Decoding Cancer Virtual Lab

Introduction

Welcome to the Decoding Cancer Virtual Lab!

What is this lab about?

In this Virtual Lab, you will follow a patient as she undergoes several tests used to gather critical information about her breast cancer. You will learn about each test and ow the results of each help physicians make decisions about treatment. Later, you will guide a new patient through some of the tests and use the test results to recommend an appropriate treatment approach.

Lab Tip

Be sure to download the Lab Handbook before you begin this lab. The Lab Handbook contains important reference information and graphic organizers for you to record your patient notes. Through this Virtual Lab, you will be prompted to use your Lab Handbook to record or collect information.

Precision medicine is changing the face of cancer treatment.

What is precision medicine?

In precision medicine, physicians consider an individual's specific genes, medical history, environment, and lifestyle. They use these factors – along with the specific characteristics of the patient's tumor – to balance various options for treatment and prevention of diseases, including breast cancer. This state-of-the-art approach reduces the chances of over-treating or under-treating breast cancer by tailoring

treatment to each patient's precise needs based on the characteristics of the tumor.

What role do genes play in cancer treatment?
Genes make up the code that a cell uses to carry out all its functions. The cell's machinery uses this code to make the proteins that perform specific roles in the cell. Cancer arises when some genes are mutated at their nucleotide sequence, resulting in protein malfunction. Physicians can test cancer cells from a tissue sample to discover which genes are abnormal. The physician can then use knowledge about the abnormal genes to recommend treatments personalized to the patient.

Patient No. 01 Velma Belt

No. 1 Mammograms

Meet your first patient. Click on Velma Belt to learn more about her.

Velma is a 44-year-old female. During her monthly breast self-exam, Velma felt a lump in her right breast.

Every patient has their own medical record containing their medical history, physical exam, and diagnostic studies and labs.

As you follow Velma and her physicians through each test, be sure to record test results, new information, and your notes in your Lab Handbook. You will use this information to create a treatment plan for Velma.

Velma's physician has ordered a mammogram to see if there is abnormal breast tissue.

Mammography is a screening technique that can detect early signs of breast cancer. To take a mammogram, the breast is briefly pressed between two plates. Flattening the breast allows better penetration of X-rays, creating a sharper image.

Mammograms can quickly reveal critical information about a patient's breast tissue.
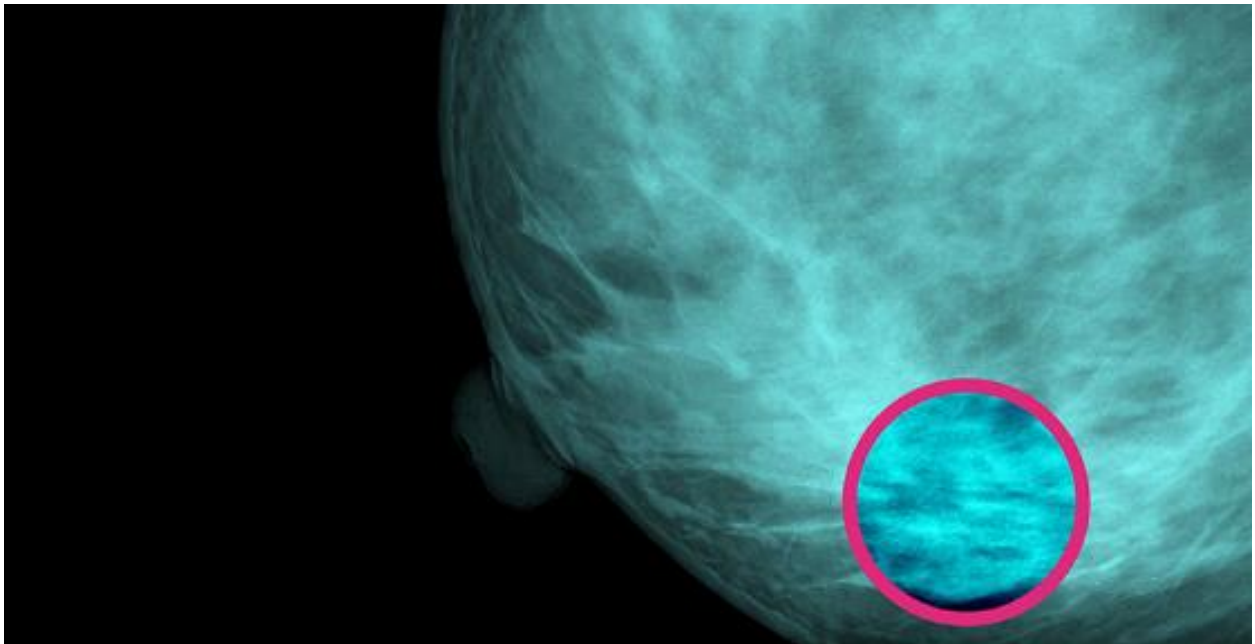
Here is a normal mammogram.
Note that there are dark and light areas that represent normal breast tissue.
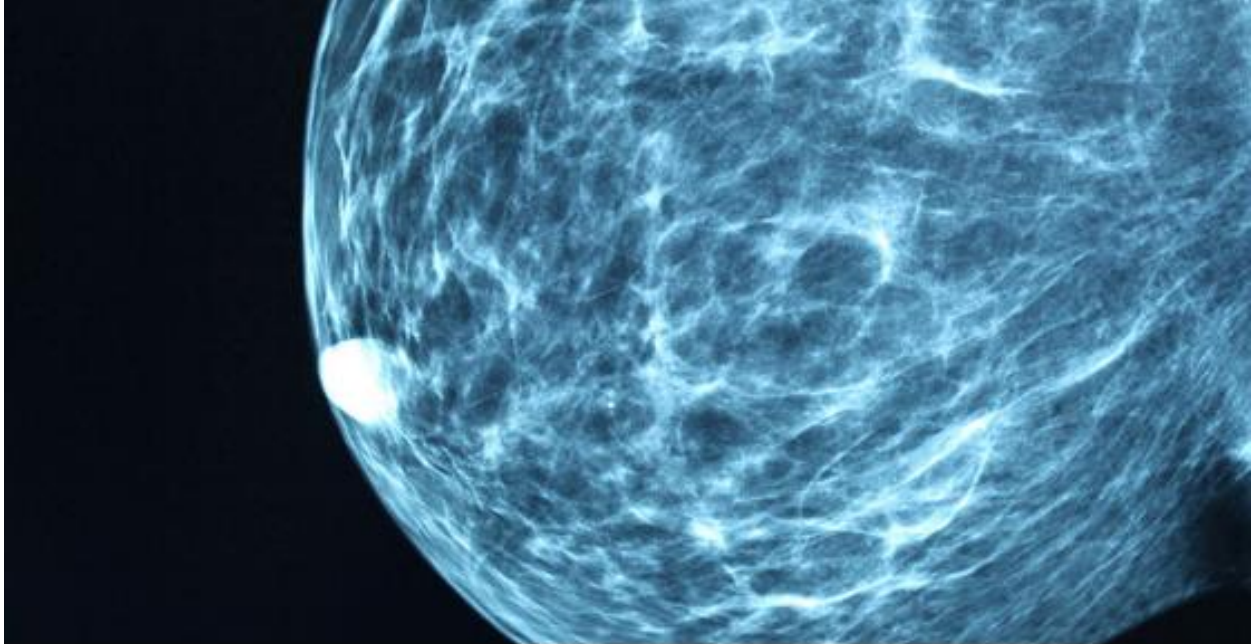
Here is an abnormal mammogram.
Note that the red circled area contains an abnormally shaped or new abnormal area of white tissue. Not all abnormal tissue seen on a mammogram is cancerous.

Review Velma's mammogram and click on the area that shows an abnormality. If necessary, click Previous to review the normal mammogram.
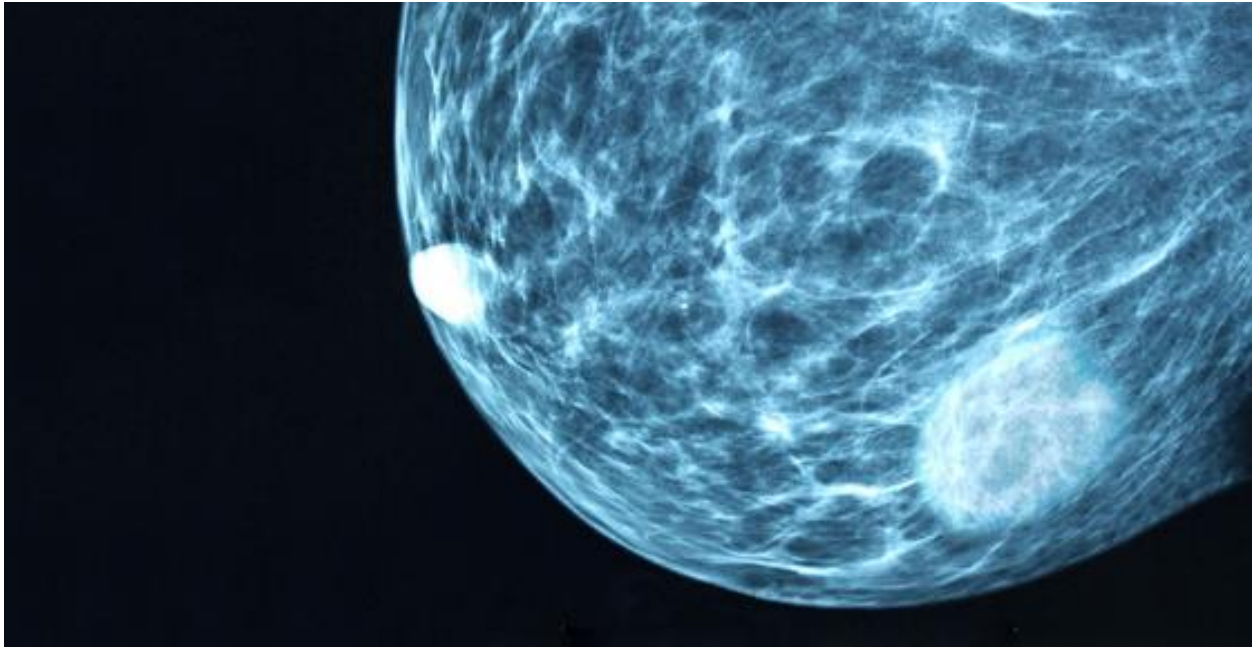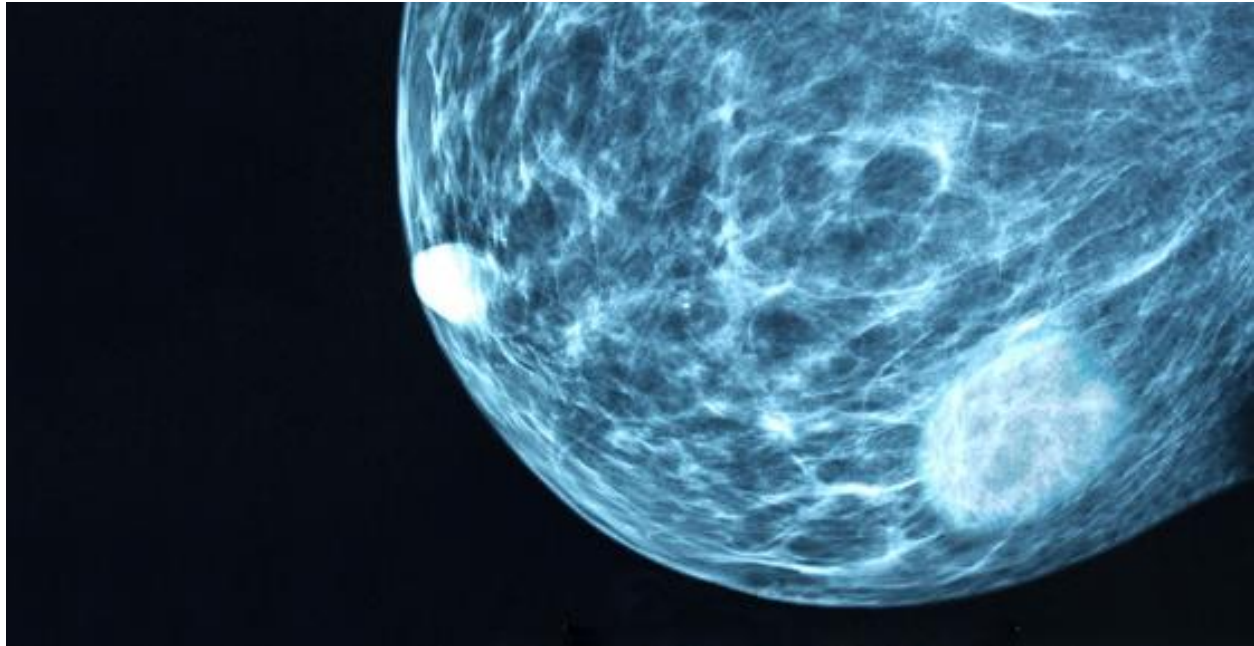

Correct! The area you click on indicates abnormal breast tissue.

It is important to consider the size of an abnormality when evaluating the mammogram.

Look at the abnormality in Velma's mammogram. Which of the objects is closest to the size of the abnormality?

Click the object that is closest in size to the abnormality.

Correct! Yes, it is about the size of a walnut.

No. 2 Biopsy

The biopsy is the first step in testing whether a breast abnormality seen on the mammogram or felt shows the presence of cancer cells.
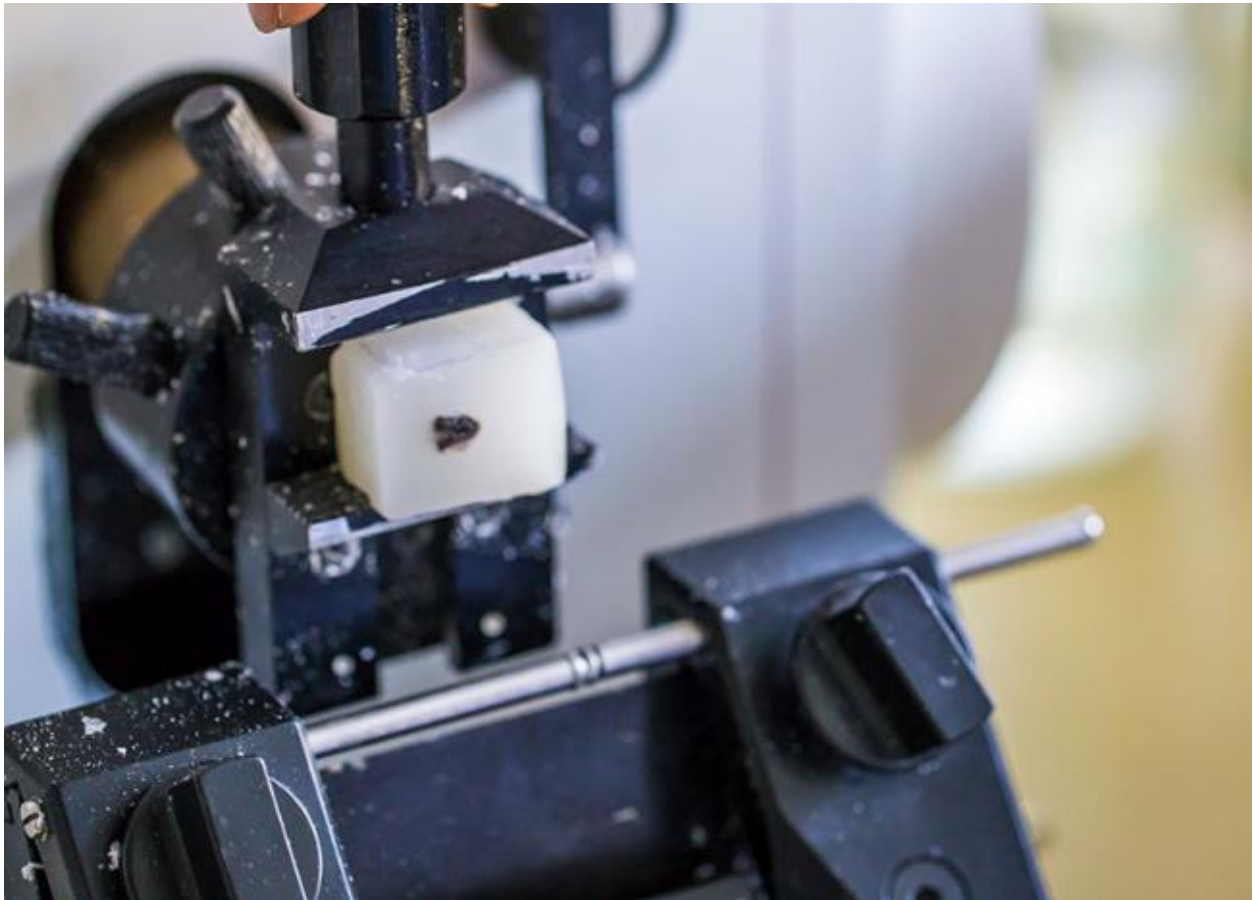
A biopsy is needed when the physician finds an abnormal area on a mammogram. Other symptoms indicating a biopsy is needed are any

lumps that can be felt or changes in the skin that may be suggestive or cancer.
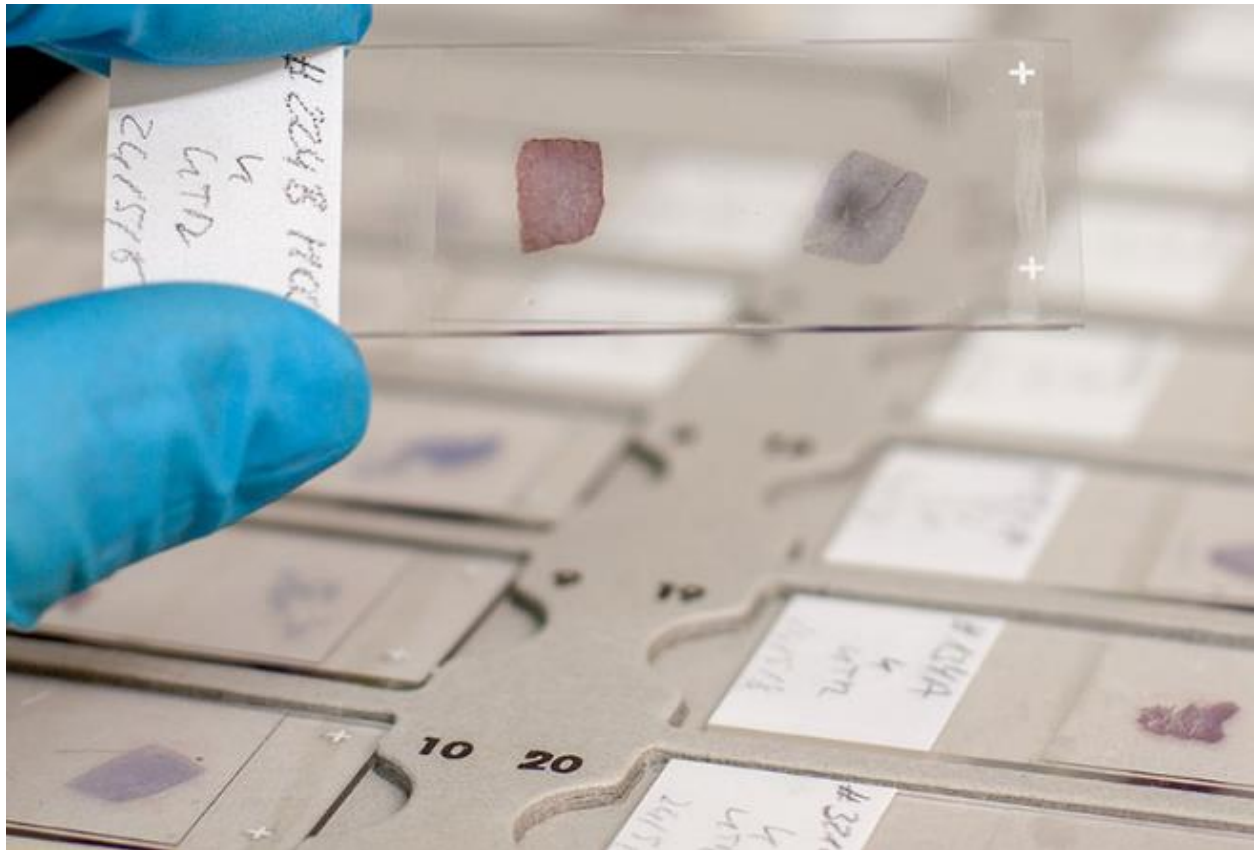
Velma's doctors have sent her biopsy tissue to be evaluated by the pathologist.

Conducting the biopsy:

Step 1: Tissue is fixed and placed into wax.

Step 2: Tissue sections are cut and placed onto a glass slide.

Step 3: Tissue is stained with two different-colored chemicals to help the pathologist determine whether or not the cells from the tissue sample are cancerous.

Normal cells are orderly and form regular breast duct structures. The cells are similar to one another and have smaller nuclei. They stain purple with intervening pink stain.

Normal
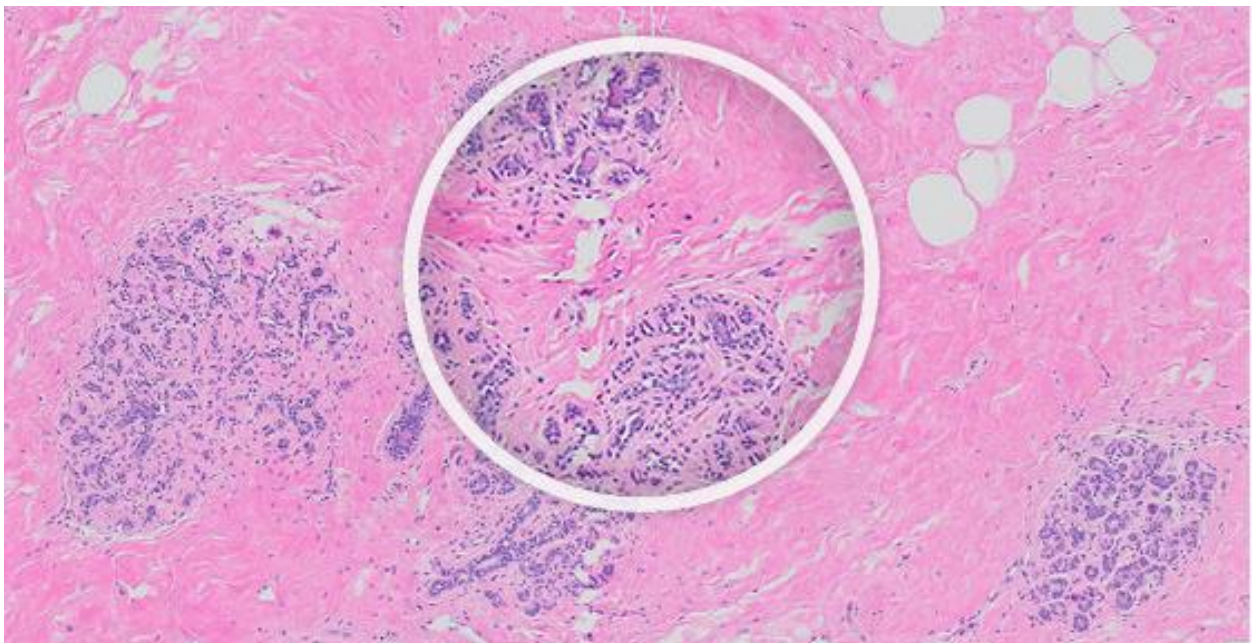
Cancerous cells have disorder appearance with large, irregular, different shapes and sizes with large nuclei. They have no duct structures and stain more purple than pink.

Cancerous
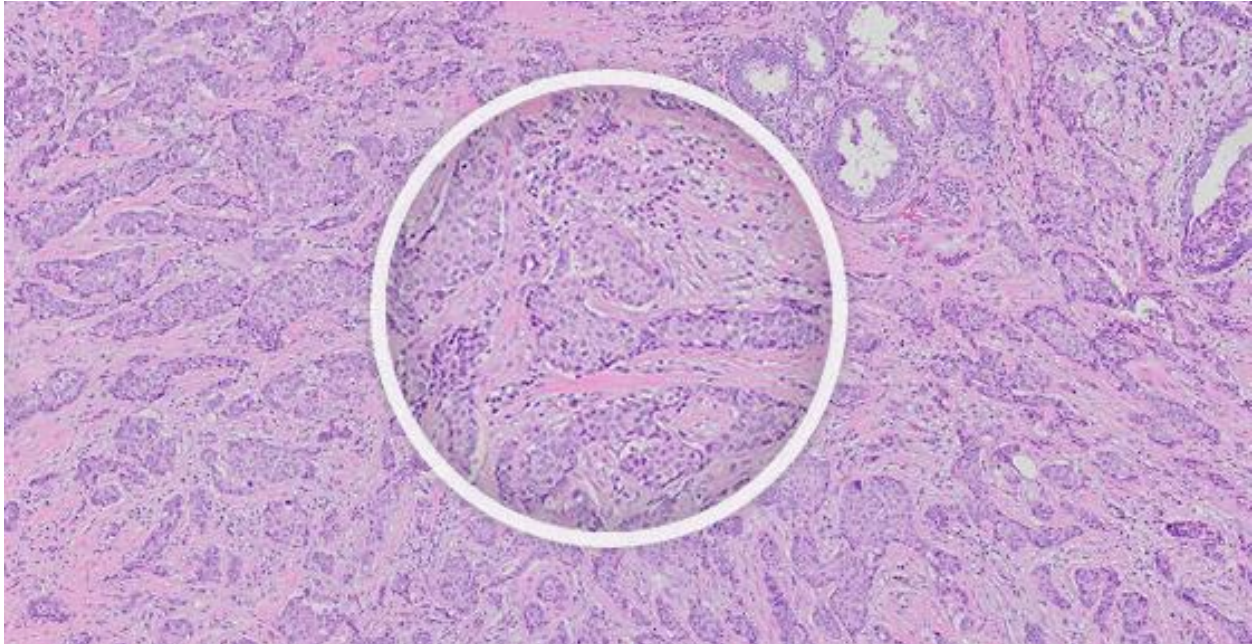
Velma had a right breast biopsy. Let's evaluate the tissue.

Does Velma's breast tissue sample indicate the presence of cancer?
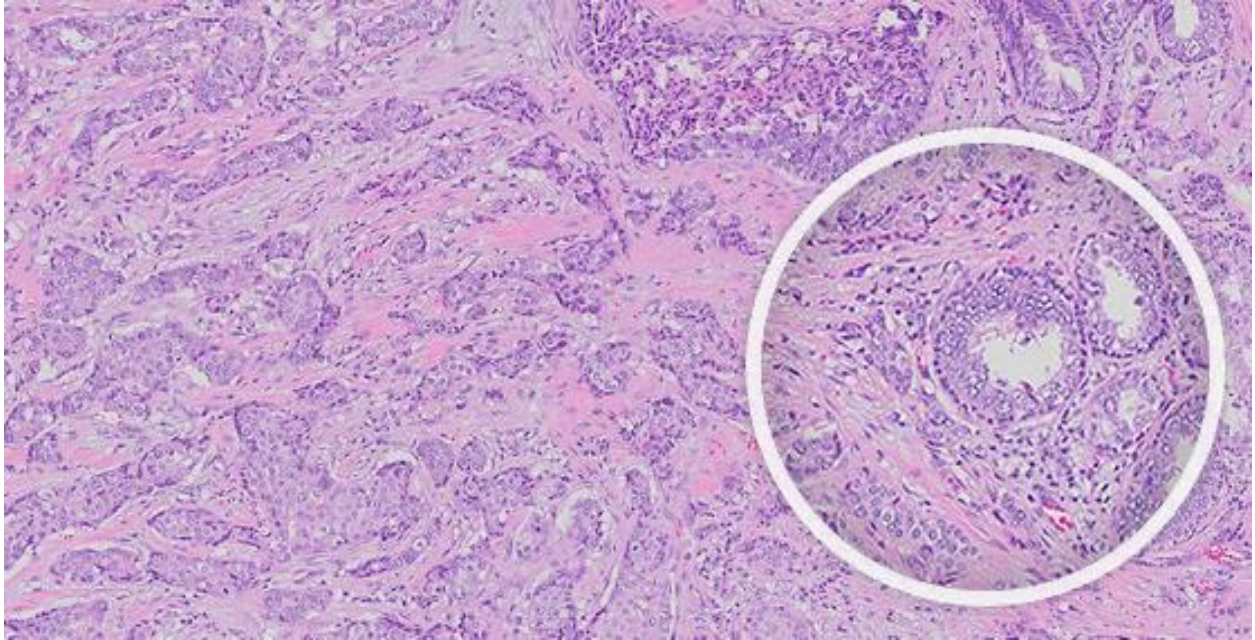
Correct! The slide does contain cancer cells.

Surgery is typically the next step after a breast biopsy confirms cancer.

Most women with breast cancer will undergo some kind of surgery to remove tissue from the area of concern. The procedure is performed by a surgeon.

There are two main types of surgery to remove cancer breast tissue.

Breast-conserving surgery: Only the part of the breast that contains cancerous tissue is removed.

Mastectomy: The entire breast is removed.

Lymph node evaluation will be done with either surgery.

Surgery that conserves the breast is always the best approach unless that are factors indicating that mastectomy is required.

Velma had a right breast lumpectomy and a sentinel lymph node biopsy.

The pathologist examined Velma's tissue and provided a pathology report.

A pathology report contains detailed information about the patient's diagnosis. Velma's physicians will use the information in the report to help them make decisions about the type of treatment that she might receive.

Let's evaluate the pathology report from Velma's right breast lumpectomy.

Generally, the smaller the tumor, the better the patient's chances for positive outcomes and the lower the chances of recurrence of breast cancer.

Surgical Pathology Report – Preliminary
Patient: Velma Belt
Medical Record #: 01234
Patient Age: 44 years old
Date of Procedure: July 1, 2016
Procedure: Right breast lumpectomy, lymph node biopsy
Specimen size: 5 cm (greatest dimension)
Laterality: Right
Tumor Size: 3.5 cm

Margins: no tumor at margin
Number of lymph nodes evaluated: 1
Number of lymph nodes with cancer: 0

Be sure to record this information in your Lab Handbook.

Let's review

Take this quiz to refresh what you have learned and that will help you
with this lesson.

Mammogram & Biopsy Quiz

1. What is precision medicine?
Choose as many as you like:
- A A strategy that allows doctors to more accurately predict treatment and prevention outcomes for a particular disease
- B A surgical method that precisely targets a specific tumor to ensure only diseased tissue is removed
- C An emerging approach for cancer treatment and prevention that takes into account individual variability
- D A "one-size-fits-all" approach, in which disease treatment and prevention strategies are developed for the average patient

Answer: A and C.
Precision medicine is an emerging approach that allows doctors to
more accurately predict treatment and prevention outcomes for a
particular disease and patient.

2. Typically, the smaller the tumor, the better the chances of patient
   survival.
   A True

B False

Answer: A
Typically, the chances of survival decrease with the size of the tumor.

3. *All breast tumors can be medically treated in the same way*
    A True
    B False

Answer: B
Medical treatment for a tumor depends on a number of factors, including the patient's age and medical history, as well as the size, location, and specific features of the tumor (in addition to other factors).

4. *A biopsy is a non-invasive procedure.*
    A True
    B False

Answer: B
Since a biopsy involves extraction of the patient's live tissue, it is considered to be an invasive procedure.

5. *A mammogram is a non-invasive procedure.*
    A True
    B False

Answer: A
Since a mammogram does not involve sampling live tissue, it is considered to be a non-invasive procedure

What is a lumpectomy?

    A A technique for detecting the presence of breast cancer

    B A surgery that removes a portion of the breast

    C A procedure involving removal of lymph nodes

    D A surgery that removes the entire breast

Answer: B

A lumpectomy is a surgery that removes a portion of the breast.

No. 3 Molecular Testing

Adjuvant treatment is the administration of chemotherapy, hormonal therapy, other therapy, or a combination to prevent the breast cancer from coming back once it has been removed.

It does this by eradicating microscopic cancer cells that may remain after initial treatment. In precision medicine, physicians evaluate the results of a range of tests in order to make recommendations about adjuvant treatment for each patient. Each test provides critical information to help physicians understand the precise treatments that will achieve the best outcome for the patient. You will learn about those tests and their implications for breast cancer treatment in this segment of the Decoding Cancer Virtual Lab.

Molecular Tissue Testing is an important part of precision medicine.

Velma's physicians need additional information in order to make the best recommendation for treatment.

In this segment, you will learn about molecular tests performed on tumor tissue and how they determine a patient's options for treatment.

Molecular tests evaluate DNA, genes, or proteins in tumor tissue. Genes encode proteins and proteins dictate cell function.

This lab is equipped to perform three different tests.

- Estrogen Receptor (ER)
- HER2 Fluorescence In-situ Hybridization (HER2 FISH)
- OncoType DX

Cancerous cells have a disordered appearance with large, irregular, different shapes and sizes with large nuclei. They have no duct structures and stain more purple than pink.

The Estrogen Receptor (ER) Test determines if the cells from the breast tissue have protein receptors for estrogen.

Estrogen can lead breast cancer cells to multiply uncontrollably. The ER Test detects whether or not a specific cancer's cells express estrogen receptor protein. If ER is expressed, this means the cancer may respond to hormone-targeted therapy. This test result will be reported either as positive or negative.
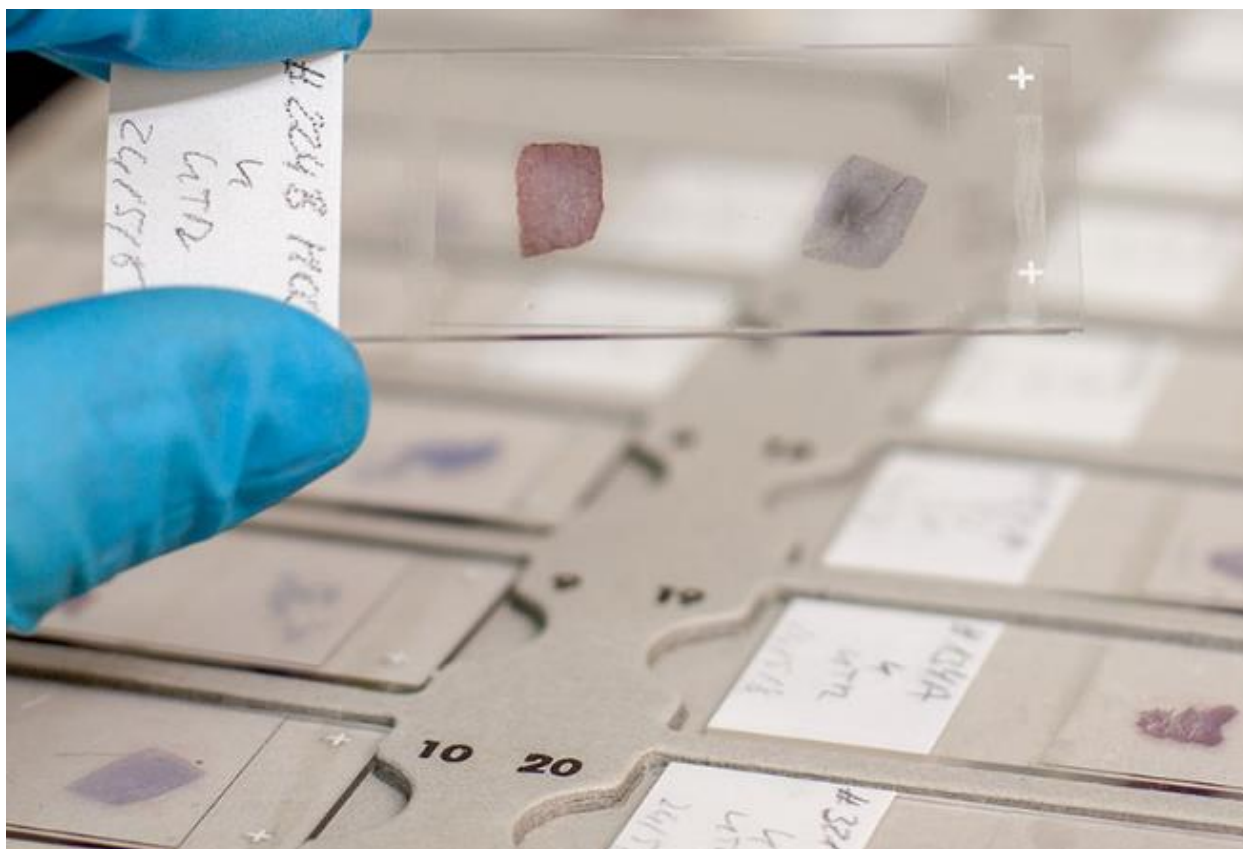
If the ER result is positive, the physician should recommend hormone blocking therapy.

Conducting the ER test:

Step 1: Tissue sections are cut, placed on a glass slide, and antibodies that bind to the ER protein are applied to the tissue.

Step 2: A second antibody binds to the first and color develops where this antibody binds.

Step 3: The sample is viewed under a microscope.
Brown color indicates a positive test. No brown color indicates a negative test.
Click the microscope to conduct the ER Test.
Are Velma's test results positive or negative?

Velma's ER Test results are in!

Velma Belt's ER Test Results: Positive

Velma's tissue tested positive for estrogen receptor. This indicates Velma's breast cancer may respond well to hormone blocking therapy.

Be sure to record the results in your Lab Handbook.

The HER2 FISH Test is another test performed on all breast cancer. FISH stands for Fluorescence in Situ Hybridization.

In the HER2 FISH Test, the pathologist uses breast tissue to detect the presence of extra copies of the HER2 gene.

The technique involves attaching special fluorescing dyes to a piece of DNA. The dye binds to a known DNA sequence in the HER2 gene and fluoresces, appearing as a colored dot under a fluorescence microscope. The HER2 gene is located on chromosome 17 (called CEP17). Dots that represent CEP17 fluoresce a different color than the HER2 dots.

The pathologist uses the microscope to observe and count the HER2 dots and the CEP17 dots. The ratio of HER2 dots to CEP17 dots is used to determine the results of the HER2 FISH Test.

The HER2 FISH test result can be amplified or not amplified.

HER2 FISH Result	Amplified	Not amplified
HER2 CEP17 ratio	Equal to or greater than 2	Less than 2
Amount of HER2 protein	Excess amount	Normal amount
Impact on cancer growth	Increases growth	No effect
Implication for treatment	Use HER2 targeted therapy to slow down	Do not use HER2 targeted therapy

	growth and kill cancer cells	

For example, if the pathologist counts a total of 422 HER2 dots and 7 CEP17 dots, the HER2/CEP17 ratio is 6. This means that the HER2 Test result will be reported as amplified.

If the HER2 FISH results come back as amplified, the physician should recommend HER2-targetd therapy.

It is important to note that, because HER2-targeted therapy is only given along with chemotherapy, chemotherapy would also be a part of the treatment plan.
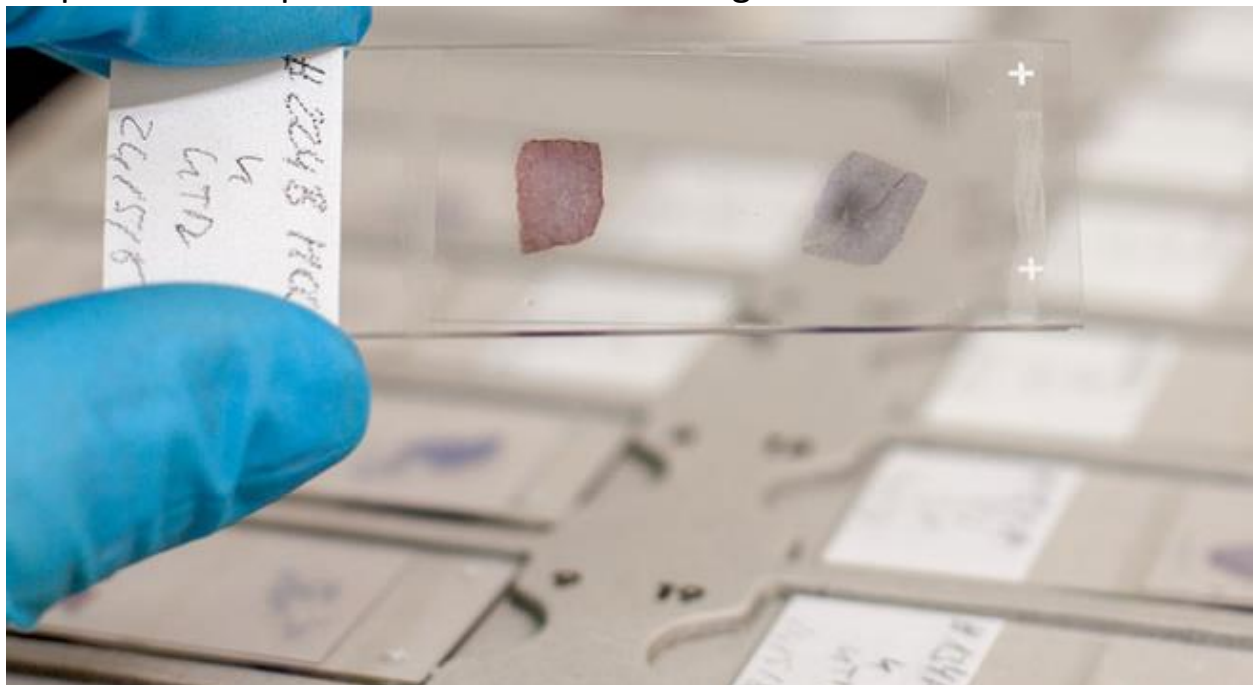
Velma's doctors have sent her tissue sample for HER2 FISH testing.

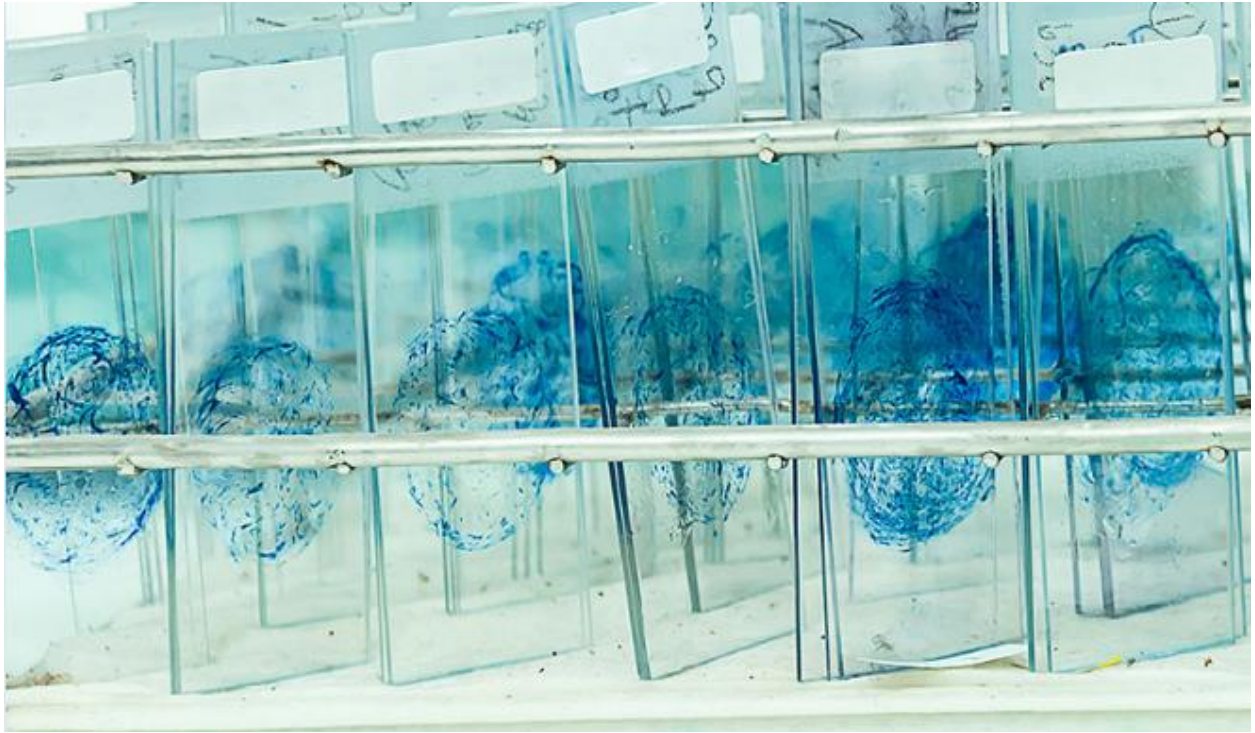*Conducting the HER2 FISH Test:*

Step 1: The slide is heated at 82°C to denature the sample.
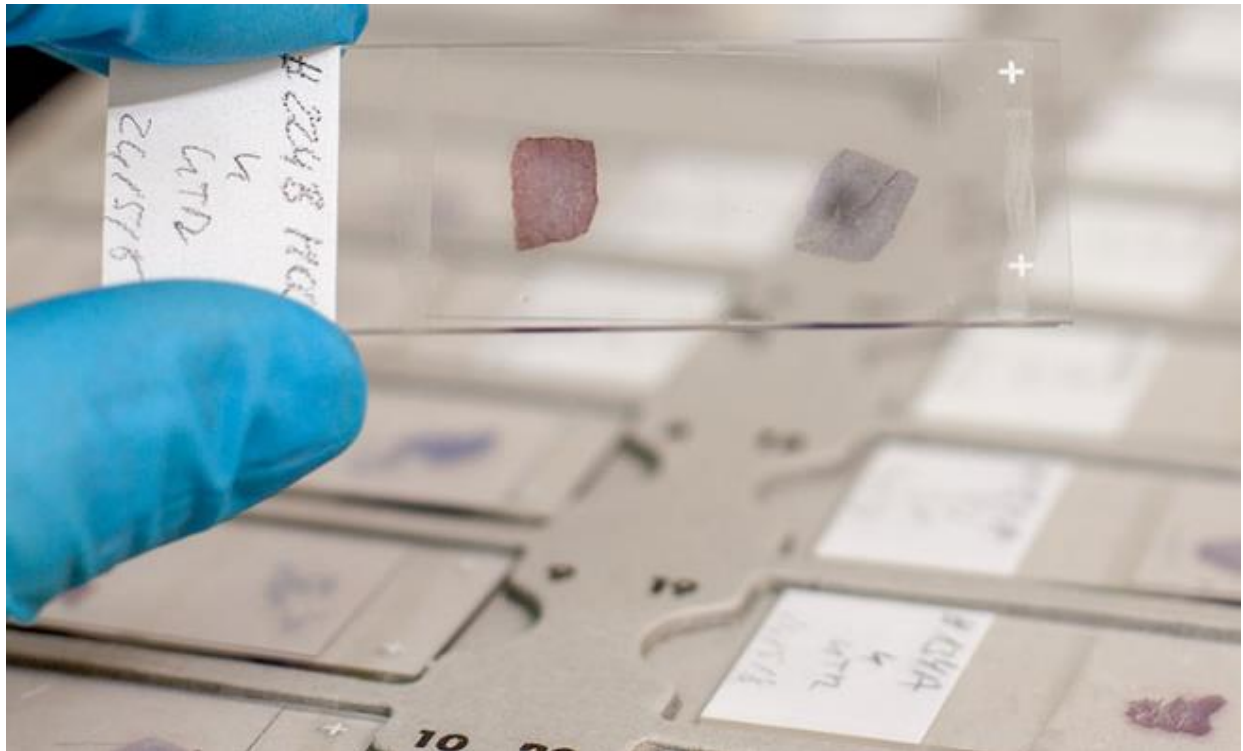
Step 2: The sample is washed in a buffer agent.

Step 3: The slides are dehydrated in ethanol and air-dried.

Step 4: The medium that contains the fluorescent dye is applied to the slide.

Step 5: The fluorescence is observed using a fluorescence microscope.

Look at each cell nucleus (depicted in blue). Count the number of red dots (HER2) and the number of green dots (CEP17). If the red areas are at least or greater than 2 times the number of green areas, the test result for HER2 FISH is amplified. In this example, the ratio of red dots to green dots is 6:2, or 3. This means that HER2 is amplified.
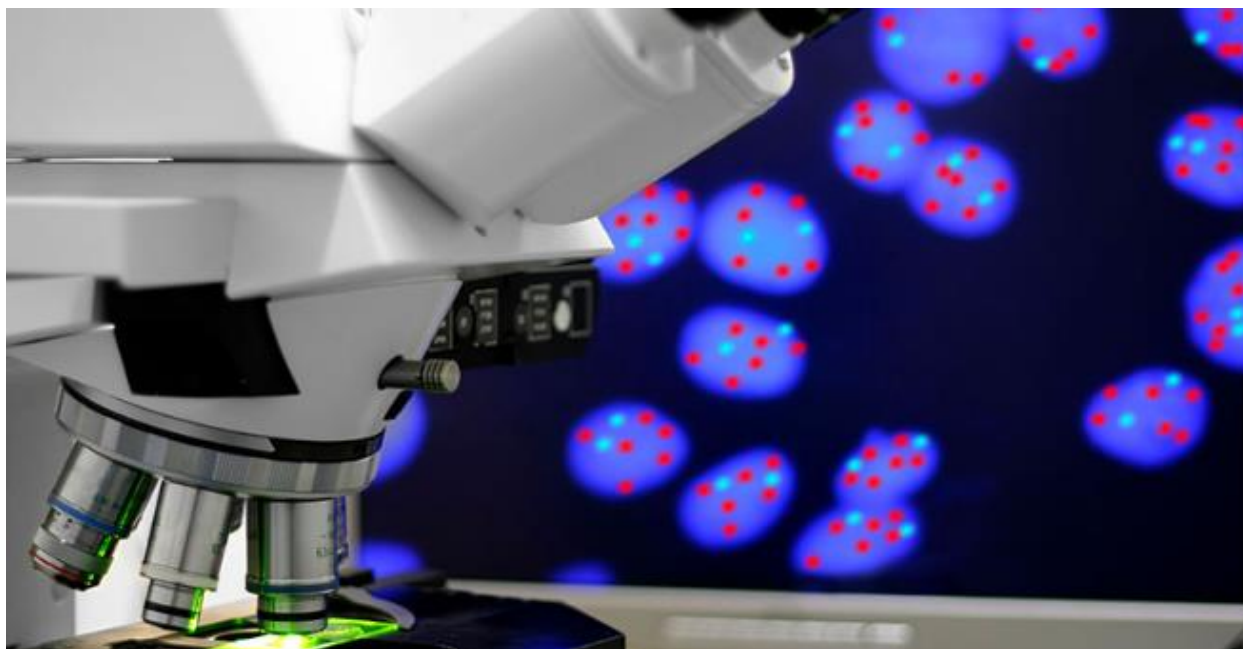
Observe the fluorescence micrograph for HER2 FISH testing.

Velma's HER2 FISH Test results are in!

Click on the microscope to analyze Velma's HER2 FISH test and calculate the ratio of red dots to green dots. Should the test results be reported as amplified or not amplified?

Correct! The HER2 FISH ratio is 1.5, so HER2 is not amplified. This indicates that HER2-targetd therapy should not be recommended as part of Velma's treatment.

Be sure to record the results in your Lab Handbook.
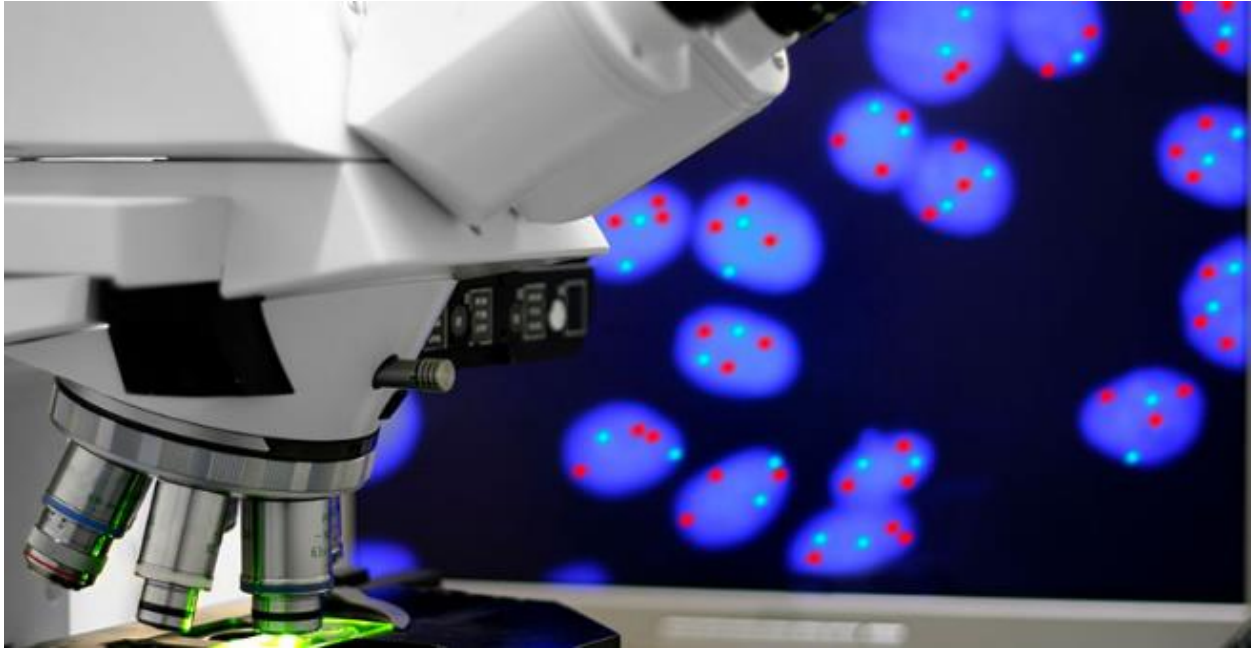
The OncoType DX Test helps determine if a patient will benefit from chemotherapy as well as hormone blocking therapy.

If a patient has an ER positive tumor, HER2 is not amplified, and no lymph nodes are involved, an OncoType DX Test is needed. This test is based on the amount genes are expressed. Gene expression is the observed product of a specific gene (mRNA). Abnormal gene expression in cancer cells may be due to DNA mutations. The OncoType DX Test gives information about prognosis (how likely the tumor will spread to other parts of the body). It also helps physicians determine whether patients with early-stage invasive breast cancer will benefit from chemotherapy (in addition to hormone blocking therapy or hormone blocking therapy alone).

OncoType DX Test: A sample of breast tumor is analyzed for the expression of a set of 21 genes.

Based on the expression of 21 selected genes, a recurrence score is generated and ranges from 0-100. The higher the Recurrence Score, the greater the chance that the breast cancer will come back and the more likely a patient will benefit from chemotherapy.

What score means lower than 18: Low risk of recurrence with hormone therapy. Risk of side effects from chemotherapy outweigh potential benefits to patient.

Between 18 and 30: Intermediate risk of recurrence with hormone therapy. Unknown whether benefits of chemotherapy outweigh risk of side effects.

Great than 30: High risk of recurrence with hormone therapy alone. Benefits of chemotherapy outweigh risk of side effects.

Velma's doctors have sent her tissue sample for OncoType DX testing.

Conducting the test:

Step 1: The pathologist sends a piece of the cancer tissue for analysis.

Step 2: RNA is extracted from the sample for analysis.

Step 3: An automated multi-gene analysis is conducted on the selected 21 genes.

Step 4: A score is calculated.

Velma's OncoType DX Test results are in!

Velma Belt's OncoType DX Test Results: 10

This score indicates that chemotherapy is NOT beneficial and should not be a part of Velma's treatment plan. She only requires hormone blocking therapy.

Be sure to record the results in your Lab Handbook.

Putting it all together: The Estrogen Receptor (ER) Test

Conducting the test:
If the ER Test score is positive, the physician may recommend hormone blocking therapy to block estrogen activity.

Velma's ER test score was positive.

Putting it all together: The HER2 FISH Test

If the HER2 FISH results return as amplified, the physician will likely recommend a HER2-targeted therapy.

Velma's HER2 FISH test score showed that her HER2 oncogene is not amplified.

Putting it all together: The OncoType DX Test

The OncoType DX Test score range indicates one of the following treatment approaches:
Under 18: Hormone blocking therapy only
From 18 to 31: Hormone blocking therapy, chemotherapy may or may not be necessary
Over 31: Both chemotherapy and Hormone blocking therapy

Velma's score was 10.

No. 04 Recommendations

Recommend a treatment plan for Velma.

Use the notes from your Lab Handbook to recommend a personalized treatment plan for Velma Belt. Select one of the following options:

- Hormone blocking therapy only
- Hormone blocking therapy and chemotherapy HER2-targeted therapy and chemotherapy
- HER2-targeted therapy and chemotherapy
- Hormone blocking therapy, HER2-targeted therapy and chemotherapy

You may change your recommendation before getting an update on your patient's status. Once you are done with your recommendation, you can review your patient's status. Be sure to record the information in your Lab Handbook.

Correct! Based on the results of Velma's tests, her physician should recommend hormone blocking therapy only.

Patient Status

Following her treatment, physicians will monitor Velma to determine whether or not her breast cancer has returned. If the cancer does not recur, the treatment approach was successful. If her breast cancer recurs, the treatment approach was not successful. As a result of hormonal therapy, Velma has not experienced a recurrence of breast cancer. Success!

Let's review

Take this quiz to refresh what you have learned and that will help you with this lesson.

1. *What is adjuvant treatment?*

   A Surgical removal of tumor tissue following detection in a mammogram

   B Conducting various tests to gather information about a patient

   C Administration of chemotherapy, hormonal therapy, other therapies or combinations of therapies to prevent breast cancer from returning

   D Radiation treatment of tumor tissue following detection in a mammogram

Answer: C

Adjuvant treatment is the administration of chemotherapy, hormonal therapy, or both to prevent breast cancer from returning.

2. *Which of the statements about cancer are false?*

Choose as many as you like:

   A Lack of a family history of cancer means that you are risk-free

   B Cancer is incurable

   C Cancer may be a genetic disease for some individuals

   D If you stop smoking today, your cancer risk soon returns to normal

Answer: A, B, D

Modern therapies have greatly improving chances of survival. Although a family history of cancer may be associated with a higher cancer risk, no one is entirely risk-free. Although stopping smoking will reduce the chances of getting cancer, someone who previously smoked will have a higher risk than someone who never smoked.

3. *A biopsy is conducted…*
   A Only as a last resort
   B After abnormal tissue has been found in a mammogram
   C Through imaging breast tissue using X-rays
   D If cells with large, variable-shaped nuclei are found

Answer: B
A biopsy can help to confirm a possible cancer diagnosis following a mammogram. The biopsy helps the pathologist to characterize individual cells and the features of a tumor.

4. *What is the best way to confirm a diagnosis of cancer?*
   A Mammogram
   B Biopsy
   C ER Test
   D OncoType DX Test

Answer: B
The biopsy allows the pathologist to observe suspect tissue at a cellular level and to characterize cells as cancerous.

5. *If the ER Test is positive, it shows…*
   A Variation in size and shape of cells in biopsied tissue
   B Cancer cells are unlikely to respond to estrogen therapy
   C Human epidermal growth factor 2 is causing tumor growth
   D Cancer cells are likely to respond to estrogen-targeting therapy

Answer: D
The ER Test detects whether or not cancer cells express estrogen receptor protein, and therefore, if the cancer will respond to estrogen targeting therapy.

6. The ER Test…

    A Gives a recurrence score from 0 to 100

    B Is inferior to the HER2 Test

    C Is either positive or negative

    D Is based on a gene expression test

Answer: C

The results for the ER Test are either positive or negative.

7. The HER2 FISH Test is conducted by…

    A Extracting RNA for analysis

    B Identifying abnormal cells in a biopsy sample

    C Counting areas on a fluorescence micrograph

    D Analyzing cells that have lost normal specialized cell features

Answer: C

The HER2 FISH Test relies on fluorescence in situ hybridization, in which special colored dyes are attached to a known HER2 gene sequence.

8. The OncoType DX Test

    A Identifies the number of CEP17 signals identifying chromosome 17

    B Helps physicians to make treatment recommendations

    C Determines whether or not tumor cells may respond to estrogen therapy

    D Helps technicians to decide whether to extract RNS for analysis

Answer: B

The correct answer is B. The OncoType DX Test helps the physician to evaluate the likelihood of recurrence and whether addition of chemotherapy to hormonal therapy is better than hormonal therapy

alone. The physician can then use test results to develop recommendations for treatment of an individual's cancer.

9. *The OncoType DX Test*
   A Does not require extraction of RNA for analysis
   B Conducts automated multi-gene analysis
   C Determines whether or not a biopsy is required
   D Tests for the presence of a single cancer-causing gene

Answer: B
The OncoType DX Test conducts automated multi-gene analysis.

10. *What treatment would you recommend if the OncoType DX Test score is 10?*
   A Chemotherapy only
   B Hormonal therapy only
   C A combination of hormonal therapy and chemotherapy
   D The score is too low to recommend a treatment

Answer: B
An OncoType DX Test score of 10 indicates that the patient should receive hormonal therapy only.

Patient No. 02 Michele Johnson

Let's choose the next patient below and learn more about her.

In this segment of the Decoding Cancer Virtual Lab, you will evaluate Michele's breast cancer and conduct tests to recommend a treatment plan.
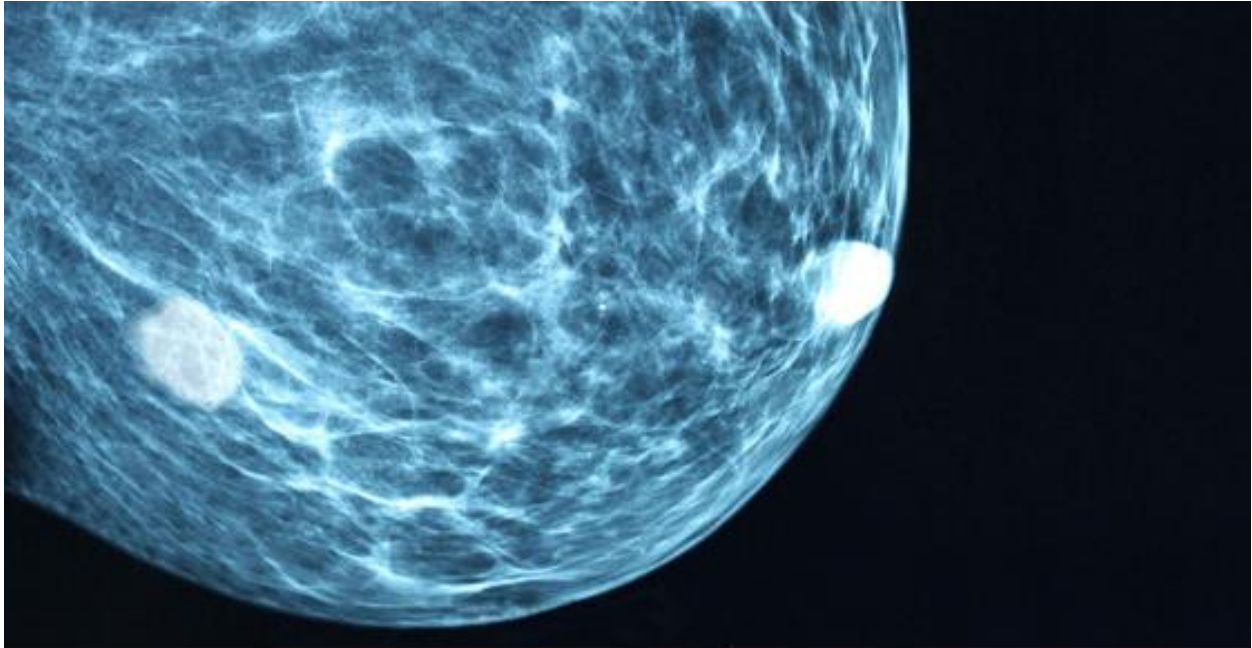
Michele Johnson is a 47-year old female. Michele recently had her routine yearly mammogram. Michele has never had breast cancer before.

As you progress through the Virtual Lab, be sure to record Michele's test results and your notes in your Lab Handbook.
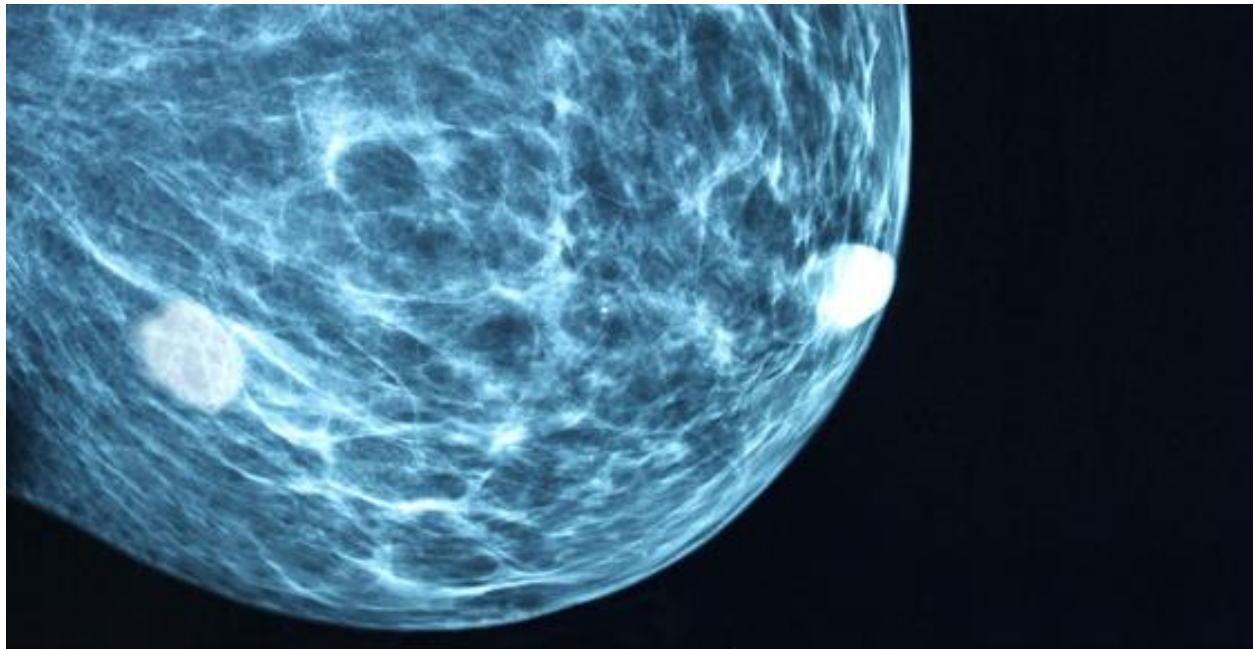
Here is Michele's mammogram.

Review Michele's mammogram and click on an area that shows abnormalities.

Correct! The area you clicked on indicates abnormal breast tissue.

Look at the abnormality in Michele's mammogram. Which of the objects is closest to the size of the abnormality?

Her physician spotted abnormal tissue during a routine mammogram. Michele has never had breast cancer before.

Correct! Yes, it is about the size of a pea.

Dr. You: Make a decision

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps:

Select Treatment
Next Test

Michele had a left breast biopsy. Let's evaluate the tissue.
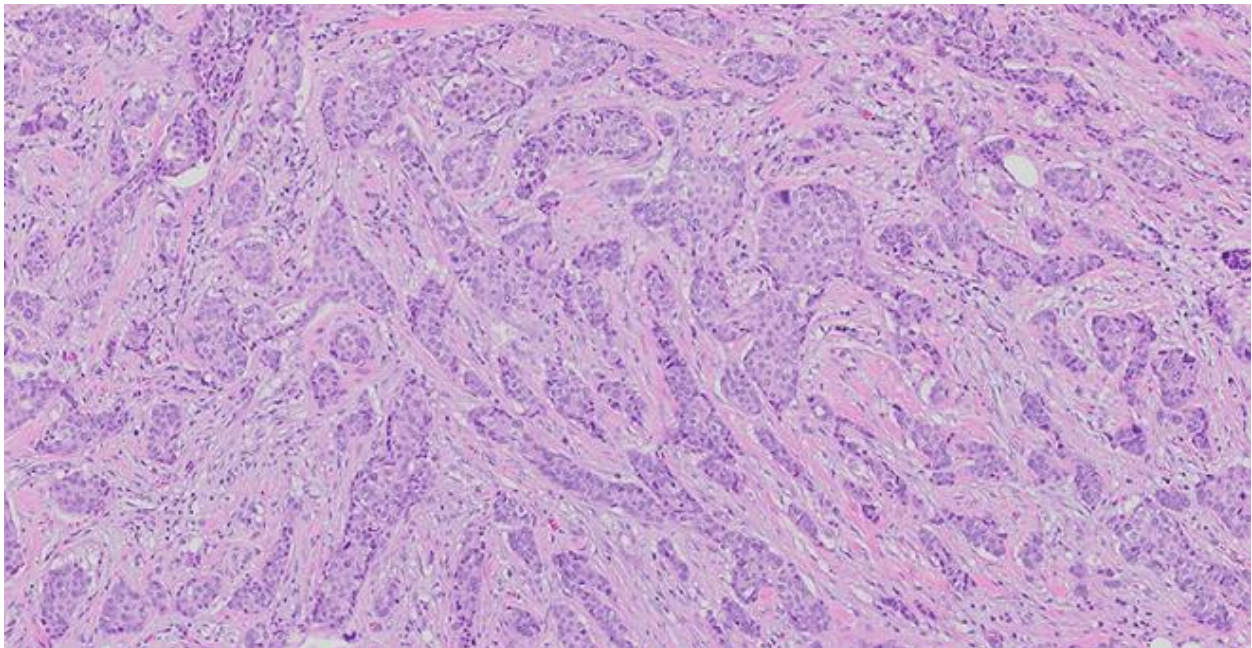
Does this tissue sample indicate the presence of cancer?

Here is important information about Michele's tissue sample. Be sure to record it in your Lab Handbook.

Specimen type: Left breast biopsy
Laterality: left
Tumor size: 1 cm

Yes, this tissue sample contains cancer cells. Based on the biopsy, Michele had a left breast lumpectomy and lymph node biopsy.

The pathologist examined Michele's tissue and has provided a pathology report.

Here is important information about Michele's tissue sample. Be sure to record it in your Lab Handbook.

Final Diagnosis: Infiltrating ductal carcinoma
Histologial Grade: 3
Stage: 1
Number of nodes examined: 2
Number of positive nodes: 0

Surgical Pathology Report – Preliminary
Patient: Michele Johnson
Medical Record #: 05684
Patient Age: 47 years old
Date of Procedure: June 1, 2016
Procedure: Left breast lumpectomy, lymph node biopsy
Specimen size: 5.2 cm (greatest dimension)
Laterality: Left
Tumor Size: 1 cm
Margins: no tumor at margin
Number of lymph nodes evaluated: 1
Number of lymph nodes with cancer: 0

Dr. You: Make a Decision

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

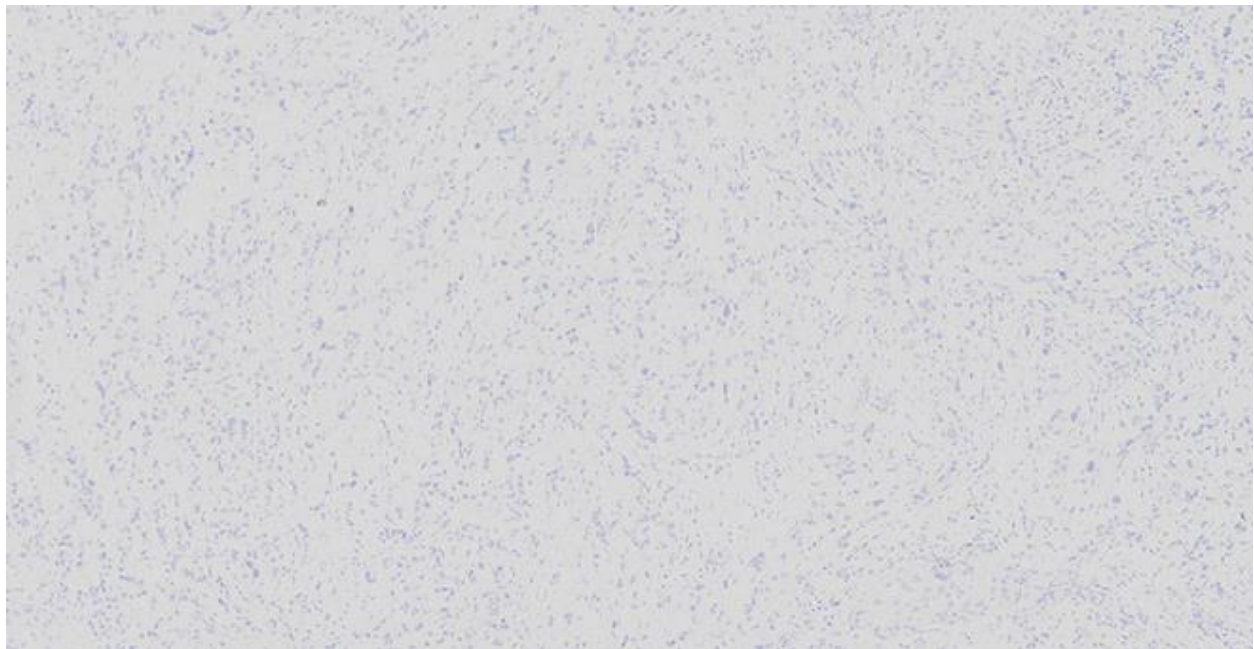## Michele's tissue sample has been sent for ER testing.

Click the microscope to conduct the ER Test.

Are Michele's ER test results positive or negative? Be sure to record this information in the Lab Handbook.

Specimen type: left breast biopsy
Laterality: left
Tumor size: 1 cm

Yes, Michele's tissue sample does not contain brown coloring. Her ER test is negative.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

Do you have enough information to make a recommendation for treatment or do you need additional information?

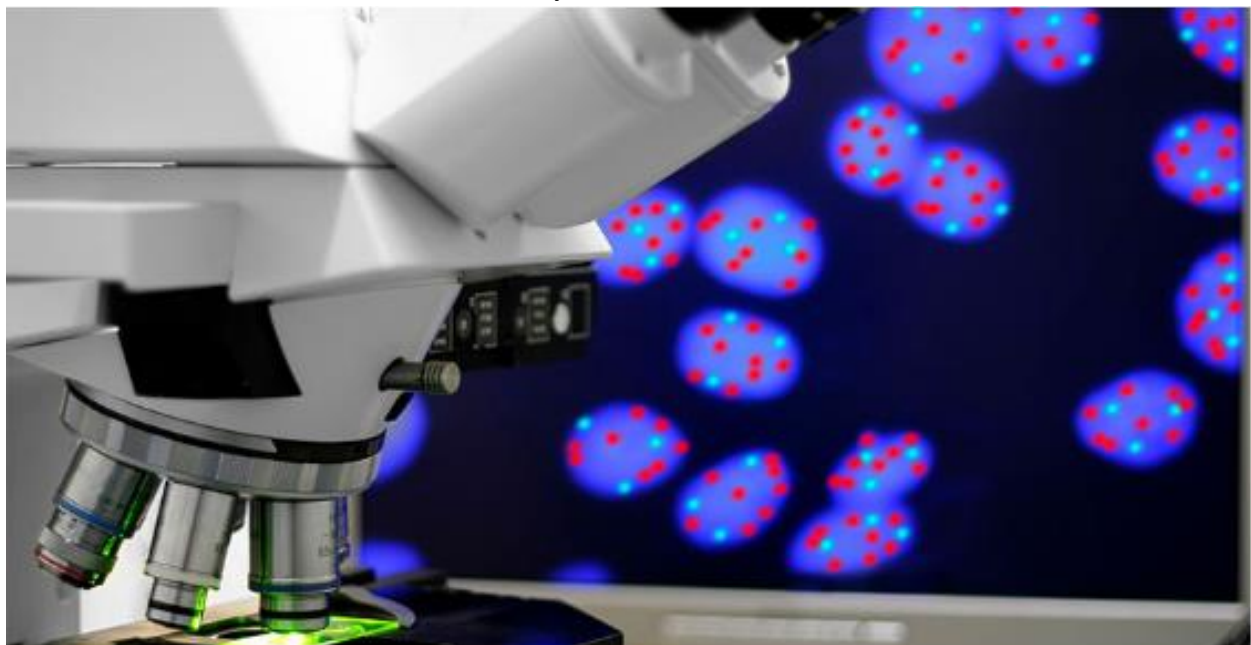Click below to make your selection for next steps.

Select Treatment
Next Test

Michele's tissue sample has been sent for HER2 FISH testing.

Click on the microscope to analyze Michele's tissue sample. Calculate the ratio of red dots to green dots.

Are the results amplified or not amplified?

Be sure to record the results in your Lab Handbook.

Yes, the ratio of red dots to green dots is greater than 2, so Michele's results are amplified.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

Select Treatment
Next Test

Use the notes from your Lab Handbook to recommend a personalized treatment plan for Michele Johnson.

Select one of the following options and review your patient's progress:

A: Hormone blocking therapy only
B: Hormone blocking therapy and chemotherapy
C: HHER2-targeted therapy and chemotherapy
D: Hormone blocking therapy, HER2-targed therapy, and chemotherapy

Answer: C
Based on Michele's test results, the recommended treatment is HER2-targed therapy and chemotherapy. As a result of HER2-targeted therapy and chemotherapy, Michele has not had a recurrence of her breast cancer. Success!

Patient No. 03 Brittany Featherston

Let's choose the next patient below and learn more about her.

In this segment of the Decoding Cancer Virtual Lab, you will evaluate Brittany's breast cancer and conduct tests to recommend a treatment plan.

Brittany Featherston is a 39-year old female. During her monthly self-breast exam, Brittany felt a lump in her left breast and immediately consulted her physician. Her physician ordered a mammogram.

As you progress through the Virtual Lab, be sure to record Brittany's test results and your notes in your Lab Handbook.

Here is Brittany's mammogram.

Her physician spotted abnormal tissue during a routine mammogram. Michele has never had breast cancer before.

Look at the abnormality in Michele's mammogram. Which of the objects is closest to the size of the abnormality?
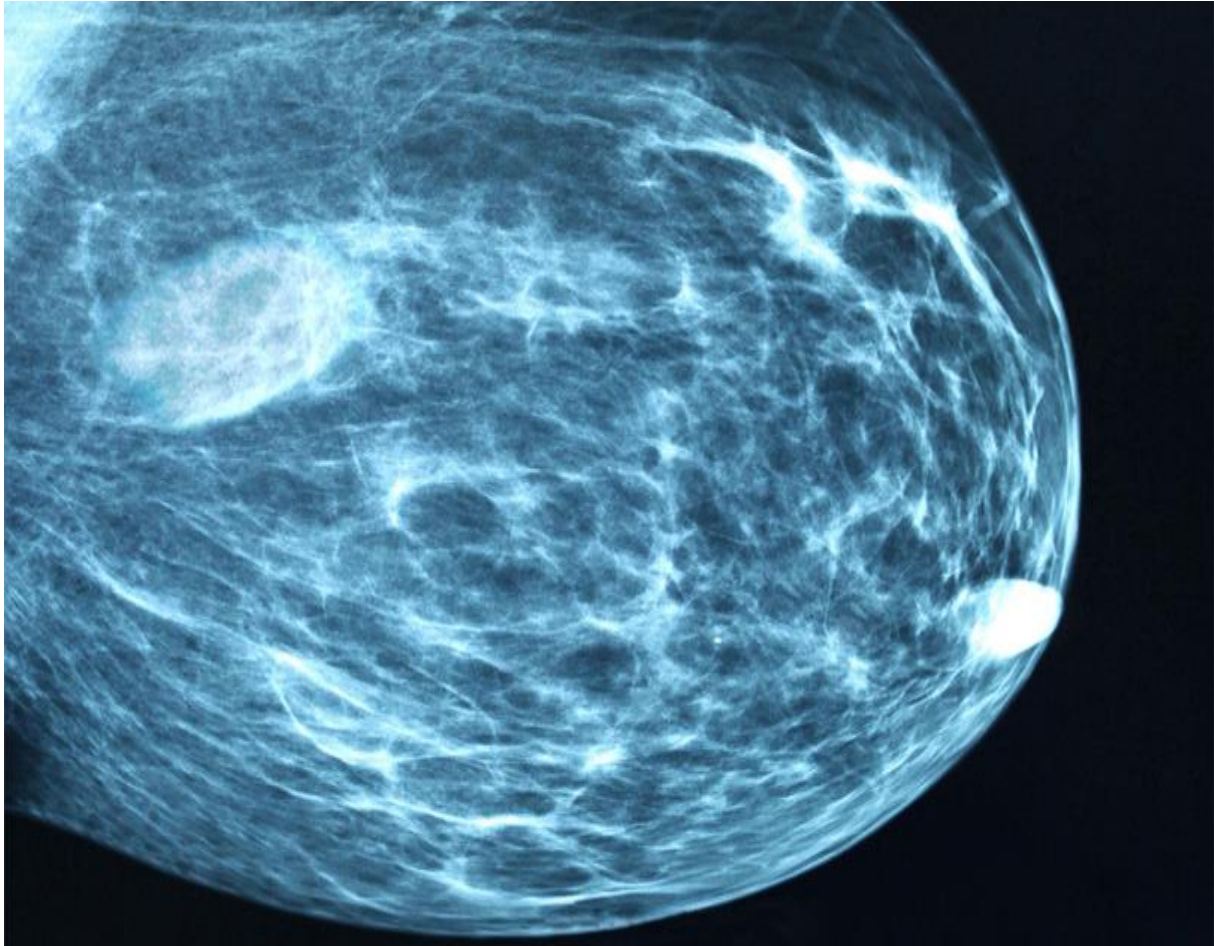
Yes, it is about the size of a walnut.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.
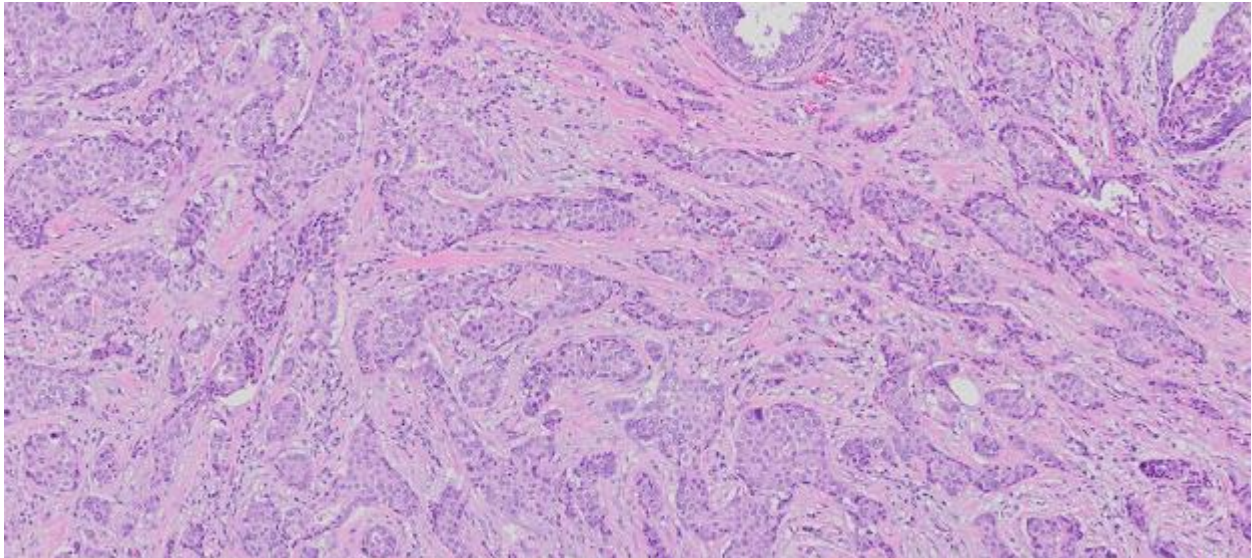
Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

Select Treatment
Next Test

Brittany had a left breast biopsy. Let's evaluate the tissue.

Does this tissue sample indicate the presence of cancer?

Here is important information about Brittany's tissue sample. Be sure to record it in your Lab Handbook.

Specimen type: Left breast biopsy
Laterality: Left

Tumor size: 3.5 cm

Yes, this tissue sample contains cancer cells. Based on the biopsy, Brittany has a left breast lumpectomy and lymph node biopsy.

The pathologist examined Brittany's tissue and has provided a pathology report.

Final diagnosis: Invasive ductal carcinoma
Histological Grade: 3
Stage: 2
Number of nodes examined: 5
Number of positive nodes: 0

Surgical Pathology Report – Preliminary
Patient: Brittnay Featherston
Medical Record #: 04523
Patient Age: 39 years old
Date of Procedure: July 10, 2016
Procedure: Left breast lumpectomy, lymph node biopsy
Specimen size: 5 cm (greatest dimension)
Laterality: Left
Tumor Size: 3.5 cm
Margins: no tumor at margin
Number of lymph nodes evaluated: 5
Number of lymph nodes with cancer: 0

Bes sure to record this information in your Lab Handbook.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

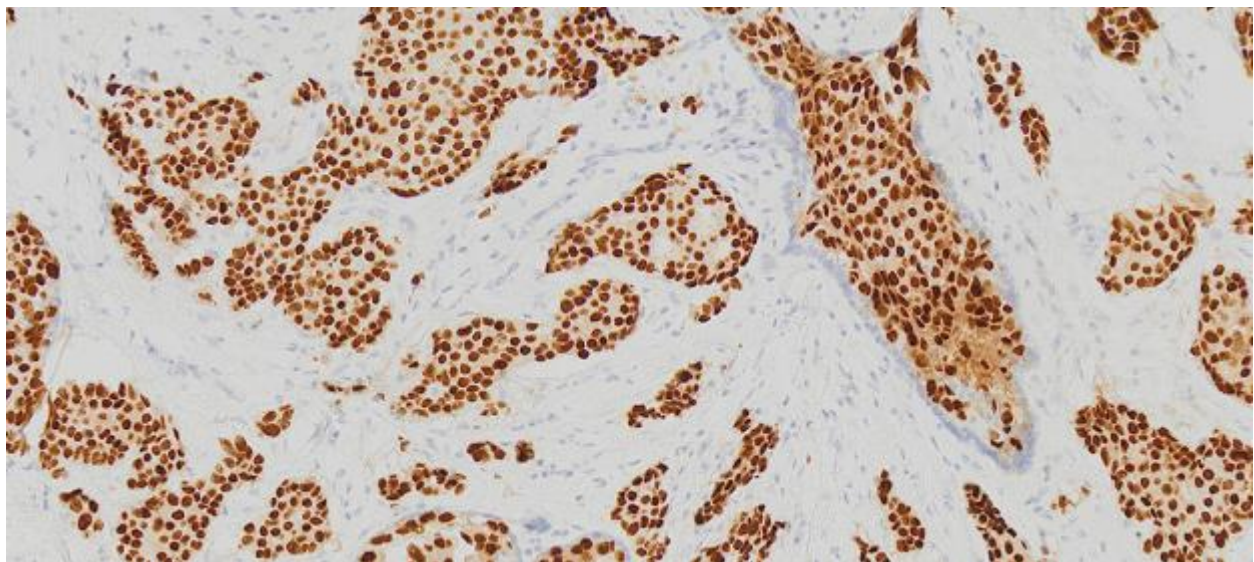Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

Select Treatment
Next Test

Brittany's tissue sample has been sent for ER testing.

Click the microscope to conduct the ER Test.

Are Brittany's ER test results positive or negative?

Be sure to record this information in the Lab Handbook.

Yes, Brittany's tissue sample contains brown coloring. Her ER test is positive.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.
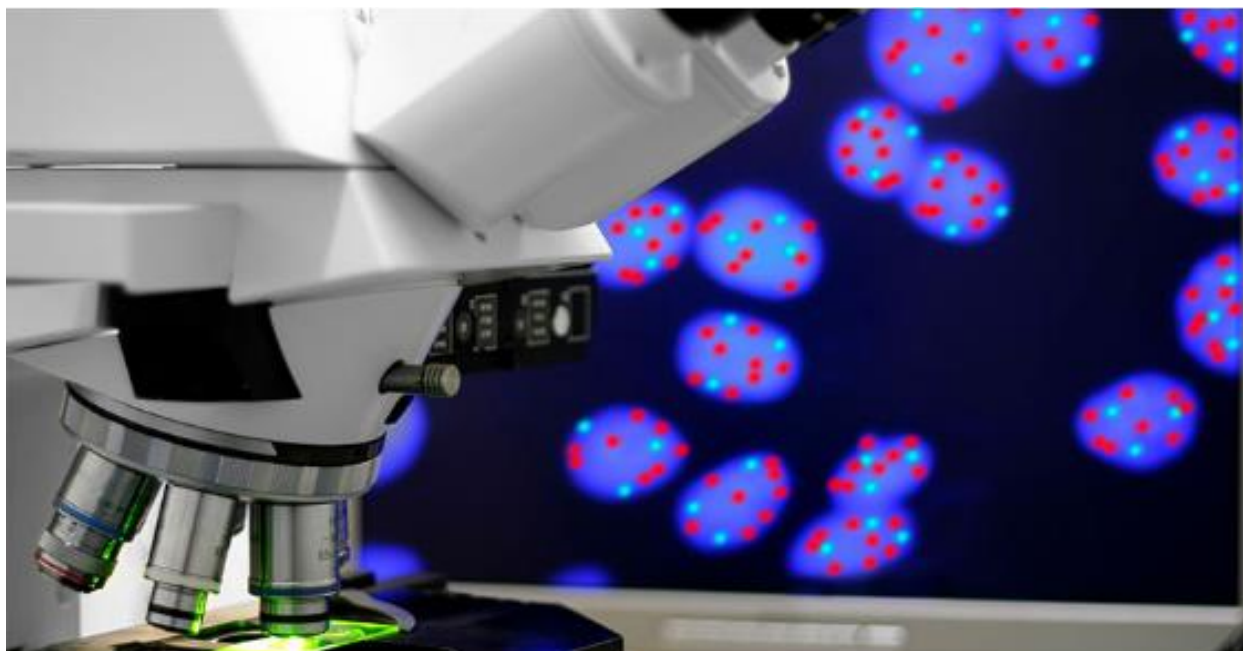
Select Treatment
Next Test

Brittany's tissue sample has been sent for HER2 FISH testing.

Click on the microscope to analyze Brittany's tissue sample. Calculate the ratio of red dots to green dots.

Are the results amplified or not amplified?

Be sure to record the results in your Lab Handbook.

Yes, the ratio of red dots to green dots is less than 2, so Brittany's results are not amplified.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

Select Treatment
Next Test

Click to send Brittany's tissue sample for OncoType DX testing.

Brittany's OncoType DX Test results are in!

Brittany Featherston's OncoType DX Test results: 35

Be sure to record the results in your Lab Handbook.

Dr. You: Make a decision

What are the implication of Michele's test results on her treatment plan? Record your thoughts in your Lab Handbook.

Do you have enough information to make a recommendation for treatment or do you need additional information?

Click below to make your selection for next steps.

Select Treatment
Next Test

Use the notes from your Lab Handbook to recommend a personalized treatment plan for Brittany Featherston.

Select one of the following options and review your patient's progress:

- Hormone blocking therapy only
- Chemotherapy followed by hormone blocking therapy
- HER2-targeted therapy and chemotherapy

- Hormone blocking therapy, HER2-targetd therapy, and chemotherapy

Answer: Based on Brittany's test results, the recommended treatment is hormone therapy and chemotherapy. As a result of hormone therapy and chemotherapy, Brittany has not had a recurrence of her breast cancer. Success!

Congratulations! You have completed the Decoding Cancer Virtual Lab!

As you have experienced in this lab, precision medicine reduces over-treatment and under-treatment of cancer. Precision medicine better defines options for treatment accounting for an individual's unique tumor characteristics and other patient factors.

This targeted approach offers particular promise in the treatment of breast cancer because it offers a more specific therapy with greater benefit and fewer side effects.

In keeping with the MoonShot initiative to cure cancer, a better understanding of the unique characteristics of each tumor will guide the development of more effective treatments of cancer patients. This strategy will one day allow us to win the war against cancer.