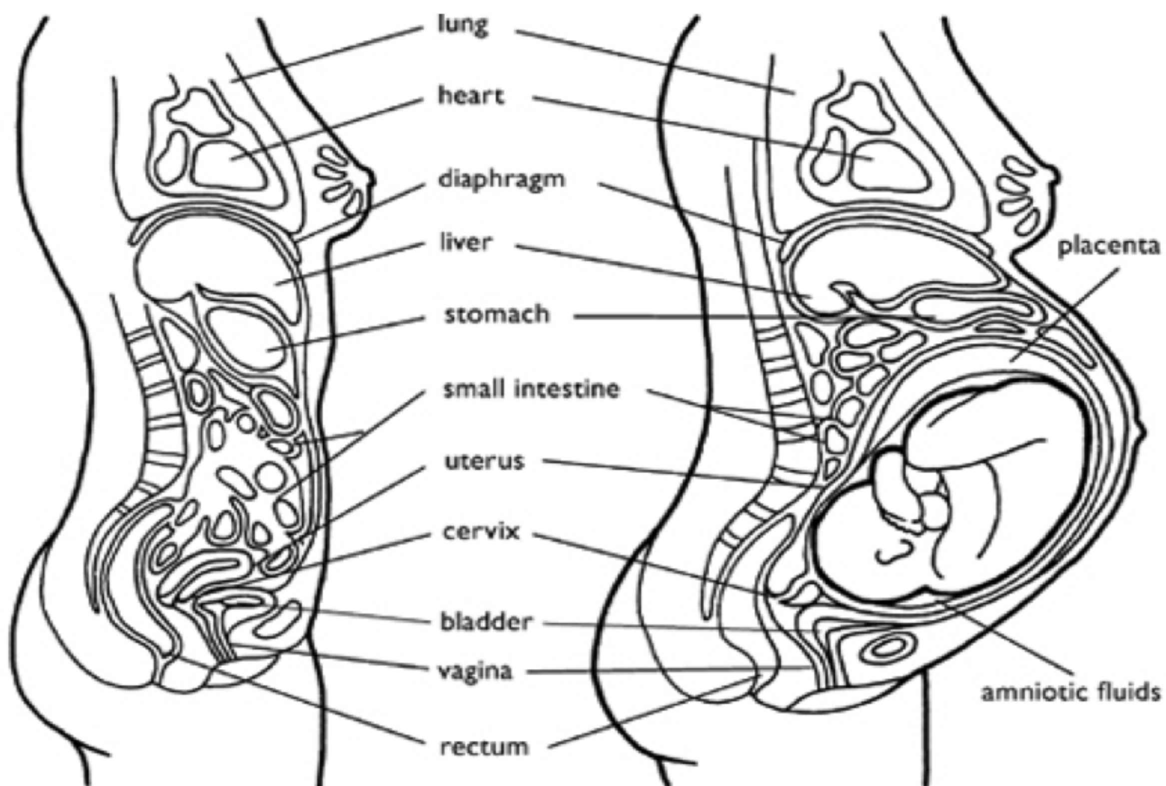
## Relaxin

Produced mainly by the placenta during pregnancy, relaxin is a hormone that causes ligaments to ‘relax’, becoming more flexible and malleable. This is important during pregnancy as women’s bodies **need to adapt to their ever-growing uterus**, change in their centre of gravity, and compensation to areas that need to expand such as the pelvis and rib cage. During labour, relaxin again helps to relax and **loosen ligaments in the pelvis for an easier delivery, and also contributes to thinning and rupturing the membranes as well as thinning and softening the cervix.** When relaxin levels are high (ie: during pregnancy), women need to be careful of over-stretching their joints as the risk of injury is higher.

**Anatomical Comparison between Nonpregnant and Pregnant Woman**

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## Nasal Passage and Throat

During pregnancy, women experience an increase in the vasculature of their mucous membranes throughout their bodies. An increase in this vasculature contributes to increased mucous production, which within the respiratory tract, then contributes to allergy-like symptoms such as chronic colds, nasal or throat congestion, voice changes, and being ‘stuffed up’.

## Breasts

Breasts go through many changes during pregnancy, starting with increased **sensitivity, tingling, swelling, and may feel sore**. These changes are due to hormones produced in early pregnancy and are one of the first signs of being pregnant.

Breasts increase in size due to an increase in **blood flow and growing ducts to prepare for breastfeeding.** Weight gain and fat storage also contribute to breast growth, and it is common for a woman to increase by 1-2 cup sizes throughout her pregnancy.

The appearance (other than size) also changes to include **larger and darker areolas,** as well as a ‘veiny’ appearance because of the increased blood supply.

Around **week 20, a pregnant woman’s breasts begin to produce colostrum,** which is hormone-driven and will be their baby’s food for the first few days of his/her life.

## Lungs and Respiration

While lungs are affected mostly in the late second and third trimester, respiration for a pregnant woman changes almost immediately. The increase in blood volume means that a pregnant woman’s **heart has to work harder** to pump all of that blood to her body, and now almost more importantly, to her uterus and growing baby. Heart rates increase by approximately **10-15 bpm**; with a faster heart rate, the rate of respiration naturally has to increase as well to around **3-4 extra breaths** per minute while resting. Pregnant women will become short of breath sooner than before they were pregnant due to this increased respiration as well as a **decrease in total lung capacity of around 5%.**

As babies develop, the growing uterus pushes up on both the diaphragm and the lungs, compressing them upwards and decreasing the ability to inhale fully. A pregnant woman’s rib cage will expand outwardly to make up for a bit of this compression, but many women feel that it is hard to take a deep breath, or may feel short of breath while pregnant.

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## Stomach

When the uterus is large enough to reach a woman's stomach, it pushes her stomach 'out of the way' upwardly and to the left, close to behind the woman's left breast. The stomach is also rotated about **45 degrees to the right** which causes the angle between the stomach and esophagus to change. These changes as well as some hormonal fluctuations create more pressure in the stomach and decreases muscle tone in the sphincter between the esophagus and the stomach. Regurgitation of stomach contents through this sphincter causes **heartburn** which is a common symptom of pregnancy (hormonally in the beginning and physically towards the end).

## Intestines

Intestines take up the majority of space in everyone's abdominal cavity. When pregnant, a woman's growing baby and uterus quickly become the largest thing inside the abdomen, which means that the intestines have to move and shift quite a bit to make room. **They get pushed to the sides and towards the back of a pregnant woman's body!**

Progesterone secreted during pregnancy causes **decreased gastrointestinal motility which results in longer gastric emptying**. Travel time of food through the intestinal tract is longer as well, with more water being reabsorbed, leading to constipation which is another very common symptom of pregnancy.

## Uterus

A pregnant woman's uterus is her baby's home for the gestational period. Starting out the size of the woman's fist, it quickly grows and accommodates a rapidly growing fetus, expanding to the largest muscle in a pregnant woman's body into the third trimester. Its weight increases from approximately **70 grams to more than 1000 grams at full term**; the volume of the uterus is approximately 10 millilitres in a nonpregnant woman, and increases to approximately 5000 millilitres by the end of pregnancy. Understandably, **ligaments** that support the uterus during pregnancy are under a lot of pressure and sometimes women feel sharp pains in these round ligaments as their bodies adapt to all of the changes going on.

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## Bladder

An increased need to urinate during pregnancy occurs for many reasons:

1. Progesterone (which is high in the first trimester) decreases bladder tone which leads to more residual urine left in the bladder after a woman as emptied it.
2. As pregnancy continues, there is a decrease in the control of the urinary sphincter due to the fact that the bladder is displaced upwards and flattened by the growing uterus.
3. The bladder sits directly under the uterus, and as the uterus gets bigger, more and more pressure is put on the bladder decreasing its capacity to retain urine. Even when the bladder is empty, pressure on it from the uterus simulates the feeling of needing to urinate.

## Vagina

Hormones and **increased mucosal vasculature** during pregnancy contribute to an increase in vaginal secretions and discharge. The vagina also becomes more expandable during pregnancy, and with the increased pressure of the baby's head towards the end of pregnancy, it appears shorter than vaginas of women who are not pregnant. Increased blood flow to the area increases sensitivity and can make the vagina appear darker in colour and swollen as well.

### Other Changes

A few more common changes that pregnant women experience include:
- hair changes (thicker, loss, fast growth, hair in unwanted areas)
- faster nail growth, brittle nails
- hyperpigmentation (linea nigra, pregnancy mask, darker areolas)
- larger feet
- vision changes
- hemeroids, varicose veins

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# Stages and Phases of Labour

There are three stages of labour; Stage One is made up of three phases: early labour, active labour and transition, followed by Stage two (Pushing), and Stage Three (birth of the placenta).

## Contractions – What are they doing?

Contractions are amazing! They are doing many things, a lot of them simultaneously, all contributing to birthing a baby. The 6 things contractions do are:

1. Moving the cervix from a posterior to an anterior position
2. Softening the cervix – from about the firmness of the tip of your nose to your soft earlobe
3. Thinning the cervix out (effacement) – 0% effaced is about two inches long while 100% effaced is 'paper thin'
4. Dilation of the cervix – from 0cm (closed) to 10cm (fully dilated)
5. Rotation of the baby – the baby is most easily birthed in the Occiput Anterior (OA) position (head down and facing the mom's back)
6. Descent of the baby – pushing the baby lower into the pelvis against the cervix, then through the cervix, under and around the pubic bone (hardest part!), and finally through the vagina and perineum

**Stage 1: Early Labour Phase**

| Length | Characteristics | How Moms may React | What Support Persons can do |
|---|---|---|---|
| - On average, approx. 12-24 hours for first labours<br>- May be only a few hours, or may last for a few days<br>- Approx. half the amount of time (or less!) of the mom's first labour for subsequent labours | - Cxns variable and inconsistent between 3-30 mins apart, lasting 15-45 sec each (all over the place like a rollercoaster)<br>- Dilation: 0-4cm<br>- Effacement: 0 up to 100%<br>- Cxns working on: moving cervix anteriorly, softening, thinning, dilation<br>- Feeling 'crampy', cxns low in uterus<br>- labour signs: loss of mucous plug, pinky-tinged mucous, diarrhea, dull ache in back | - Confusion, not sure if in labour or not<br>- Mixed feelings (excited, unsure, scared, happy, etc.)<br>- Easily distractible<br>- May want to head to hospital/call midwives to home too early | - Make sure everything is packed/set-up<br>- Give moral support<br>- Rest and suggest rest/sleep to mom<br>- Distract her<br>- Periodically time cxns (5-6) when there is a noticeable difference in the pattern<br>- Help mom stay nourished and hydrated |

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## Stage 1: Active Labour Phase

| Length | Characteristics | How Moms may React | What Support Persons can do |
|---|---|---|---|
| - Approx. 2-12 hours for first labours on average<br>- Approx. half the amount of time (or less!) of the mom's first labour for subsequent labours | - Cxns consistent, forming REGULAR pattern at 2-5 mins apart, lasting approx. 60-90 sec<br>- Dilation: 4-7cm<br>- Effacement: approx. 50-100%<br>- Cxns working on: thinning, dilating, turning baby<br>- Noticeable change in pattern and intensity, cxns have moved up higher in the uterus<br>- Bloody show<br>- Membranes may release | - Talkative, excited that 'things are rolling'<br>- Need to focus on labour and body during cxns (loses focus elsewhere)<br>- 'Overreacted' to early labour<br>- Surprised by AL cxns<br>- Change in personality<br>- Not talking during cxns but resumes conversation between<br>- Feel the need for extra support at this time<br>- Want to move around | - Help pass the time<br>- Time and record cxns periodically (5-6 when noticeable change in pattern)<br>- Help mom to relax<br>- Offer comfort techniques (massage, bath/shower, position chances, etc.)<br>- Offer encouragement<br>- Help mom stay nourished and hydrated<br>- Stay close |

## Stage 1: Transition Phase

| Length | Characteristics | How Moms may React | What Support Persons can do |
|---|---|---|---|
| - Approx. 2 hours or less for first labours<br>- Approx. half the amount of time (or less!) of the mom's first labour for subsequent labours | - Cxns VERY regular around 2 mins or less apart, lasting approx. 60-90+ sec.<br>- Dilation: 7-10cm (fully)<br>- Effacement: 100% (completely)<br>- Cxns working on: dilating, turning baby, moving baby down<br>- 'Peak of Sensation', meaning that when transition starts, it is the most intense and continues at that intensity until fully dilated<br>- Likely that membranes will release<br>- Lots of bloody show<br>- Very intuitive and animalistic<br>- piggy backing cxns<br>- Labour sounds are common | - Very focused and serious<br>- May not tolerate small talk/humour<br>- Restless<br>- Weepy or panicky<br>- Overwhelmed<br>- Ready to give up<br>- Statements such as: "I don't want to do this anymore"<br>- May feel as though labour is out of her control | - Stay calm and tune in<br>- Use soothing voice and touch<br>- Offer clear fluids/ice chips<br>- Help her feel safe, reassure her that everything is ok normal<br>- Compliment her: "You're doing so well", "You couldn't be doing any better", "You are amazing"<br>- Stay with her<br>- Help maintain a calm breathing pattern<br>- <u>Ask for cervical assessment before she makes a decision about</u> |

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|  | - Nausea, shaking, hiccups/indigestion<br>- Increasing pressure in rectum during contractions<br>- May feel urge to push |  | pain medication<br>- Remind her this is the shortest part and she is close to the end |

## Stage 2: The Pushing Phase

| Length | Characteristics | How Moms may React | What Support Persons can do |
| --- | --- | --- | --- |
| - Average pushing phase for first vaginal delivery is 2 hours<br>- May be less (15 mins or so) or more (up to 3 hours)<br>- After the 3-hour mark is when care providers may start looking into assisting<br>- Significantly shorter for subsequent vaginal deliveries, approx. 5-30 mins on average | - Cxns slow down slightly to every 3-5 mins, lasting approx. 60 sec.<br>- Dilation: 10cm/'Fully'<br>- Effacement: 100%/'Complete'<br>- Cxns working on: moving baby down, turning baby if necessary<br>- Strong urge to push<br>- Increasing pressure in rectum and vagina during and between cxns<br>- Membranes release if they haven't already<br>- Intense moment during crowning (burning and/or lots of pressure) | - Excited, renewed sense of energy<br>- Relief while pushing<br>- Knows she's in the final stretch and meeting her baby soon<br>- Tired or exhausted<br>- May feel like she's not making progress, or like her pushing efforts aren't working<br>- May feel more in control and empowered<br>- Many moms really enjoy pushing! | - Help support her in her chosen position<br>- Help guide her pushing efforts and breathing pattern<br>- Cool her face and neck with cool cloths<br>- LOTS of encouragement and reassurance<br>- Ease the tension in her face, focus her pushing efforts 'down and out' her bum, not in her shoulders, chest or face<br>- Encourage her to touch her baby's head if she wants to<br>- Reinforce care providers suggestions<br>- Give her fluids between each cxn |

## Stage 3: Birth of the Placenta

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| Length | Characteristics | How Moms may React | What Support Persons can do |
|---|---|---|---|
| - Naturally delivered (without assistance) within 10-45 mins after the birth of the baby<br>- Routinely delivered (with assistance) within 3-10 mins in hospitals and some home births | - Cxns are still there but taper off significantly; nursing and skin-to-skin immediately after birth will help the uterus contract and expel the placenta<br>- Cxns working on: making the uterus clamp down so the placenta detaches itself from the wall<br>- Care providers doing uterine massage<br>- Intramuscular pitocin administered<br>- Care providers may attempt cord traction<br>- Mom gives a little push when placenta has detached and it slides out easily<br>- Lots of blood and fluids come with | - Exhilarated with her baby on her chest<br>- May be adamant about (or forget!) about letting the cord pulse out before it is C&C<br>- Focused on the baby<br>- Relief that the birth is over and the baby is there<br>- Talkative<br>- Tired, but alert<br>- Endorphin high | - Stay with mom<br>- Take pictures<br>- Help establish breastfeeding<br>- Encourage skin-to-skin with mom or partner if mom can't do it<br>- Explain any of the newborn procedures<br>- Offer fluids and a light snack<br>- Be assertive of wishes about delivery of the placenta (banking, pulsing, avoiding traction, etc.); reinforce them if they are being ignored |

Demonstration: Fitting baby through the pelvis

Video of Childbirth through pelvis:
http://www.youtube.com/watch?v=duPxBXN4qMg

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