

>> December 5, 2016. Believe it or not, our last lecture in your favorite course, anatomy. And, what better way to end than female reproductive anatomy, since many of you own this equipment, so to speak. The female anatomy, quite different than those structures in men. Nevertheless, the external structures are referred to as genitalia. The major or inclusive word that defines all of female external genitalia is the word vulva which, in Latin means skin wound. Because most of these structures are somewhat concealed. Here's a section, a mid sagittal section which we'll use for reference. And, the first structure as we descend into the genitalia is actually a prominence of adipose called the mons pubis. The word "mons" means mountain. The word "pubis" of course a reference to the pubic bone. This is just that, subcutaneous adipose that develops during puberty, especially under the influence of estrogen. And, its one and only function is no difference from adipose anywhere and that is what? Store energy. Why, in general, are females, why do females have more adipose than men? Well, because they have to sustain a pregnancy, right? That is, they have to provide for the development, the maturation of an embryo and fetus. So, this energy reserve is designed to allow the female to get pregnant and stay pregnant and even provide for the nutrition of the infant to some extent for a few weeks afterwards in the form of providing for milk. The mons pubis. As we leave or otherwise descend further, the skin takes on two concentric folds which are referred to as labia. In Latin, the word "labia" means lip. Labium is singular, labia plural. And, the first of these two folds larger, and therefore referred to as labia majora. This skin has the same appearance, that is, its pigmented in the same way as the skin throughout the female's body. There are melanocytes here. There are also hair follicles here. So, hair develops at this location during puberty. But, aside from that, the labia majora has no function. We are careful to point out that it is homologous to something. Homologous mean derived from the same tissue or tissues. And so, had this individual been a male instead of a female, the labia majora would have formed into the scrotum. Let's be clear, the labia majora is not the same in function. What do you call those structures which are or share the same function across sexes? Analogous. So, it's by far not analogous, but it is homologous to the scrotum. If we separate the labia majora, somewhat hidden and smaller in size is the labia minora. Very different because there's no adipose here at all. So, it's a very thin layer of skin which is vascular, very richly vascular but not pigmented and contains no hair follicles. So, it's an inner vascular fold of hairless skin which surrounds and defines a space within referred to as the vestibule. Here's an illustration that you have, more or less. And so, to recapitulate this fold of skin which is outermost is the labia majora, and the inner one that we're speaking of is the labia minora. If we look at these structures straight on, the labia minora can be separated and reveal this entryway which is referred to by the Latin term vestibule which means lobby or entry. The vestibule, we'll mention in a moment, but the labia minora basically surrounds it bilaterally and defines it to some extent. If you were to dissect the labia minora inside, amongst all the blood vessels, you'd find two very tiny exocrine glands that were previously called the Bartholin's glands. Today, they're called just the vestibular glands

because they secrete into the vestibule. What do they secrete? They secrete a clear, colorless, slippery, mucoid secretion which basically fills or otherwise coats the labia, at least the labia minora. And, also, therefore serves to lubricate this area, the vestibule. And, this makes introduction of the penis easier, that is reduces friction. Understand, of course, that these glands are not active all the time, only during sexual arousal, sexual excitement. And, therefore, they tend to make the introduction, again, of a penis somewhat easier and more comfortable. These are called the vestibule or vestibular glands, secreting mucus in and around the vestibule during sexual excitation. This illustration looks a bit odd and certainly colored strangely, but it attempts, it attempts to show this idea of homology with respect to tissue. So, as we said, here are the labia majora, and they are kin to what? They are homologous to the scrotum. The labia minora represented in the penis just as a narrow fold or line of skin on the ventral side of the penis. Let's move somewhat internally. Again, as we describe and discuss the structures of the vestibule, certainly an important structure that dominates this area in terms of size and visibility is the vaginal orifice itself. The vagina is analogous to what? What male structure has the same function as the vagina? I guess we need to clarify the vagina is the female organ of copulation. So, with that said, what is the male organ of copulation? Penis. So, the vagina is analogous to the penis, but certainly not homologous. Surrounding the vaginal orifice and certainly in youth rather lush and developed is a ruffle of columnar epithelium which somewhat narrows and obscures the vaginal opening itself. The name of this epithelial ring, so to speak, is the hymen. A strange word. It's actually a reference to the Greek god of marriage. I didn't make that up. And, although this has no function, the hymen has no physiological function, what is its utility, at least from a forensic standpoint. You probably know that this is certainly developed in youth. That is in childhood. But, with sexual activity, it tends to be destroyed, and therefore, this can be used as an indication of rape or incest, especially in a young child. So, it can be thought of as an indicator of virginity, and, in fact, in some female children, it's so developed that it blocks the vaginal orifice altogether. Now, why would that be problematic later on? If the vaginal orifice was sealed, not only would there be difficult entry for a penis later in life, but it would also disallow the discharge of what? The menses, the blood, the cells that will happen with menarche. So, the structure sometimes has to be physically separated or punctured in order to allow for the discharge of normal menstrual flow. The name of it, hymen. Here's an actual photo of the structures we're talking about. This hairy fold of skin bilateral must be what? Labia majora. And, this must be the labia minora. This area, then, within is the vestibule. And, here's the vaginal orifice with hymen intact. I got this out of an old textbook because it says what? 19 year old. Be hard to find a 19 year old virgin these days. I didn't actually say that. But, you know, there you go. So, let's move on. Aside from the vaginal orifice, simply situated and somewhat inconspicuous above is another orifice through which urine passes. The name of that, naturally, is the urethral orifice. This just testifies to the fact that in females, the urinary system and reproductive system are not shared in any way. Just to remind you, what goes through the male urethra? Sperm and urine. In

the female, it's only urine, of course. So, the urethra orifice situated somewhat superior to the vaginal orifice. Now, this are that we're looking at, aside from being described as the vulva, is also demarcated or can be at least described in another way as the perineum. That term is mentioned later in this page, but you know from lab that this area from the pubic synthesis over to the ischial tuberosities over to the anus and then back again forms a diamond which is known as the perineum. This has no reproductive function, no function whatsoever actually and is not uniquely feminine. That is, it's an area also found in men. Do men have an anus? Do they have ischial tuberosities? Do they have a pubic synthesis? So, the perineum is just a description of this area of skin which encompasses, at least in females, the vaginal orifice, the vestibule, and so forth. This area between the vaginal orifice and the anus is further described as the obstetrical perineum which does have some clinical significance because during vaginal birth, does this skin in this area sometimes separate or tear? It does. And so, for that reason, obstetricians may, at their discretion, make a scalpel incision in the skin away from the anus because the probability of tearing into the anus may, in some cases, bring fecal material into the birth canal. What's the name of that procedure when done? It's called an episiotomy, and it's by no means obligatory. Vaginal deliver does not require or necessitate an episiotomy. But, if you've had a child, certainly that option or possibility may have been discussed with you prior to normal vaginal delivery. Now, moving on to the clitoris which is somewhat withdrawn and inconspicuous in this photo. The clitoris is, indeed homologous to the penis. That means made of or derived from the same tissue. It does not have the same function because the clitoris is not the female organ of copulation. What is? The vagina. So, it is homologous to the penis but not analogous to the penis. In size, naturally, it's considerably smaller. But, just as in the male, it has a hood or prepuce also known as the foreskin which somewhat conceals the tip of the clitoris which goes by a similar name, the glans, the glans clitoris. The glans clitoris, very sensitive to touch, and therefore the source of sexual enjoyment and arousal as a result of direct or indirect stimulation during sexual activity. So, the clitoris, a tactile receptor. That means sensitive to touch, is naturally responsible for much of the pleasure associated with normal vaginal sexual activity. And, of course, is also the source of the feminine orgasmic experience to some degree. Finishing up this page, a reminder of the superficial region known as the perineum which is simply a region of skin defined from the pubis to the ischial tuberosities to the anus and then back again. So, let's go, now, beyond the external genitalia and look at the internal organs encountered from the outside in. And, certainly, the entry into these internal structures is the vagina. The vagina is the female copulatory organ, but it has an additional function. What's that? It's the birth canal. It's the passageway for a fetus to the outside world, as you know. It is just posterior to the pubic synthesis and just anterior to the rectum. So, that's its approximate place of position in the female body. It actually has three layers, and they are, from the inside out, an internal layer's referred to as the mucosa. Mucosa because it is mucoid or slippery and is made of essentially the same tissue as the inside of your mouth. It's what? Stratified, squamous, epithelium.

Unlike the mouth, it is not smooth, but it's wrinkled or pleated. And, those folds are referred to as what? Rugae. By now, you've seen rugae in the urinary bladder, in the gall bladder, in the stomach, and what's the function of rugae in any location? And, that expansion is to accommodate the penis, but certainly much more to allow for the stretch necessary to deliver a full term infant. It's quite amazing when you think about it. The head and body of an eight pound baby has to go through the vagina with normal delivery. Now, the middle layer is not surprisingly muscle. What kind of muscle? Smooth muscle. Arranged longitudinally which allows for contraction, contraction around a penis, but also contraction around the head and body of an infant that's passing through the so called birth canal. And, finally, the outer layer is reinforced and made strong by the presence of connective tissue, highly vascularized connective tissue, and that layer is simply called the fibrous layer. Vascular allows this area to vasodilate and therefore contribute to increased blood flow. And, therefore, increased secretions into the vagina during sexual activity. Vaginal lubrication, then, is made possible by the fibrous layer of the vagina. Here's a cut through the vagina. And, lu stands for lumen. The inner layer is very thin, the mucosal layer. My stands for muscular layer. And, the outer layer, which is replete with all of these blood vessels is called the fibrous layer. On the inside, we have epithelium which you see magnified here. What kind of epithelium does it appear to be? Stratified, squamous epithelium. Are these cells being sloughed all the time just as in your mouth? And, also, this surface is by no means smooth but rather folded and pleated. And, those create the characteristic rugae which we said allow for vaginal expansion. Moving on to the end of the vagina is the gateway into the uterus. The other name for the uterus is womb, and so it's, well, it's an incubator, isn't it? And, in animals such as dogs and cats, you know that the uterus is not singular but actually a bilateral structure referred to instead as a duplex uterus. In humans, is a simplex uterus, meaning a single structure. Often compared to a pear, P-E-A-R, turned upside down. Normally, about the size of a pear, but certainly capable of incredible expansion. The entry into the uterus is normally tightly closed and plugged with mucus. And, this neck, this neck of the uterus goes by what term? Cervix. What are these bones in your neck called? Cervical vertebrae. So, the word "cervix" means neck, and this is the part which protrudes into the vagina and is obviously there for somewhat exposed or at least indirectly in contact with the outside environment. It is also the area which comes into contact with microbes, whether viruses or bacteria. And so, is a kind of gatekeeper because is the vagina sterile? Is your mouth sterile? Is the vagina sterile? No. But, is the uterus sterile? Yes, and it's kept so by the plug of mucus which actually fills the cervical os, O-S, right here. Now, women of reproductive years typically have cells scraped from the cervix gently as part of a physical exam. And, what's the name of that test invented by a male, as it turns out? A Pap smear, and this checks for early changes, histological changes in these cells. Which naturally can give early diagnosis to cervical cancer, which, of course, a serious condition. And, therefore, a Pap smear is recommended and important for early screening or diagnosis of that kind of change. The uterus, apart from the cervix is quite muscular. So, let's

actually describe and define the layers. Essentially, the top of the uterus is called the fundus. The rest of it referred to as the body. And, as you know from, well, your work in lab, the uterus normally is held forward. That is, it tips forward and is held there by two ligaments which attach to the anterior body wall. You know those to be the round ligaments. If it weren't for the round ligaments, the uterus would rise up, and then it would fall of its own weight into the vagina. And, perhaps, then, the cervix could actually be seen or protrude to the outside. What's that called when something descends like that? A prolapse. And so, a prolapsed uterus is a result of slack or stretched round ligaments which typically develops in women if they've had multiple full term deliveries. The layers of the uterus are as follows. On the outside, and actually not literally a part of the uterus is the curtain of peritoneum which more or less drapes down onto the female reproductive tract. The name of this outer layer is the peri, what? Metrium, perimetrium. The external serous membrane, which really nothing more than the parietal peritoneum which, once it comes off the uterus, continues to more or less lay across the round ligaments and other structures. And, then, it becomes known as the broad ligament. So, the perimetrium gives rise to the broad ligament as it descends away from or comes off of the uterus itself. This is a cut away through the uterus, and so se stands for the serous layer which is the outer serous membrane, better known as the perimetrium. The middle layer, which does all of the real work, is called the myometrium. Very thick, at least in a nonpregnant uterus. And, what's the function of it? What's the histology of it? It's smooth muscle. This allows for contraction which delivers the infant through the cervix, through the vagina, and so the myometrium contracts under the influence of what hormone? Oxytocin, also known as pitocin. And then, finally, the inner layer, which is essentially that defining the lumen of the uterus, is variably made of epithelium that is different kinds of epithelium, usually in mostly simple columnar epithelium. The endometrium is highly sensitive to estrogens and progesterone, and in the absence of those two hormones, it essentially, it essentially is discarded or sloughed. And, this natural and normal sloughing occurs at the end of every menstrual cycle, as you know. So, when we speak of menstruation, or the menses, many women consider it just to be blood. But, it's not blood. It's the cells of the what? Endometrium. Which are coming off of the uterus, passing through the cervix, and into the vagina. This is a natural and normal event in a woman of reproductive years. Do eight year old girls have an endometrium? No. Do 70 year old women have an endometrium? No. because both of those lack what hormones? Estrogens and progestogens. So, the endometrium is a function of those hormones. Its existence is determined by those hormones, and that goes to its obvious value. It is the site, S-I-T-E, where implantation occurs. In other words, implantation of a zygote, an embryo. So, no endometrium? Obviously, no capacity to hold or maintain a pregnancy. The three layers, then, from the outside in, perimetrium, myometrium, and endometrium. Here's yet another section. This one is more longitudinal. So, this is the inside. So, that's the endometrium. My is what? Myometrium. Needless to say, the myometrium is going to be stretched considerably because from pregnancy through nine months

of gestation, that has to be stretched considerably to accommodate what? An eight pound baby, ultimately. Never mind Octomom. You all know the story of Octomom. No? Oh, you do. Okay. Say no more. Moving on. Extending bilateral from the uterus, or you could say into the uterus, are two tubes which are popularly known as the Fallopian tubes. But, that's an eponym named after a male, Gabriello Fallopio. So, if you want to honor him, you can continue to call them, what? Which is kind of strange to honor these very feminine structures with a male. That's be like calling the George Washington Memorial Tubes. It makes no sense whatsoever. So, let's call them what they really are? What are they? You can call them uterine tubes. We also like to call them oviducts because either way, at least there's some description there. The uterine tubes are maybe three, four inches in length. Their inside histology is important, and not surprisingly, epithelium, but it's ciliated, ciliated cuboidal epithelium. And, beneath that, a layer of smooth muscle, both of which are involved in moving where? What are you trying to move? Sperm don't need any assistance? Why don't sperm need any assistance? They are their own outboard motor. You bet. So, the oviducts are allowing for peristalsis of the ovum, later the zygote as it moves from its entry into the oviduct, ultimately into the uterus itself. So, the function of this inner histology is to allow for movement, rather slow movement, maybe an inch a day, along the oviduct. The opening into the oviduct is quite elaborate, and it's rather beautiful in its appearance. These fringe-like tentacles are called fimbriae, and the word fimbriae means fringe, like you might have on a lampshade or some ornamental piece of one kind or another. These are designed to massage, to manipulate, this structure, and therefore, guide what? Guide the entry of an ovum into the oviduct. In this, they normally do well. But, digressing for a minute, is it possible for an ovum to not be captured by the fimbriae and actually move outside the female reproductive tract? Yes. Can sperm make it this far even into the pelvic cavity? Yes. And so, is it possible to have fertilization of an ovum outside the female reproductive tract? Yes. It's even more, but even possible, nevertheless, for this zygote to get ahold of the mesentery and develop into a fetus and even a mature and viable child. That's called an ectopic pregnancy. Google that, and you'll read some interesting stories of ectopic pregnancies. Speaking of the ovaries, in this view, you see them tethered or attached, not to the oviduct. They're not actually attached to the oviduct at all. But, rather, they're secured by the ovarian ligament to the uterus. They are, of course, the primary female gonads. That is, the reproductive organs. They're attached, not only by the ovarian ligament, but also, somewhat enveloped by the broad ligament and suspensory ligaments which bring down blood vessels, namely ovarian artery to the ovary itself. So, this is a cut away view of an adult ovary which is about the size of an almond. And, let's see if we can sort it out of this superior view of the pelvis. Before we get lost, let's get oriented. This is anterior, and this is posterior. So, what is this organ here? The bladder, the urinary bladder. So, this must be the uterus, and this must be the r word, rectum. Extending away from the uterus, we have the oviducts, and these are the familiar fimbriae. This, then, must be the ovary. Attached, as you can see, to the uterus by the ovarian ligament.

And, it has its own blood supply. That means ovarian vein and artery. So, to repeat, from front to back, we have bladder, uterus, and rectum in that order. Here's a nice internal view of the oviduct which, of course, displays this band of fimbriae here. Here's the broad ligament, and over here's the uterus itself. And, perhaps, here's yet another view showing those structures pretty well. So, the vagina, cervix, uterus, oviduct, ovary, and ovarian ligament. In this view, we see some interesting developments. These are actually tumors called intramural fibroids or simply uterine fibroids. These can be painful, even precancerous. And, therefore, sometimes necessitating what surgical, what rather common surgical approach to these development? A hysterectomy which means to remove the uterus, usually also the cervix, perhaps optionally, the ovary and oviducts. It's just a matter of overall purpose or preference in this particular case. What's it called? A hysterectomy. An interesting term because the word hysteria means to be crazy. And, in ancient times, I mean, real ancient times, it was thought that if a woman was a bit nuts it was the result of problems with her what? Uterus. I'm not making this up. It's the truth. Google it. And so, what's the term hysterectomy mean? To remove the source of hysteria, which apparently was thought to be the uterus. Moving on to the internal anatomy of the ovary and trying to more or less map this as it might undergo change over a month long period. Here's yet another slide showing the oviduct. These must be what? And this is the ovary. In this view of an isolated ovary, you see what, perhaps looks like a blister, but this is a perfectly normal structure which is described here, the result of two weeks of development. Something called a Graafian follicle, but let's start at the beginning. Inside the ovary, there is, of course, a lot of what's called germinal epithelium, especially along the surface. Germinal meaning the source of these germ cells, these cells that ultimately will become gametes. And, this epithelium is mainly simple columnar. In the interior of the organ, there's a lot of connective tissue, referred to only generally as stroma. But, certainly, and in great abundance, there are thousands of follicles referred to as primary follicles. Remember, a follicle is not a cell, but a group of cells, a hollow cluster of cells, which will contain a potential ovum. And, at least at birth, the female child will have hundreds of thousands of these. What are they called? Primary follicles. Nothing happens to them for, let's say, ten years. What hormones arrive at puberty which stimulate some of these follicles? Follicle stimulating hormone. And so, the arrival of FSH really heralds the arrival of puberty, and therefore, is responsible for the female's first menses, something called menarche. Menarche is when a woman has her first menstrual period. So, the target of FSH are these primary follicles which are essentially spheres containing one one, what? One potential ovum. Incidentally, many of these never respond to FSH and perish, and therefore, perhaps, it's already known to you, does a woman have an unlimited supply of ova in her ovaries? If she did, she would ovulate to her death in her 80s and beyond. So, there is a finite number of these primary follicles, and when those are exhausted, that means when they've been ovulated or otherwise perished, then she transitions through this stage of life called menopause. Let's say mid-40s just to give it a number. So, FSH targets these primary follicles, and in the first two weeks of any menstrual

period, those follicle cells are responsible for estrogens which actually target the uterus. What part of the uterus responds to estrogens? The endometrium, which, then, develops and prepares itself for the acceptance or arrival of the hopefully fertilized egg. Here's a better view of this anatomy showing the many or at least some of these what? Primary follicles. And, the development of these is fostered by FSH. In any given month, only one, maybe two of these primary follicles will be large enough and ready enough to be classified as a mature follicle. The mature follicle is also known as a Graafian follicle which contains, at this point, a mature egg or ovum. And, when I say at this point, I mean day 15 of the menstrual cycle. So, this structure, which we saw a picture of a moment ago, is actually a fluid-filled structure, quite large actually, which contains how many? One mature ovum which will be, at some point soon, actually cast out through the surface of the ovary. And, this event which is rather violent, is called what? Ovulation. Which occurs mid-cycle, about day 14 every month. Let's be clear, when we talk about ovulation, it's not a single cell, but a cluster of many, most of which have come from the follicle itself. But, in that entourage, there's one cell which is designated the mature ovum and, therefore, available for fertilization, provided sperm are in the vicinity. Now, this remnant, this group of cells that used to be the Graafian follicle, will reform into a visible and notably different structure, a yellow body called the corpus luteum, described here as a vestige that means a remnant, a leftover of a single ruptured Graafian follicle. And, this structure is, by no means, without function. In fact, it's very active for the next two weeks in any given menstrual cycle and cranks out what hormones? Estrogens and progesterone, both of which target the endometrium and prepare for the possibility, at least, of an arriving zygote. In other words, prepare the endometrium for pregnancy. In any given month where there is no pregnancy, the corpus luteum will die off in about two weeks, and with the death of the corpus luteum, what hormones disappear, at least for a moment? And, therefore, what happens to the endometrium without the support of these ovarian hormones? It's sloughed or discarded, and that forms the recognizable loss of blood and cells which is the menses. So, the corpus luteum, very important because it provides for these two endometrial sustaining hormones, progesterone and estrogen, and its development is supported by lh. What's that stand for? Luteinizing hormone. Here's a look inside the oviduct, just to remind you that there are these projections. What are they called? Cilia, which move the ova along. And, therefore, bring it into potential proximity with sperm. This is inside the oviduct, an actual photo. And, this is even more incredible because that's the, what? That's the ovum. The ovum is about the size of the head on a pin, P-I-N. So, it's actually the largest cell in the human body, visible even to the naked eye. The oviduct, that's the ovum. It's not green. It's just shown green there for fun. Now, of course, estrogens subside at menopause because what ultimately is exhausted in an ovary? At age 45, does a woman have any eggs left? No. Therefore, no source of what? Or, for that matter estrogen. So, will she menstruate? Is she able to carry a child? No, no, no. A lot of changes occur, not the least of which is vaginal dryness, hot flashes, and so forth. And, therefore, a woman is faced, at this point, with a decision.

What's the decision? The decision, every woman's dilemma, to take estrogen or what? Not. This is called HRT, hormone replacement therapy. And, that, of course, I suppose is more of a physiological issue. Let's go on to the mammary glands and finish with them. Actually, the mammary glands don't even belong to this system. You might think that preposterous, but are mammary glands necessary for reproduction? No. Do men have mammary glands? Yes. So, there you go. In other words, mammary glands actually belong to the integument. They are supportive to at least reproductive functions because, of course, all mammals have mammary glands, and they're the source of milk which provides nutrition to the offspring naturally. But, at least in terms of their histology, in terms of their anatomy, they are modified sweat glands. Now, don't get me wrong, they don't produce sweat. They produce what? Milk. And, they don't even do that until what? Until the proper hormones appear. And, what are the three hormones which are necessary to actually create functional mammary glands? Prolactin, estrogen, and progesterone. So, with that said, to repeat, do men have nipples? Yes, you've seen that. Do they have the mammary gland? Yes. Could they be made to lactate? Could men lactate with the proper adjustments? Yes. So, if you wanted to get your favorite male to lactate, you could obviously get him to do so, with his cooperation, by giving him what? Prolactin, estrogen, and progesterone. Now, chances are, he's not going to be too keen on that because, even though lactating might be fun and, you know, supportive for the family. I'm being facetious. It tends to take away shall we say certain male characteristics. Anyway, let's move on. Modified sweat glands. Basically, the size of the mammary glands dictated not by the glands themselves but all of this yellow stuff. What is most of the breast tissue actually composed of? Ordinary adipose. Located, as it is, over or on top of the pectoralis major muscle. Now, within this dense area of adipose there are what are called glandular alveoli. That word, we've used before. Certainly with the lungs in mind. But, these don't contain air. They produce and contain milk. And, they do so when stimulated, again, by prolactin, estrogens, and progesterone. Each of these 20 or so alveoli are connected to ducts, lactiferous ducts which are made of smooth muscle. And, therefore, the milk is moved along by what process of smooth muscle contraction? Peristalsis. What hormone stimulates the lactiferous ducts? Oxytocin which is responsible for what's called milk let down. That is the delivery of milk from these alveoli through the lactiferous ducts and eventually to the nipple. Departing for a second, one out of every eight women will get what in their lifetime? Breast cancer. And, of course, this is a devastating diagnosis requiring aggressive treatment, including, of course, not uncommonly, chemotherapy, radiation therapy, hormone therapy, and ultimately, in some cases, removal of a breast. What's that called? Mastectomy. Here's a rather rare photo of breast cancer, which rarely gets this far because, of course, it can be and is usually surgically dealt with before it reaches this advanced state. Today, aside from self exam, there are certainly genetic tests which can screen for the presence of genes which predispose you to what? Breast cancer. And, is there a familial history? Are there risk factors associated with that cancer that you should be aware of as a female within your family? Nat-

urally. This is a story that, I think, everybody knows about. Angelina, her mother, her sisters all died of what? Breast cancer, which she tested for this mutation in that gene. Yes. Was she found to have it? Yes. What did she elect to do? What did she decide to do? She had bilateral what? Mastectomy. This was a proactive, very courageous decision which really saved her life, undoubtedly, because she would have, of course, most certainly have developed breast cancer. Finishing off, these lactiferous ducts lead to the nipple which protrudes and is surrounded by a pigmented, circular area of skin called the areola which is just that, a darkly pigmented layer of skin which is also equipped with a lot of sebaceous glands called areolar glands. What do sebaceous glands produce? Not sweat. They produce the oil called sebum, S-E-B-U-M. And, why would that be welcome here? What's the function of sebum? I know this goes way back. But, doesn't sebum coat the skin and therefore seal, S-E-A-L? Is this an area which is likely to be chaffed or otherwise sucked on, shall we say? So, the function of these sebaceous glands is to minimize breakdown of that skin as a result of nursing or suckling. It remains completely mysterious as to why this, why the skin has more pigmentation. Is the areola darker than the surrounding skin in all cases? Yes. And, nobody knows why. Although, I did read a preposterous sentence in a textbook once. It said, "The function of the areola is to allow the infant to better see the nipple."

[Laughter]

And, I burst out laughing on that because, first of all, infants can't see that well to begin with. And, most of the time, they're nursing in complete darkness. So, why do they need a target like that? I don't know. It's crazy, but nobody knows the reason for that pigmentation. Nevertheless, that brings to the end of this lecture and this course. So, we'll see you guys, well, in this room 12:30 on Wednesday.