Multi-Course Case Studies in Health Sciences

MULTI-COURSE CASE STUDIES IN HEALTH SCIENCES

LAURA BANKS; BRENDA BARTH; ROBERT BALOGH; ADAM COLE; MIKA NONOYAMA; ELITA PARTOSOEDARSO; AND OTTO SANCHEZ

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Caption: OER Equal Love

Thank You!

Thank you to the students employed by the OE Lab for working hard to make this book a reality. Congratulations on your achievement!

Editors: Noopa Kuriakose, Pranjal Saloni, Shreya Patel

Project Managers: Rebecca Maynard, Sarah Stokes

About the Open Education (OE) Lab

Ontario Tech University is proud to host the OE Lab – a student-run, staff-managed group that brings content and technological expertise to the timely **creation of high quality OER that will be used directly in an Ontario Tech course by Ontario Tech students**.

If you adopt this book, you will be using a work created by students as an experiential learning and employment opportunity. Please let us know if you are using this work by emailing oer@ontariotechu.ca.

Family Tree

An interactive H5P element has been excluded from this version of the text. You can view it online here:
https://ecampusontario.pressbooks.pub/casestudieshealthsciences/?p=4#h5p-3

Legend

	Male
	Female
	Married
I, II, III	Roman numerals symbolize generations
	Adoption: brackets around the adopted individual. A dashed offspring line indicates the individual was adopted into the family.

Background

In 2020, our team of six (6) faculty collaborators Ontario Tech University received a Teaching Innovation Fund (TIF) grant to develop a multi-course approach to case-based learning in the health sciences. Case studies

may prepare students for their future careers by connecting theoretical concepts to community practice with the application of knowledge.

Our team has developed ten (10) interconnected, multidisciplinary cases exploring health and disease across the lifespan in an extended family living in Canada. These cases have been designed for use in multiple undergraduate courses to facilitate scaffolding of student knowledge with increasingly complex case analyses. This novel approach may enable students to apply critical knowledge from a biological, behavioural and sociological perspective into unified clinical situations. As students review the cases, several perspectives should be considered, including:

Biological Perspectives

- Normal anatomy and physiology
- Pathophysiology
- Growth, development, and aging

Behavioural Perspectives

- Health behaviours
- Mental health
- Health-related quality of life

Sociological Perspectives

- Social determinants of health
- Age
- Sex and gender
- Sexual orientation
- Race
- Cultural norms
- Intersectionality

Content Organization

These case studies have been organized with the following resources available for use:

1. Ten (10) multi-disciplinary case study readings and presentations
2. Academic content with links to peer-reviewed publications
3. Multimedia resources with links to online videos
4. Teaching notes (in progress)

CASE 1: JACK

JACK'S STORY

Case Study Downloads

- Meet Jack (PPT)
- Jack's Story (Single Slide) (PPT)
- Jack's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Human Anatomy and Physiology
- Human Pathophysiology/Altered Physiology
- Perspectives in Aging
- Mental Health and Disabilities

Jack's Story

In 1946, Ojibwe parents in Northwestern Ontario brought a son into the world. At the age 6 years he was forcibly removed from his home on the reserve and sent to a Residential school

run by a religious organization and given the name 'Jack'. The school focused on instruction in trades and agriculture. He was often subjected to harsh discipline, malnutrition, poor healthcare, physical, emotional, and sexual abuse, and the deliberate suppression of his culture and language.

Jack recalls that first day; he was loaded onto a bus and drove him to the school. He thought he was just going for a drive for a few hours and would be returning home. That first day after he arrived, he didn't know what was going on. They gave him clothes and a shower, it was difficult for him to stay there. His parents told him that he was going to a school, but Jack thought it was just going to be for the day, and he would be returning home to his parents and community. When allowed outside to play, the boys were segregated from the girls in the yard.

A typical day at the residential school consisted of waking up at about 6:00 a.m., having breakfast, taking a shower, and then going to church. He remembers praying more than going to school. In the early days when Jack spoke his own language, the teachers would pull his ear and hit him with a ruler. They would make him kneel down in the church as additional punishment for speaking his own language.

If he had stayed with his parents he would have been able to speak the language, understand them and their culture. However, the few times he returned to see his parents and community, he felt like an outsider, unable to understand the language, unable to communicate effectively with his family. Jack would describe his years at the Residential school as bad. It made him scared of regulations and rules. After Jack left the school, he was always getting in trouble with the police due to alcohol consumption. He would get picked up for being drunk and disorderly, and spend a few days in jail.

The thing Jack hated the most about his time at Residential school was the daily showers. They would dry the kids off, and rub powder all over them. Jack did not realize at the time that this was sexual abuse, he and his friends would laugh at teachers rubbing them.

He did not feel like he received a good education from the Residential school. When he first left, he lived on the streets. He found it difficult to gain employment, as his education lacked, and no one wanted to employ an "Indian". Jack persevered, eventually finding odd jobs over the years.

He worked as a farm-hand, in the local lumber yard, and finally got a permanent position working in the mine.

Based on the recorded story of Tim Antoine https://legacyofhope.ca/wherearethechildren/stories/

He met Mary in 1962 at the general store where she worked. He was away working in the mines for a few years, upon his return he rekindled his relationship with Mary and they married in 1969. Jack found a mining job close to home and worked there until he retired. Jack and Mary had two children. Mary attended church regularly with the children, however Jack refused to go with her as it brought back too many painful memories.

Jack often felt he had nothing to offer his children, he had lost his heritage years ago. Of Jack's two children, he is closest to his daughter Nancy. He encouraged her to play sports, took her fishing and hunting, these were things he felt comfortable doing. Jack's son, Phillip had no interest in any of these activities.

Jack worked hard to maintain the home that he has shared with his wife for almost 50 years. Over the last 5 years, Jack has been struggling with pain and numbness in his feet which has affected his ability to maintain his home. Jack started doing less and less as time went on due to the pain and numbness.

Jack was diagnosed with Type II diabetes mellitus just before he turned 50. Jack takes short-acting insulin with meals. Mary has been testing Jack's blood glucose levels and giving him his insulin injections routinely for the last 25 years.

A Turn of Events...

While Mary was in hospital for 7 days, Jack struggled with meal prep, testing his blood glucose

levels, and giving himself his insulin injections. As Mary's discharge from hospital approaches, it is decided that Jack and Mary will move in with Nancy and Paul.

A few days prior to Mary's discharge, Nancy travels up to the family home to help pack up what her mother and father will need while they stay at her house.

Nancy is shocked at the disrepair of her childhood home and the unkempt look of her father. Nancy quickly assesses that Jack is unwashed, appears to be slightly short of breath (SOB), limping slightly, and there is a strange odor coming from her father.

Jack admits that he has been struggling since Mary went into hospital. He has not been eating or managing his blood sugars and insulin well. He is also embarrassed to admit he has not bathed since Mary has gone due to his inability to access the bathtub safely on his own.

Nancy prepares lunch for Jack and checks his blood glucose levels (12.4 mmol/L). Nancy administers the required amount of insulin and eats their lunch.

After lunch, Nancy helps her father into the bathtub for a shower. Jack's SOB increases slightly with exertion, he states he feels like his heart is racing and he can't catch his breath. Nancy takes a radial pulse, and is pretty sure it is 130 BPM. Although Jack is embarrassed that Nancy is helping him, he allows her to help him undress and get into the tub.

As Jack's socks are removed, the odd odor increases. Nancy now sees the source of that odor, an open, oozing wound on her father's right foot. After Jack finished bathing, Nancy settled him with a snack and a cup of tea while she went to call his family doctor.

Upon hearing the circumstances Nancy had found her father in, the family physician told Nancy to bring her father into the emergency department of the local hospital. The physician called ahead to let the ED know Jack was coming.

Jack was seen by the emergency physician and diagnosed with new onset of atrial fibrillation. Jack was admitted with a referral to the cardiologist for the newly developed atrial fibrillation and the endocrinologist to provide appropriate care for Jack's Type II diabetes. A referral was sent for the wound-care nurse.

Medications

- Lovenox
- Propranolol: beta blocker
- Cardizem: calcium channel blocker

Nancy was now in a dilemma as both of her parents were in hospital. Her mother was due to be discharged the next day. The plan had been for Nancy to take both of her parents to stay with her while her mother recuperated. She needed to get home to her son, husband and her studies.

Nancy spoke with the discharge planner and explained the situation. Mary would be kept in hospital until Jack was ready for discharge. Nancy then drove back to Toronto, awaiting her parents discharge.

Four days after admission, Jack was ready for discharge. He had explicit discharge instructions for follow-up:

- Wound care nurse to come daily to change foot dressing and assess healing
- Blood sugar monitoring four times each day, values to be recorded
- Insulin to be adjusted based on blood sugars, and given by Nancy
- Medications to be taken as prescribed
- Follow-up appointments with cardiology and endocrinology in 4 weeks

Jack had now been in his daughter's house for a week and had noticed the tension between Nancy and her husband. He did not understand what was wrong with Sam, but could not help but think they should be able to return the sick child they had adopted, this is not what Nancy and Paul had signed up for.

He constantly felt like a burden with all the care he required and spent most of his time in the room that he and Mary shared. He was concerned about his wife's recovery and wished that they could just go home.

Since Mary has been ill, Jack has had time to contemplate his life. He felt that if he had not gone to Residential school, he would have been a very different person, and led a very different life.

The school took away his birthright, his culture and history. He stopped going back to the reserve to visit family shortly after he got married, as he felt like an outsider. Jack felt that he had let his children down, as he was not able to provide them with the rich heritage of the Ojibwe people.

Case Key Words

- Aboriginal
- Atrial Fibrillation
- Cardiovascular-Conduction
- Endocrine System
- Foot Ulcer
- Heart
- Indigenous
- Occupational Illness and Disease
- Pancreas
- Peripheral Circulation
- Peripheral Neuropathy
- Post-Traumatic Stress Disorder (PTSD)
- Residential Schools
- Type II Diabetes

RESIDENTIAL SCHOOLS AND THE EFFECTS ON INDIGENOUS HEALTH

Residential Schools: Background

Shingwauk Residential School, Sault Ste. Marie, Ontario

- Owned & operated by The Anglican Church of Canada
- Opened August 2nd, 1875
- New school opened October 3rd, 1935 & housed 140 pupils
- The school focused on teaching trades & agriculture

Jack was often subjected to:

- Harsh discipline
- Malnutrition
- Poor health

- Physical, emotional, and sexual abuse
- Deliberate suppression of his culture and language

Daily Schedule

5 AM	Bell rings; students rise, wash, & dress
5:30 AM	Breakfast, then prayers
6 – 9 AM	Boys work on farm; girls work in house
9 – 12 PM	School
12 – 1 PM	Lunch & recreation
1 – 3:30 PM	School
3:30 – 6 PM	Work on farm
6 PM	Dinner & prayers
Evening	Boys: school in winter; work on farm in summer Girls: learn needlework
9 PM	Bedtime

Effects on Indigenous Health

Personal or familial residential school attendance is related to health in a multitude of ways. People who attended residential schools generally feel their health or quality of life has been negatively impacted.

General health: poorer overall self-rated health, less likely to seek health care

Physical health: chronic health conditions and infectious diseases

Mental health and emotional well-being: mental distress, depression, addictive behaviour, substance misuse, stress, and suicidal behaviours

Web of Being: Determinants and Indigenous People's Health

Determinants of health can be conceptualized as either historical (distal) or contemporary (proximal). To understand the interconnectedness of these determinants and their combined influence on the general health of Indigenous peoples, one must look into the past.

Occupational Illness and Disease

Occupational health focused on the physical health – respiratory disease, the impact of noise, heat and vibration on the miners' health. A significant number of miners are experiencing high levels of stress, anxiety, and depression (Centre for Research in Occupational Safety and Health).

JACK'S HEALTH: TYPE II DIABETES MELLITUS

Jack was diagnosed with type II diabetes mellitus (DM) just before he turned 50 years of age.

Signs and Symptoms

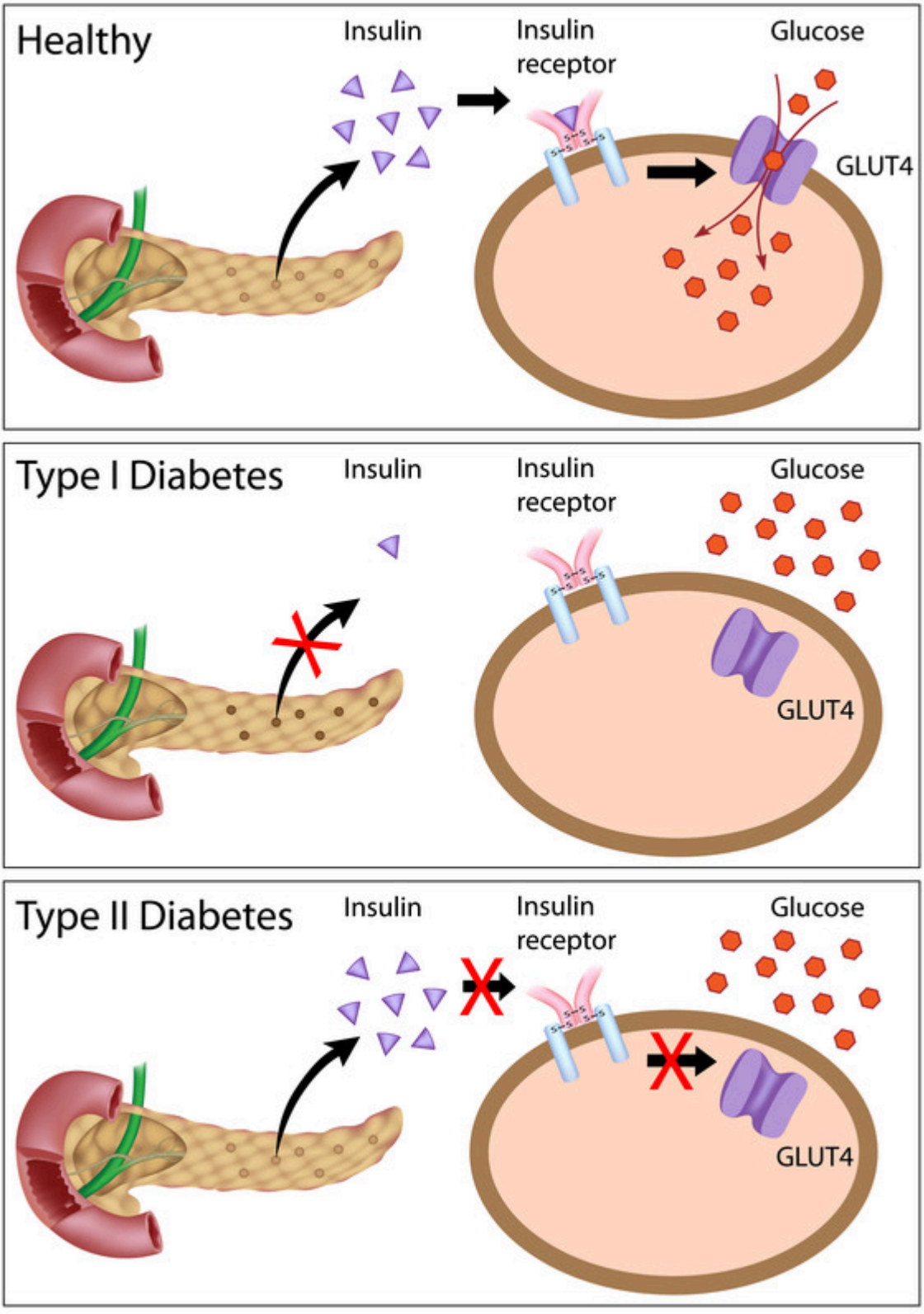
Signs and symptoms of type II DM often develop slowly. You can live with type II DM for years and not know it. When signs and symptoms are present, they include:

- Increased thirst
- Frequent urination
- Increased hunger
- Unintended weight loss
- Fatigue
- Blurred vision
- Slow-healing sores
- Frequent infections
- Numbness or tingling in hands or feet
- Areas of darkened skin, usually in the armpits & neck

Causes

Type II DM is primarily the result of two interrelated problems:

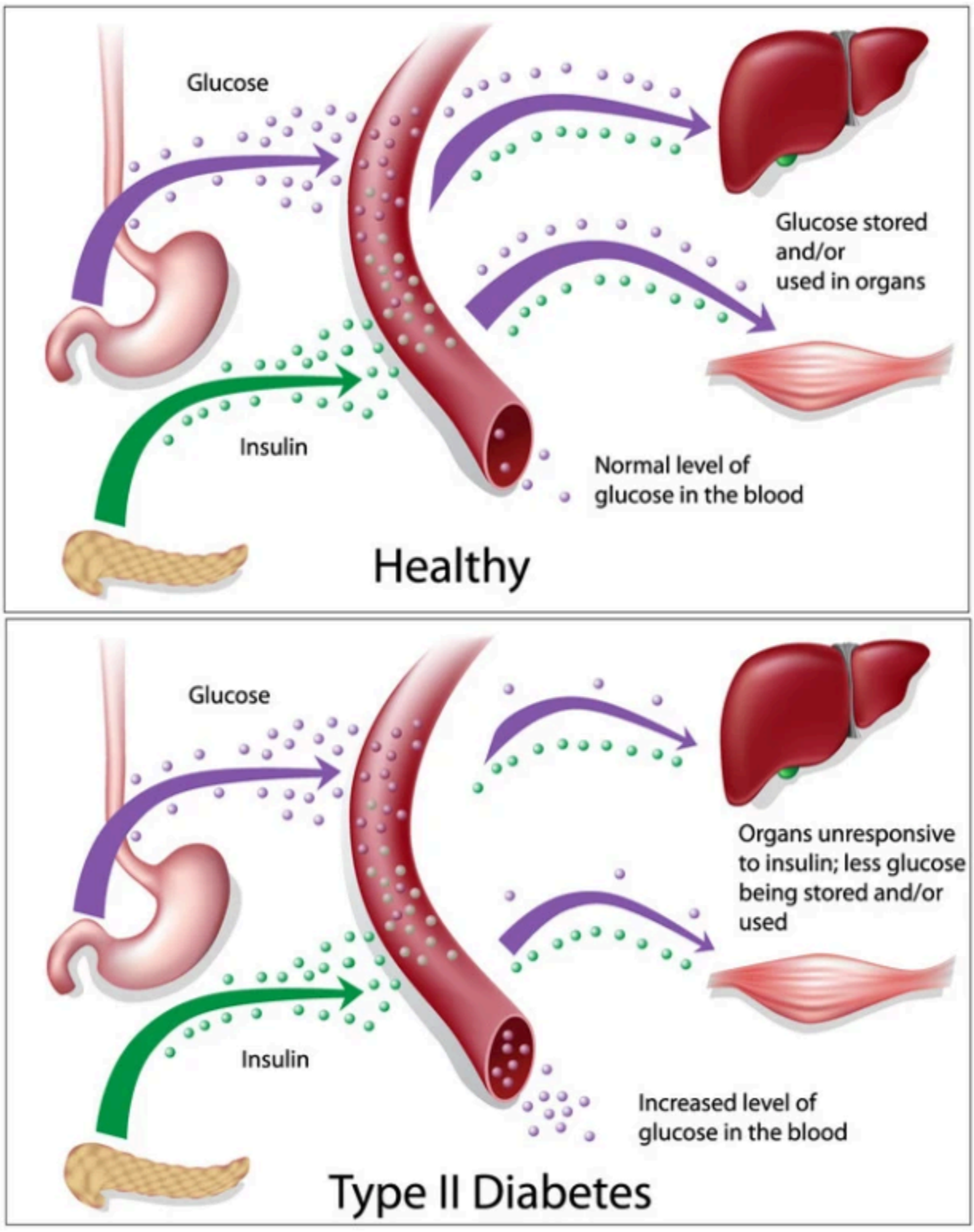
- Cells in muscle, fat, and the liver become resilient to insulin.
- Because these cells don't interact in a normal way with insulin, they don't take in enough sugar.
- The pancreas is unable to produce enough insulin to manage blood sugar levels.


Healthy
Insulin
Insulin receptor
Glucose
GLUT4
Type I Diabetes
Insulin
Insulin receptor
Glucose
GLUT4
Type II Diabetes
Insulin
Insulin receptor
Glucose
GLUT4

How Insulin Works

Insulin is a hormone that comes from the pancreas and regulates how the body uses sugar in the following ways:

- Sugar in the bloodstream triggers the pancreas to secrete insulin
- Insulin circulates in the bloodstream, enabling sugar to enter the cells
- The amount of sugar in the bloodstream drops
- In response to this drop, the pancreas releases less insulin


Glucose
Glucose stored and/or used in organs
Insulin
Normal level of glucose in the blood
Healthy
Glucose
Organs unresponsive to insulin; less glucose being stored and/or used
Insulin
Increased level of glucose in the blood
Type II Diabetes

Type	Examples	Appearance	Onset	Peak	Duration
Rapid-acting	Apidra (insulin glulisine)	Clear	10-15 mins	1-1.5 hrs	3.5-5 hrs
	Fiasp (faster-acting insulin aspart)	Clear	4 mins	0.5-1.5 hrs	3-5 hrs
	Humalog (insulin lispro)	Clear	10-15 mins	1-2 hrs	3-4.75 hrs
	NovoRapid (insulin aspart)	Clear	9-20 mins	1-1.5 hrs	3-5 hrs
Short-acting	Entuzity (insulin regular)	Clear	15 mins	4-8 hrs	17-24 hrs
	Humulin R, Novolin ge Toronto (insulin regular)	Clear	30 mins	2-3 hrs	6.5 hrs
Long-acting	Basaglar (insulin glargine biosimilar)	Clear	1.5 hrs	Does not apply	24 hrs
	Lantus (insulin glargine U-100)	Clear	1.5 hrs	Does not apply	24 hrs
	Levemir (insulin detemir U-300)	Clear	1.5 hrs	Does not apply	16-24 hrs
	Toujeo (insulin glargine U-300)	Clear	1.5 hrs	Does not apply	Up to 30 hrs
	Tresiba (degludec)	Clear	1.5 hrs	Does not apply	42 hrs

Insulin Mixtures

For convenience, there are premixed rapid- and intermediate-acting insulin. The insulin will start to work as quickly as the fastest-acting insulin in the combination. It will peak when each type of insulin typically peaks, and it will last as long as the longest-acting insulin.

Examples include:

- 30% regular and 70% NPH (Humulin 30/70, Novolin ge 30/70)
- 50% lispro and 50% lispro protamine (Humalog Mix 50)
- 25% lispro and 75% lispro protamine (Humalog Mix 25)
- 30% aspart and 70% aspart protamine (NovoMix 30)

The Role of Glucose

Glucose – a sugar – is a main source of energy for the cells that make up muscles and other tissue. The use and regulation of glucose includes the following:

- Glucose comes from 2 major sources: food and the liver
- Glucose is absorbed into the bloodstream, where it enters cells with the help of insulin
- The liver stores and makes glucose
- When glucose levels are low, the liver breaks down stored glycogen into glucose

In type II DM, this process does not work well. Sugar does not enter the cells, builds up in bloodstream. The beta cells in the pancreas release more insulin. Eventually these cells become impaired.

In type I DM, the immune system mistakenly destroys the beta cells, leaving the body with little to no insulin.

Risk Factors

Weight – being overweight or obese is a main risk

Fat distribution – storing fat mainly in the abdomen (men waist >40 inches, women waist >35 inches)

Inactivity – physical activity keeps weight done, and uses up glucose as energy, makes cells more sensitive to insulin

Family history – increases if parent or sibling has type II DM

Race and ethnicity – Black, Hispanic, Indigenous, Asian, Pacific Islanders

Blood lipid levels – increased risk associated with love levels of HDL cholesterol and high levels of triglycerides

Age – increases with age, especially after age 45

Prediabetes – blood sugars higher than normal, but not high enough to be classified as diabetes, if left untreated often progresses to type II DM

Pregnancy-related risks – increases if you develop gestational diabetes or if you give birth to a baby weighing > 9 pounds

Polycystic ovary syndrome – common condition characterized by irregular menstrual periods, excess hair growth and obesity-increases the risk of diabetes

Complications and Frequent Comorbidities

Heart and blood vessel disease – increase risk of heart disease, stroke, hypertension, and atherosclerosis

Neuropathy in limbs – overtime nerves are destroyed, resulting in tingling, numbness, burning pain or eventual loss of feeling. Begins at tips of toes or fingers and gradually spreads

Other nerve damage – damage to heart nerves can contribute to irregular heart rhythms. Digestive nerve damage may lead to nausea, vomiting, diarrhea or constipation. Men, erectile dysfunction.

Kidney disease – may lead to irreversible end-stage kidney disease

Eye damage – cataracts and glaucoma, may damage the blood vessels in the retina

Skin conditions – more susceptible to bacterial and fungal infections

Slow healing – cuts and blisters can become seriously infected, severe damage might require amputation

Hearing impairment

Sleep apnea – obstructive sleep apnea is common, obesity may be the main contributing factor. Not clear if treating sleep apnea improves blood sugar control

Dementia – seems to increase risk of Alzheimer's disease and other dementia disorders. Poor blood sugar control linked to more-rapid decline in memory and thinking skills

Prevention

- Monitor and/or lower blood pressure and cholesterol
- 30 minutes of activity per day five days per week helps lower risk of developing type II diabetes by 58%
- Eat a healthy diet, including less fats, more fiber, whole grains, veggies, fruits, lean meats
- Manage weight and BMI

JACK'S HEALTH: DIABETIC FOOT ULCERS

Jack's Story Continues

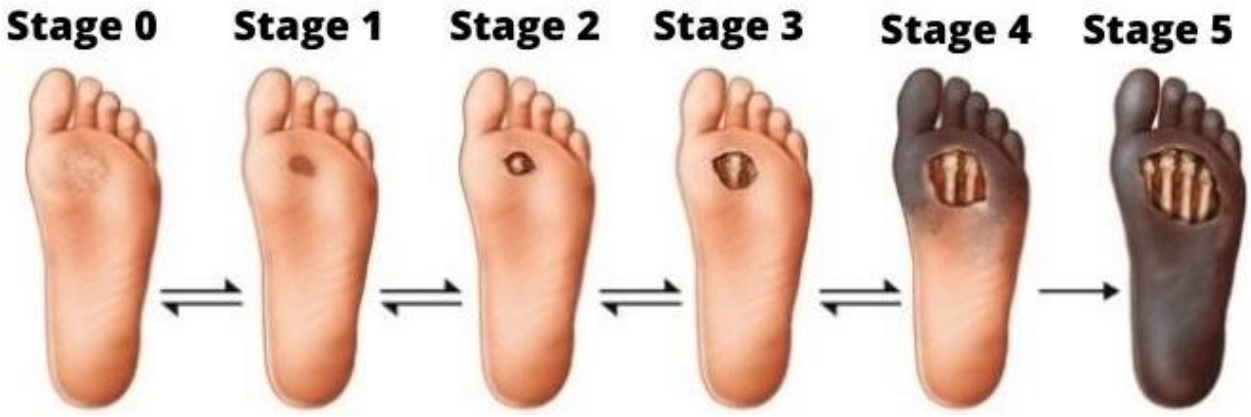
- Jack is found by his daughter unkempt, SOB, limping slightly, and has a strange odor coming from him
- States he has not been eating or managing his blood sugars and insulin well
- Has not bathed since his wife went to hospital (unable to access the bathtub safely)
- Blood glucose level is 12.4 mmol/L
- Heart rate 130 BPM
- Daughter finds an open, oozing wound on Jack's foot

Symptoms and Diagnosis

Wagner Ulcer Classification System:

- 0: no open lesions, may have healed lesion
- 1: superficial ulcer without penetration to deeper layers

- 2: deeper ulcer, reaching tendon, bone, or joint capsule
- 3: deeper tissues involved, with abscess, osteomyelitis, or tendonitis
- 4: gangrene in a portion of forefoot or heel
- 5: extensive gangrenous involvement of the entire foot



Causes

Poor circulation – blood does not flow to feet efficiently, also making ulcers more difficult to heal

Hyperglycemia – can slow healing process

Nerve damage – tingling and pain, decrease or loss of feeling

Irritated or wounded foot – reduced sensitivity results in painless wounds

Wearing inappropriate footwear – may be significant in wound progression

Treatment

Treatment primarily depends on the stage of the ulcer. Essential to start treatment as soon as possible – helps prevent infection and provides better results sooner

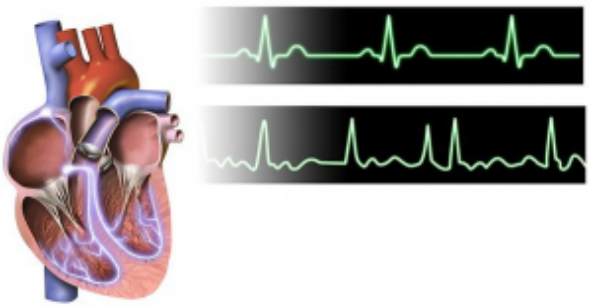
- Antibiotics if applicable (C&S of wound site)
- Shoes designed for individuals with DM
- Debridement
- Foot baths
- Disinfecting the skin around the ulcer
- Keeping the ulcer dry with frequent dressing changes
- Dressings containing calcium alginates to inhibit bacterial growth
- Surgical procedures – shave bone or removing foot abnormalities (bunions or hammertoes)
- Other treatment options ineffective – amputation

Prevention

- Washing feet every day
- Keeping toenails adequately trimmed, but not too short
- Keeping feet dry and moisturized
- Changing socks frequently
- Seeing a podiatrist for corn and callus removal
- Wearing proper-fitting shoes

JACK'S HEALTH: ATRIAL FIBRILLATION

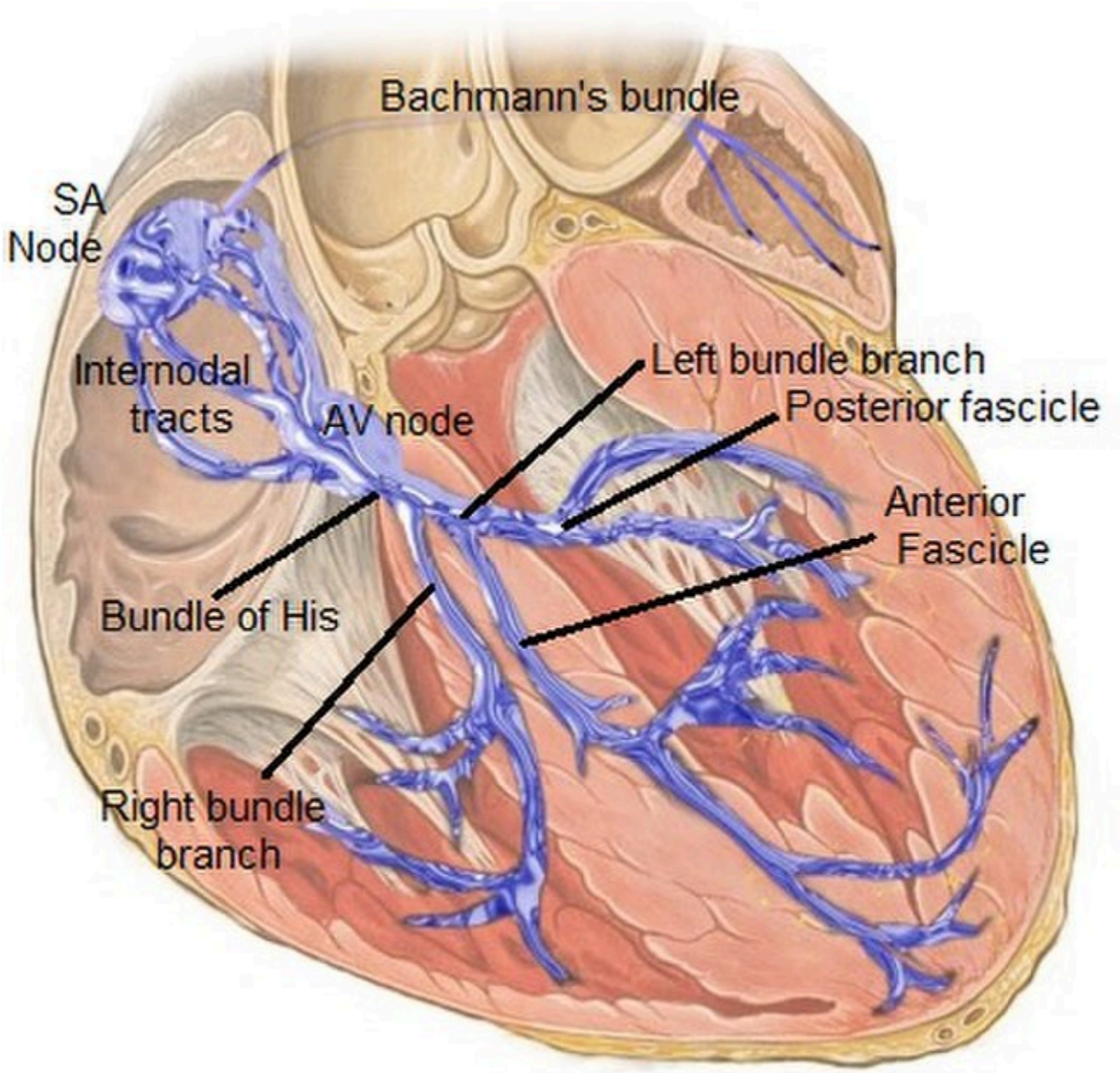
Jack's Story Continues



- Jack is found by his daughter unkempt, SOB, limping slightly, and has a strange odor coming from him
- States it feels like his heart is racing and he can't catch his breath
- Radial pulse 130 BPM (irregular)
- Jack is taken to the emergency department as per his family physician's recommendation
- Jack is diagnosed with new onset of atrial fibrillation
- Admitted to hospital with a cardiologist and endocrinologist referral

Overview

In a normal heart rhythm, a tiny cluster of cells at the sinus node sends out an electrical signal. The signal then travels through the atria to the atrioventricular (AV) node and passes into the ventricles, causing them to contract and pump out blood. In atrial fibrillation, electrical signals fire from multiple locations in the atria (typically pulmonary veins), causing them to beat chaotically. Since the atrioventricular (AV) node doesn't prevent all of these chaotic signals from entering the ventricles, your heart will beat faster and more irregularly than normal.



Atrial Fibrillation

- Irregular and often rapid heart rate
- Can increase risk of stroke, heart failure, other heart-related complications
- The two atria beat chaotically and irregularly – out of coordination with the two ventricles
- Episodes may come and go, or does not go away requiring treatment
- Is not life-threatening but a serious medical condition that may require emergency treatment
- Major concern is the potential to develop blood clots in the atria
- These clots may circulate to other organs and lead to ischemia
- May weaken the heart and lead to heart failure

Atrial fibrillation may be:

Occasional – paroxysmal A-fib comes and goes, usually lasting for a few minutes to hours. May last up to a week and happen repeatedly.

Persistent – heart rhythm does not go back to normal on its own. Will need treatment; medication or electrical shock to restore normal heart rhythm.

Long-standing persistent – continuous and lasts longer than 12 months.

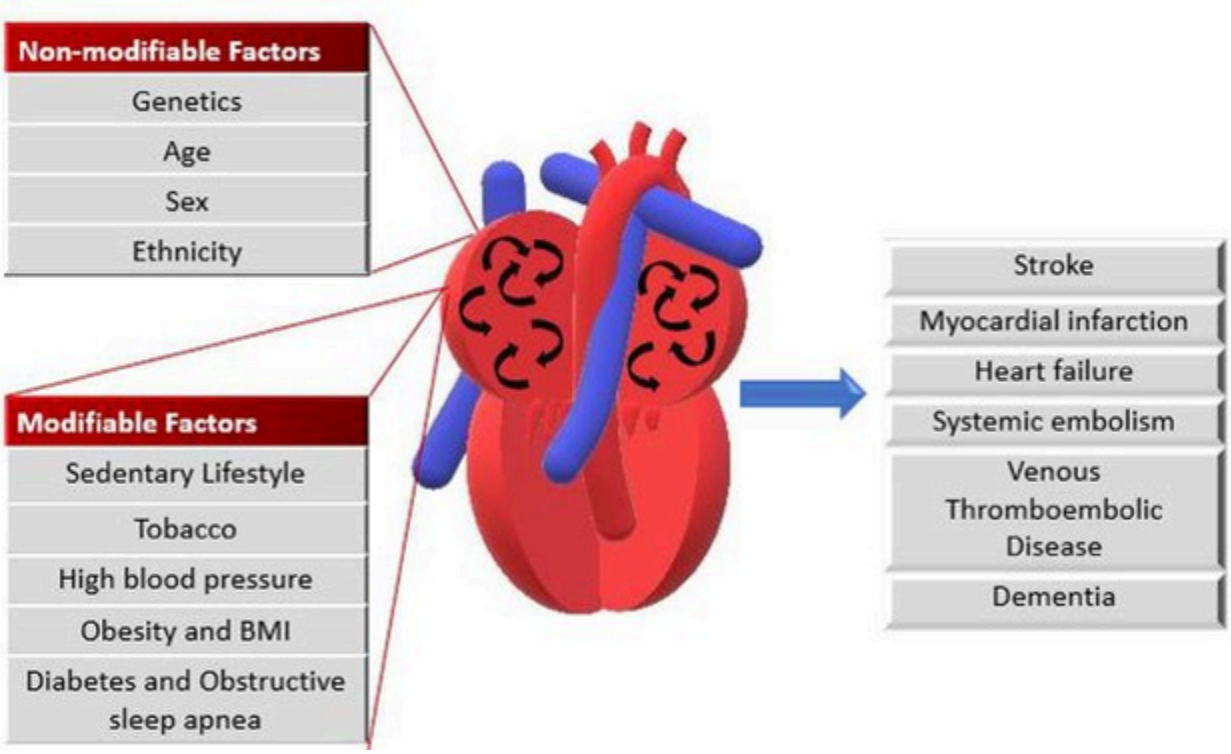
Permanent – normal heart rhythm cannot be restored. Requires medication to control heart rate and to prevent clots.

Symptoms

- Palpitations, sensations of a racing, uncomfortable, irregular heartbeat or a 'flip-flopping' in the chest
- Weakness
- Reduced ability to exercise
- Fatigue
- Lightheadedness
- Dizziness
- Shortness of breath
- Chest pain

Possible Causes

Abnormalities or damage to the heart's structure are the most common cause of A-fib.



Possible causes of A-fib include:

- High blood pressure
- Heart attack
- Coronary artery disease
- Abnormal heart valves
- Heart defects (congenital)
- Overactive thyroid gland or other metabolic imbalance
- Exposure to stimulants – medications, caffeine, tobacco, alcohol
- Sick sinus syndrome – improper functioning of the heart's natural pacemaker
- Lung diseases
- Previous heart surgery
- Viral infections
- Stress due to surgery, pneumonia or other illnesses
- Sleep apnea

Management

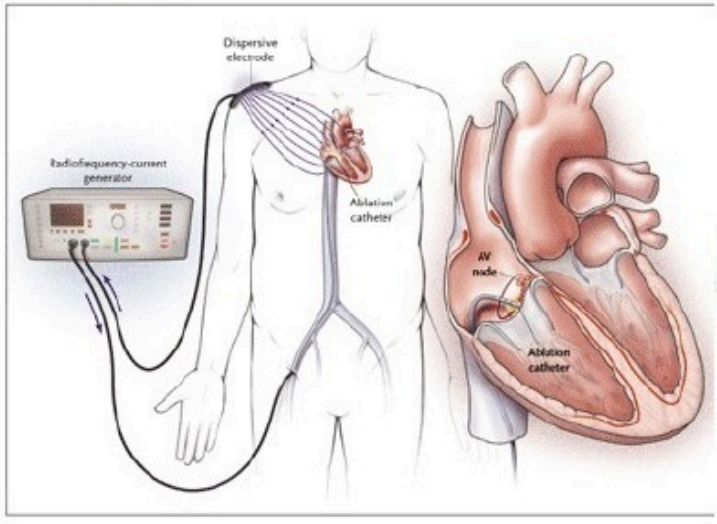
Treatment with Medication

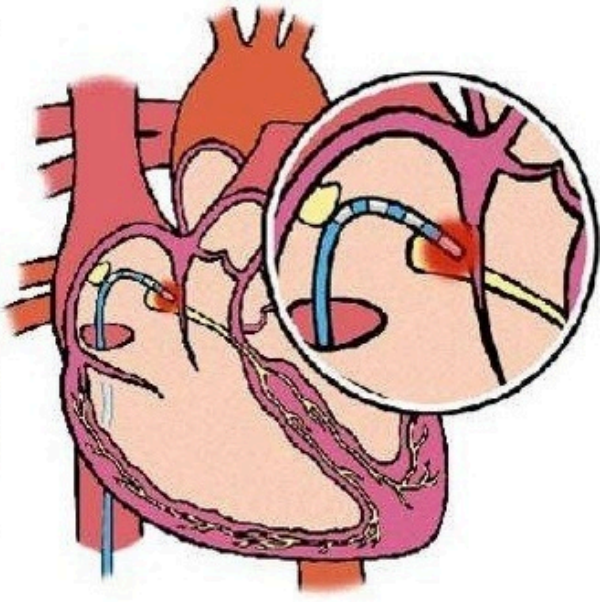
Rate Control Medications	Rhythm Control Medications
Beta blockers (Metroprolol or Bisoprolol)	Amiodarone (Cordarone)
Calcium channel blockers (Diltiazem)	Dronedarone (Multaq)
Cardiac glycosides (Digitalis)	Flecainide (Tambocor)
	Propafenone (Rythmol)
	Sotalol (Sotacor)

Procedures for Rhythm Control

Electrical Cardioversion – delivering a shock to the heart, like defibrillation but a smaller amount of electricity. Cardioversion is a short-term solution. In most patients, the A-fib comes back.

Catheter Ablation – inserting thin wires into the veins in your groin or neck. The tip of the wire is directed towards the area in your heart that is firing irregular impulses. Once in position, a small jolt of radiofrequency electrical current is delivered to burn out the tiny areas.





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Video Resources

Atrial fibrillation

Diabetic foot ulcers

How do your hormones work?
Normal cardiovascular function
PTSD
What does the pancreas do?
What happens during a stroke?

Additional Resources

Legacy of Hope Foundation
The Residential School System
Types of Insulin

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Feedback

Instructor feedback

Student feedback

CASE 2: MARY

MARY'S STORY

Case Study Downloads

- Meet Mary (PPT)
- Mary's Story (Single Slide) (PPT)
- Mary's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Human Anatomy and Physiology
- Human Pathophysiology/Altered Physiology
- Health Research
- Perspectives in Aging
- Mental Health and Disabilities

Mary's Story

Mary was born in 1948 in a small rural town in northern Ontario. After finishing grade eight, she

went to work at the local general store to help her family out financially. Jack came into the store once a month when he got paid. Mary and Jack struck up a friendship and later got married.

The early years of their marriage were tough. Mary sensed that Jack had many 'ghosts' from his past, which he never spoke of. The few times Mary and Jack went to visit his family, she never felt comfortable or had the feeling that she or Jack were accepted. When she asked Jack about this, he refused to talk about it. So Mary settled into their marriage and worked hard at making a home for her husband and children. They had two children, Phillip and Nancy.

Five years after they got married, Mary and Jack could finally afford to buy their own home. It was a lovely two-story home, with three bedrooms and one bathroom on the second floor. It had a nice big backyard with lots of gardens, which Mary loved to tend. This home was Mary's pride and joy, and a source of many happy memories for her: this is where she raised her children, took care of her husband, and entertained her lady friends from church. Mary was happy in life as a stay-at-home mother and housewife.

Over the last few years, Mary has been having difficulties with maintaining their home both inside and out. Mary has been slowing down with her indoor and outdoor activities due to joint pain and stiffness. Both of her children have moved far away, and Jack has health issues which affect how much he is able to help Mary with the upkeep of their home.

In 2012, Mary went to see her family physician because the OTC medications she had been taking were no longer relieving her joint pain and stiffness. After a thorough physical examination and some diagnostic tests, Mary was diagnosed with Stage 4 osteoarthritis (OA) and osteoporosis (OP).

Mary's OA was affecting her mobility and her ability to perform basic activities of daily living (ADLs). Jack assisted Mary as much as possible, but was having some difficulties with his own

ADLs. Jack would assist Mary downstairs in the morning. Mary wore an incontinence product as she was unable to get up the stairs to the bathroom in time.

Due to the pain Mary was having from her OA and OP, her physician prescribed hydrocodone for the pain. By 2018, Mary was having increased difficulty with mobility and required a walker. She seldom left the house anymore as getting around proved to be challenging. She missed gardening, going to church, and visiting with her friends.

In the spring of 2018, she experienced a fall in the bathroom, resulting in a fractured right hip. Surgical intervention was required, and Mary had a total right hip arthroplasty. The plan upon discharge from the hospital was that Mary and Jack would move in with Nancy and Paul in the GTA. Mary's hospital stay was extended due to Jack's hospitalization.

The weeks that followed Mary's discharge and subsequent move to her daughter's home saw Mary become more withdrawn, often spending the day in her pajamas, unwashed and distant from those around her. Mary is struggling with the many changes happening in her and Jack's life.

Case Key Words

- Bone
- Depression
- Elder fall
- Fractured hip

- Hip replacement
- Joint
- Mixed marriage
- Opioids
- Osteoarthritis
- Osteoporosis

MARY'S HEALTH: OSTEOARTHRITIS (OA)

Mary was diagnosed with Stage 4 osteoarthritis (OA) and osteoporosis(OP) in 2012.

Diagnosis

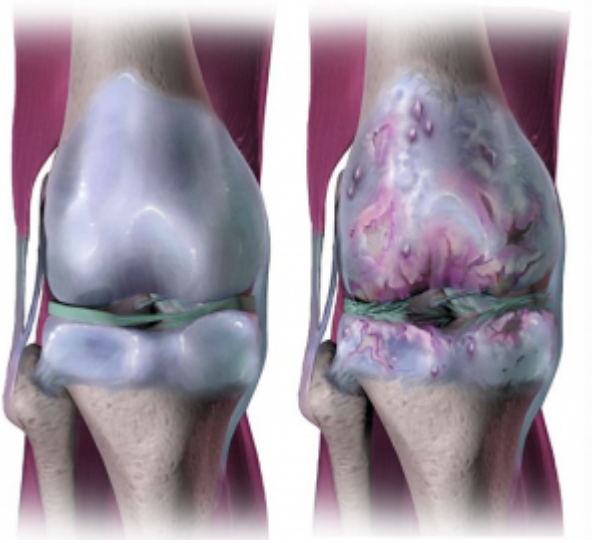
- Physical examination checks affected joints for tenderness, swelling, redness, and flexibility
- Imaging tests
- X-ray
- Magnetic resonance imaging
- Bone densitometry
- Lab tests
- Blood tests
- Joint fluid analysis

Hand	Hip
• Pain on ROM • Hypertrophic changes at distal and proximal interphalangeal joints (Heberden nodes-1 & Bouchard nodes-2) • Tenderness over carpometacarpal joint of thumb	• Pain on ROM • Pain in buttock • Limitation of ROM, especially internal rotation
Shoulder	**Foot**
• Pain on ROM • Limitation of ROM, especially external rotation • Crepitus on ROM	• Pain on ambulation, especially at 1st metatarsophalangeal joint • Limited ROM of 1st metatarsophalangeal joint, hallux rigidus • Hallux valgus deformity
Knee	**Spine**
• Pain on ROM • Joint effusion • Crepitus on ROM • Presence of popliteal cyst (Baker cyst) • Lateral instability • Valgus or Varus deformity	• Pain on ROM • Limitation of ROM • Lower extremity sensory loss, reflex loss, motor weakness (nerve root impingement) • Pseudoclaudication (spinal stenosis)

Overview

- Called degenerative joint disease
- Most common form of arthritis
- Affecting millions of people worldwide
- Occurs when the protective cartilage that cushions the ends of the bones wears down over time
- Can damage any joint
- Most commonly affects joints in hands, knees, hips & spine
- OA can cause pain, stiffness & swelling
- Can cause reduced function & disability

4 Stages of Osteoarthritis



Stage 1 – Minor

- Very minor wear & tear and bone spurs, unlikely to feel pain or discomfort
- Treatment-supplements (glucosamine & chondroitin), regular exercise

Stage 2 – Mild

- Noticeable bone spurs on x-ray, stiffness and discomfort
- Treatment-OTC pain medications, stricter exercise routine

Stage 3 – Moderate

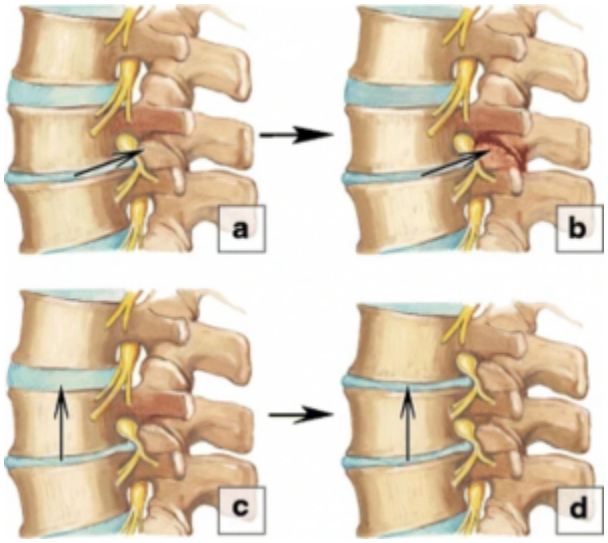
- Cartilage is affected, narrow gap between bone and joint
- Joint becomes inflamed, discomfort with ADLs
- OTC pain medication or prescription pain medications, hyaluronic injections

Stage 4 – Severe

- Cartilage is almost completely gone, bone spurs have multiplied, very painful
- Inflammatory response from the joint
- OTC pain medication or prescription pain medications, hyaluronic injections
- Bone realignment surgery for knee & hip

X-rays

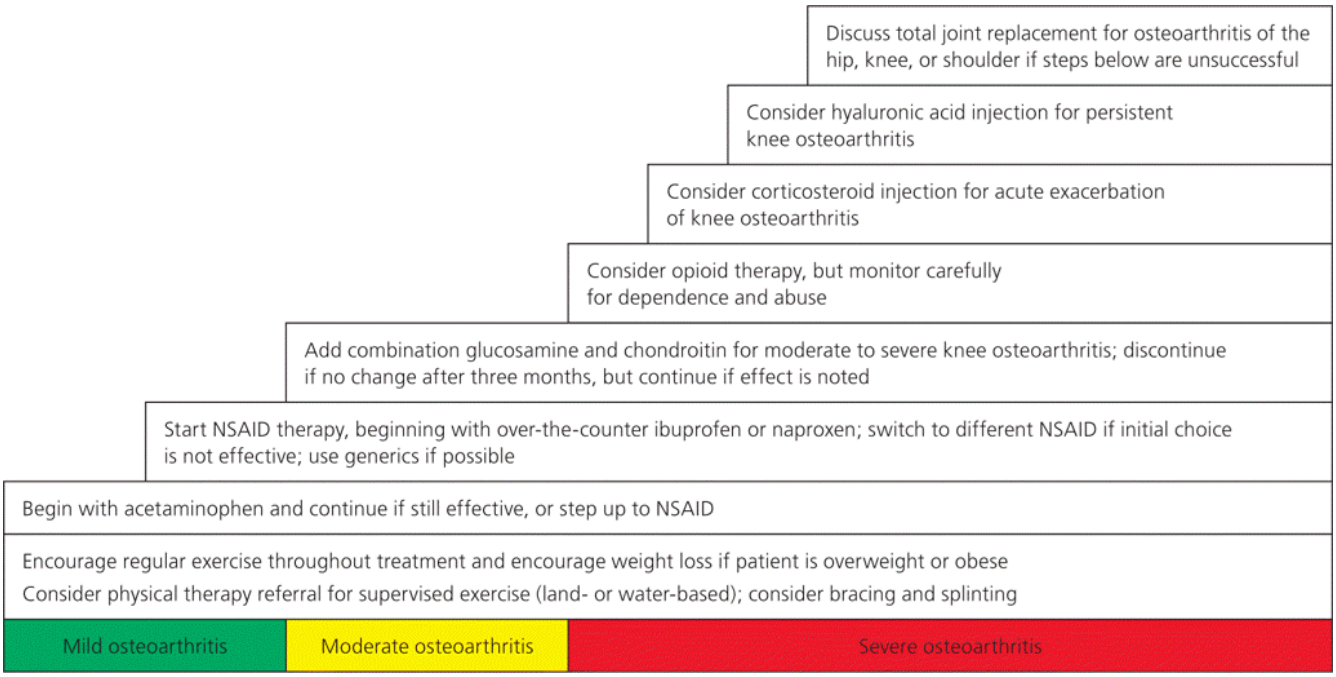
Osteoarthritic Hip and Spine



Types of spinal degeneration. (a–b) Horizontal degeneration. Initial degeneration of the intervertebral disc (a) subsequently leads to the facet joint osteoarthritis (b). (c–d) Adjacent segment disease. Severe degenerative changes on a segment result in abnormalities in the level above

Stepped-Care Approach for the Treatment of OA

OA cannot be reversed. However, treatments can reduce pain and improve movement.



Medications Commonly Used for OA

Medication	Typical Dosage
Acetaminophen	650 to 1000 mg QID
Celecoxib (Celebrix)	50 to 400 mg OD
Diclofenac/misoprostol (Arthrotec)	50 mg/200 mcg BID-TID
Ibuprofen (OTC)	400 to 600 mg TID
Meloxicam (Mobic)	7.5 to 15 mg OD
Nabumetone	500 mg BID
Naproxen (OTC) (Aleve)	220 to 440 mg BID
Oxaprozin (Daypro)	1200 mg OD
Sulindac (Clinoril)	150 to 200 mg BID

OTC Medications Aren't Working...

Strong medications may be prescribed if OTC medications lose effectiveness:

Opioids

- Low dosages and careful monitoring
- May cause chronic constipation
- Older patients at risk of falls

Intra-articular injections of corticosteroids or hyaluronic acid

- Short-term relief lasting 4 to 8 weeks
- May cause flare-up within the first 24 hours
- Improvement from baseline at 48 hours

MARY'S HEALTH: OSTEOPOROSIS (OP)

Typically, there are no symptoms in the early stages of OP.

Mary though the back pain was part of growing old, along with the being a 'bit shorter' & the slight stoop in her posture.

Overview

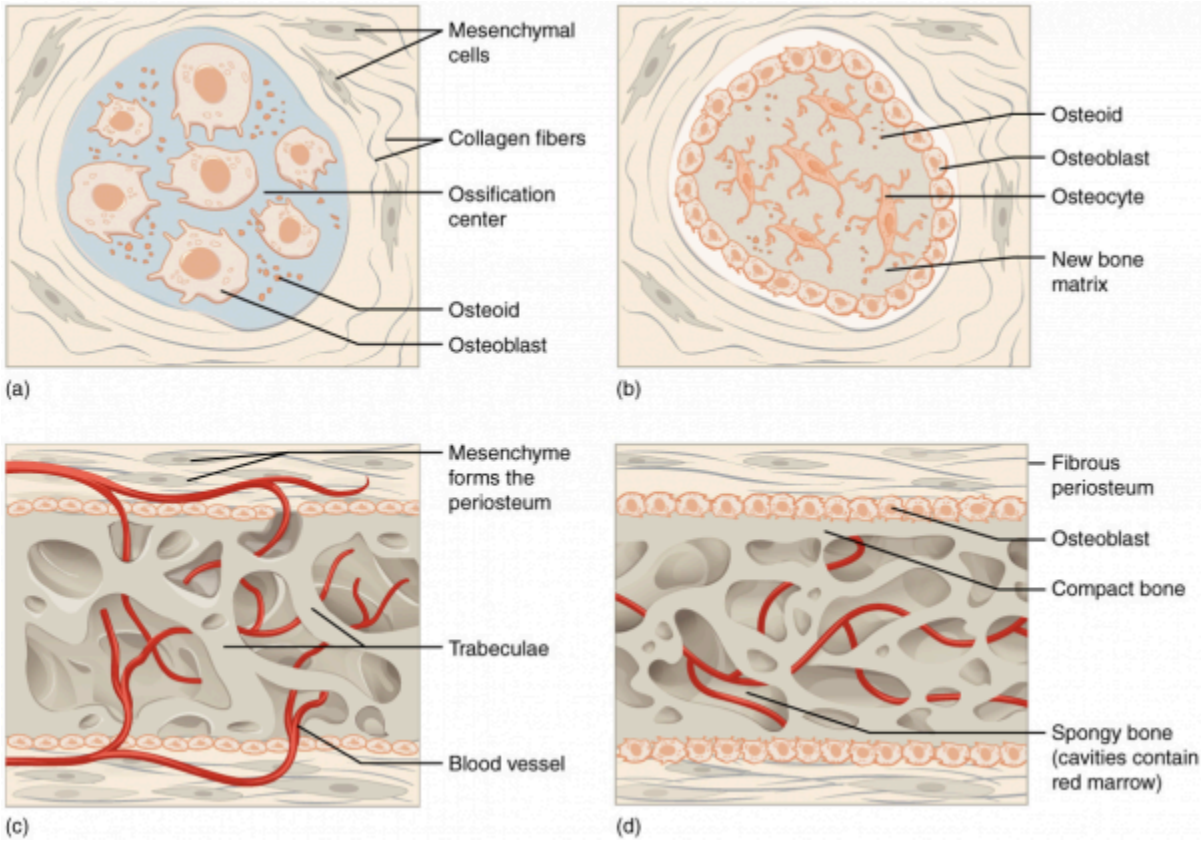
- Causes bones to become weak & brittle
- A fall or even mild stress can cause a fracture
- OP related fractures most commonly occur in the hip, wrist, or spine
- Bone is living tissue that is constantly being broken down & replaced
- OP occurs when the creation of new bone doesn't keep up with the loss of old bone
- OP affect men & women of all races
- White & Asian women (especially post-menopause) are at higher risk

Causes

- After the early 20s the process of making new bone slows
- Most people reach their peak bone mass by age 30
- How likely you are to develop OP depends partly on how much bone mass you attained in your youth
- Peak bone mass is somewhat inherited and also varies by ethnic group

Intramembranous Ossification

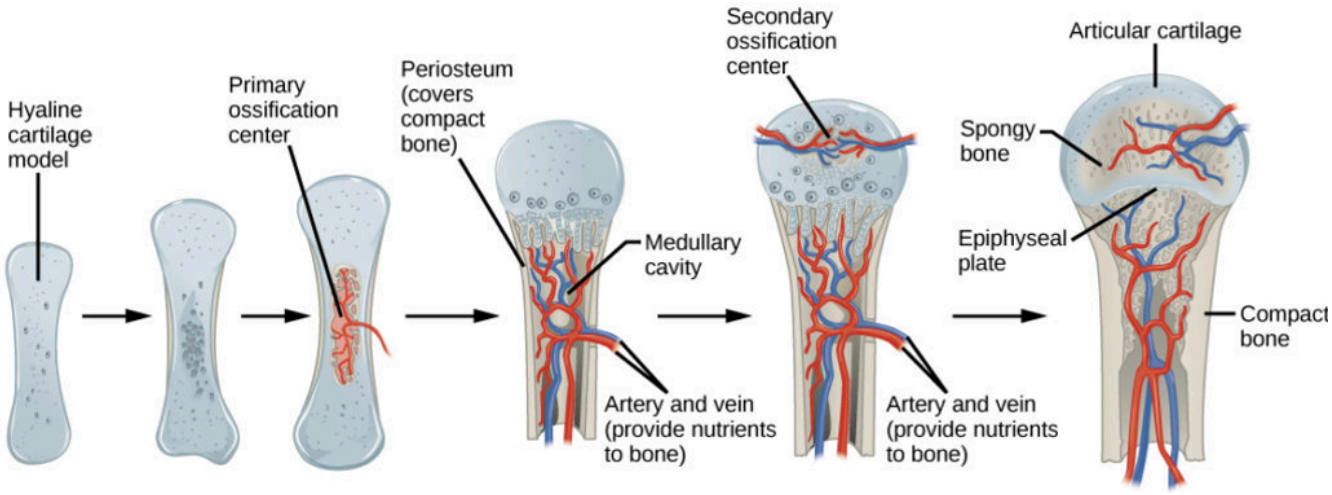
Intramembranous ossification follows four steps:



1. Mesenchymal cells group into clusters, and ossification centers form.
2. Secreted osteoid traps osteoblasts, which then become osteocytes.
3. Trabecular matrix and periosteum form.
4. Compact bone develops superficial to the trabecular bone, and crowded blood vessels condense into red marrow.

Endochondral Ossification

Endochondral ossification follows six steps:



1. Mesenchymal cells differentiate into chondrocytes.
2. The cartilage model of the future bony skeleton and the perichondrium form.
3. Capillaries penetrate cartilage. Perichondrium transforms into periosteum. Periosteal collar develops. Primary ossification center develops.
4. Cartilage and chondrocytes continue to grow at ends of the bone.
5. Secondary ossification centers develop.
6. Cartilage remains at epiphyseal (growth) plate and at joint surface as articular cartilage.

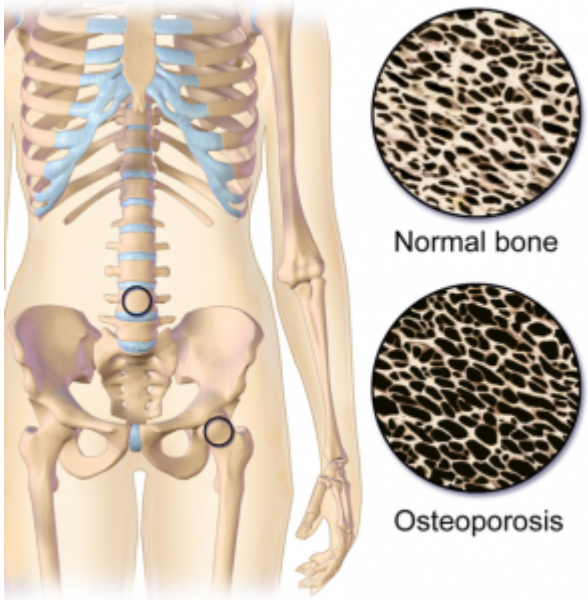
Risk Factors

Modifiable Risks	Non-modifiable Risks
Alcohol	Age
Smoking	Ethnicity
Low body mass index (BMI)	Female gender
Poor nutrition	Family history of fractures
Eating disorders	Previous fractures
Insufficient physical activity	Menopause/hysterectomy
Low dietary calcium intake	Hormonal status
Vitamin D deficiency	Long-term glucocorticoid therapy
Frequent falls	Primary/secondary hypogonadism in men

Complications

Bone fractures:

- Particularly in the spine or hip
- Often caused by a fall & can result in disability
- Increase risk of death within the first year after injury
- Spinal fractures can occur without injury
- Vertebrae can weaken to the point of crumpling



Prevention:

- Good nutrition
- Maintain a health body weight
- Calcium
- Vitamin D
- Exercise
- Limit alcohol consumption
- Quit smoking

MARY'S HEALTH: HIP FRACTURE

Due to her existing OA and OP, Mary's fall resulted in a fractured hip that required surgical repair.

Symptoms:

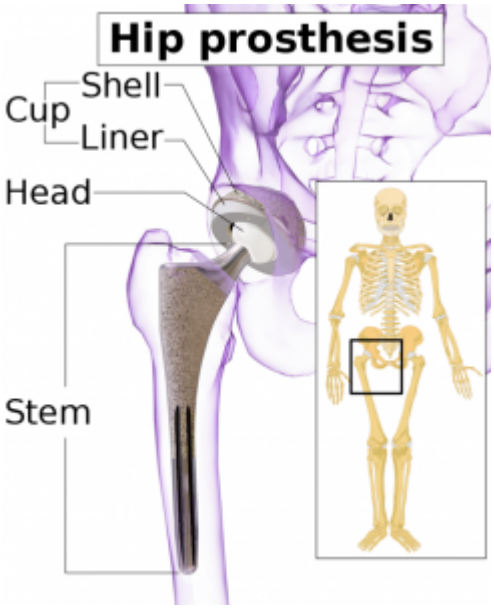
- Inability to get up from a fall or to walk
- Severe pain in hip or groin
- Inability to weight bear on the affected side
- Bruising & swelling in & around hip area
- Shorter leg on the affected side
- Outward rotation of the leg on the affected side

Surgical Repair

The type of repair depends on where & how severe the fracture is, displaced bone, age, & underlying health conditions.

Options include:

- Internal repair using screws
- Total hip replacement
- Partial hip replacement



Rehabilitation

- Out of bed and moving on the 1st day post-op
- Physical therapy will initially focus on ROM and strengthening exercises
- Home exercise program and follow-up PT appointments
- Assistive devices required: walker, cane, safety bars in bathtub, elevated toilet seat

Precautions to Prevent a Dislocation

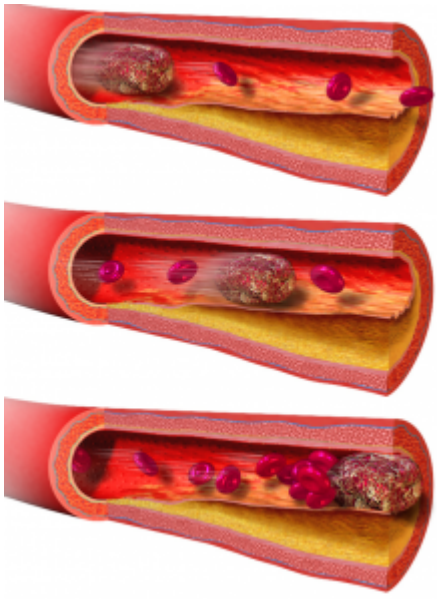
Posterior Approach:

- Do not bend at the waist past 90 degrees
- Do not cross your legs
- Do not internally rotate the surgical leg

Anterior Approach:

- Do not step backwards with the surgical leg
- Do not externally rotate the surgical leg

Complications



- Can reduce independence
- About half the people who have a hip fracture do not regain the ability to live independently

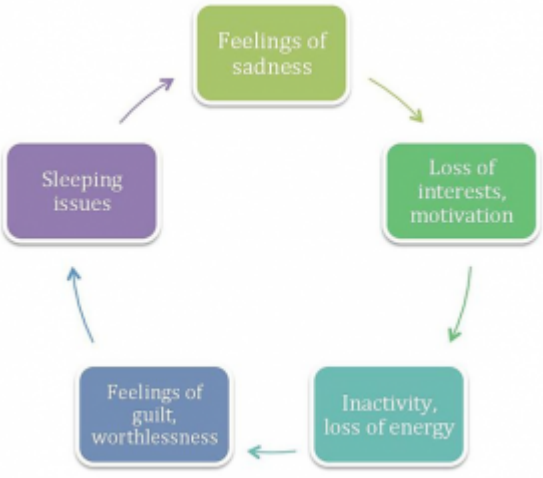
Immobility may lead to:

- Blood clots in the legs or lungs
- Bedsores
- Urinary tract infections
- Pneumonia
- Further loss of muscle mass
- Increase risk of falls & injury
- Death

Post-Operative Depression

It can be challenging to differentiate between typical post-op recovery and depression symptoms.

Depression is a psychological illness that can lead to impaired decision-making, difficulty with day-to-day life, and may lead to physical illness.



Signs & Symptoms of Depression:

- Eating significantly more or less than is normal
- Sleeping significantly more or less than is normal
- Fatigue
- Irritability
- Difficulty making decisions, even minor ones
- Loss of interest in activities
- Feelings of hopelessness and despair

- Feelings of anxiety, stress, agitation or restlessness
- Thoughts of self-harm
- Thoughts of harming others

RESOURCES

Text Resources

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Video Resources

Why haven't we cured arthritis?

How to grow a bone

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Feedback

Instructor feedback

Student feedback

CASE 3: PHILLIP

PHILLIP'S STORY

Case Study Downloads

- Meet Philip (PPT)
- Philip's Story (Single Slide) (PPT)
- Philip's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Human Anatomy and Physiology
- Human Pathophysiology/Altered Physiology
- Health Research
- Mental Health and Disabilities

Philip's Story

Phillip was born in a small town in northern Ontario in 1979 to biracial parents. His father, Jack, was Ojibway, and his mother, Mary, was Anglican. He was six years old when he became a big brother to Nancy. Phillip was known as a 'sensitive boy' when he was younger. He did not have any interest in sports, much to his father's dismay. Phillip loved to spend time with his mother: cuddling on her lap, helping her out in the kitchen, and watching her get ready for parties.

Once Phillip started school, some of the other children bullied him: calling him names, physically pushing him around, and ostracizing him when it came time for teamwork.

As the siblings grew older, Phillip watched his sister Nancy play numerous sports while his father cheered her on and commented to Phillip that "this was what he should be doing if he was a real boy." Phillip's self-esteem plummeted. He would often ask himself "what is wrong with me?"

Once he started high school, Phillip felt even more alone and more confused. He was not interested in sports or girls like his classmates. He secretly had a 'crush' on another boy at his high school but did not dare to act upon his feelings. By grade 11, Phillip could no longer take the bullying of his schoolmates, the whispers and comments from the small community in which he lived, and the disappointment he saw on his father's face every day.

At 16, Phillip left his small hometown without a word to anyone, and headed for Toronto. There he soon found a community of individuals that accepted him. It was an exciting time for Phillip, with drinking, drugs, and multiple same-sex partners. This reckless lifestyle continued for many years. His drinking increased and eventually he began using IV drugs. Phillip went from one relationship to another, often having multiple partners at the same time. He had no contact with his family since he left home, and often wondered if they cared where he was and what he was doing. He had called home a number of times, but hung up as soon as someone answered the phone.

It was in the late fall of 2008 that Phillip came down with the "flu".

Flu-like symptoms can include:

- Fever
- Chills
- Rash
- Night sweats
- Muscle aches
- Sore throat
- Fatigue
- Swollen lymph nodes
- Mouth ulcers

These symptoms lasted a few weeks, but eventually Phillip started feeling better. His close friends were concerned about his weight loss and suggested that he get tested for HIV. Phillip was not concerned because he was feeling better, and thought to himself "I use condoms most times, HIV could not possibly happen to me." He continued with his reckless lifestyle for another ten years.

Phillip had been feeling unwell again. He had lost even more weight, was tired all the time, and noticed 'blotches' on his face and in his mouth.

After three months with no improvement, Phillip went to a local medical clinic for assessment. The attending physician provided testing to confirm his suspicions of HIV/AIDS.

With positive results, Phillip was referred to a specialist trained in treating HIV.

The specialist ordered further testing to determine the stage of the disease and the best treatment options. He ordered other lab tests to check for a number of infections or complications often related to HIV.

Phillip was distraught over the diagnosis and treatment. He felt like this was a death sentence. After much consideration, he decided to reach out to his sister for support.

Nancy was sympathetic, but stated that there was not much she could do to help out as her 'plate was overflowing' at present. She did suggest that Phillip could come visit Nancy and her family once a month, but when he found out his parents were living there too, he quickly declined the offer.

Phillip contemplated trying to reach out to his father's people. He had struggled all his life with feeling like he didn't belong. Would they accept him?

Phillip is considered a two spirited person (both male and female spirits). Two spirited people were held in high regard. However, due to residential schools and the church's influence on Indigenous people, many were taught that this type of lifestyle was unacceptable. While many communities would not accept Phillip, many others were now coming around and realizing that rejecting him for his gender and sexuality was not their traditional way. However, if the community was very traditional, Phillip's drug use could also be a problem.

Case Key Words

- Addiction
- AIDS
- Biracial
- HIV
- Homosexual
- Indigenous
- IV drug use
- LGBTQ+
- Risk behaviours
- Self-identity

BARRIERS TO LGBTQ+ HEALTH

LGBTQ+ Risk Factors for Mental Health Problems

Harassment & Discrimination in Education

- About three quarters of LGBTQ+ students report having been harassed at school; even worse, 35% have experienced physical assault, and 12% have been the victim of sexual violence at school.
- Harassment and assault, especially when it occurs in what should be a safe and supportive setting, can have serious impacts on mental health such as fear, anxiety, depression, and post-traumatic stress disorder (PTSD).

Institutional Discrimination

- The LGBTQ+ population experiences institutional discrimination in a variety of situations and settings such as the workplace and places of worship.
- LGBTQ+ individuals are frequently denied career advancement or equal compensation compared with their gender-conforming peers, and their unemployment rate is double that of the general population.

Health Disparities

- Discrimination in health care settings endangers LGBTQ+ people's lives through delays or denials of

medically necessary care. Transgender patients may require medical interventions such as hormone therapy and/or surgery.

- Other common barriers are discrimination, lack of insurance, lack of cultural competence/sensitivity by health care providers, and socioeconomic barriers such as low income, lack of transportation, and inadequate housing.

Family Rejection

- Family rejection can also lead to long-lasting psychiatric problems later in life.
- Rejected individuals may develop depression and low self-esteem and may turn to alcohol, cigarettes, or drugs, smoking cigarettes to cope.

History of Trauma

- Many individuals in the LGBTQ+ population have experienced past physical assault and harassment.
- Past trauma compounds any current trauma, exacerbating anxiety about future safety, especially in a political climate that feels hostile.

Microtraumas/Microaggressions

- People who identify as LGBTQ+ often experience brief, subtle expressions of hostility or discrimination.
  While microaggressions are often associated with racial/ethnic minorities, they can also impact LGBTQ+ and other marginalized populations, and cumulatively they can take a toll on mental and physical health.
- LGBTQ+ people who experience microtraumas may not meet diagnosable criteria for PTSD yet suffer tremendously from minority stressors such as from internalized phobia, rejection sensitivity, marginalization, and discrimination both in their personal life and health care settings.

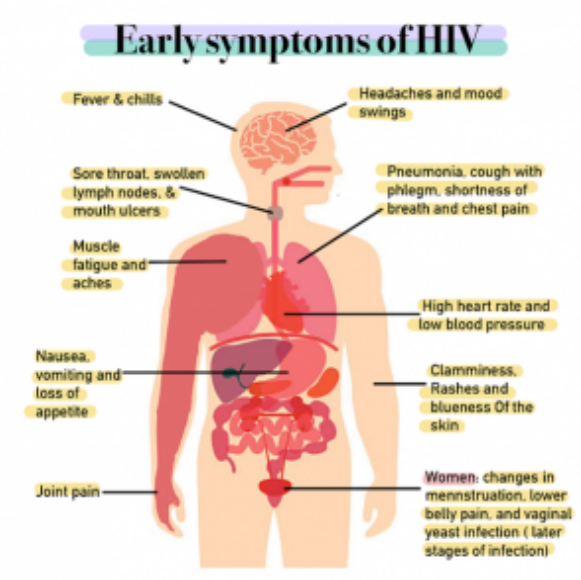
PHILLIP'S HEALTH: HIV/AIDS

New Community…New Life

- Phillip moved to Toronto
- Found a community that accepted him
- Exciting time for Phillip – drinking, drugs, multiple same-sex partners
- Soon turned to IV drugs
- No contact with his family

Phillip Catches the 'Flu'

- Phillip is now 29 years of age
- Comes down with flu-like symptoms:
    - Fever
    - Chills
    - Rash
    - Night sweats
    - Muscle aches
    - Sore throat
    - Fatigue
    - Swollen lymph nodes
    - Mouth ulcers



- These symptoms last a few weeks
- He is feeling better
- Close friends are concerned about Phillip's weight loss and suggest he get tested for HIV

10 Years Later…

- Phillip is feeling unwell
    - Lost even more weight
    - Tired all the time
    - Noticed 'blotches' on his face & in his mouth
- Phillip sees a physician at a local clinic
- Doctor orders tests to confirm his suspicions of HIV/AIDS

Overview

What is HIV?

- HIV (human immunodeficiency virus) is a virus that attacks the body's immune system
- If HIV is not treated, it can lead to AIDS (acquired immunodeficiency syndrome)
- There is currently no effective cure. Once people get HIV, they have it for life
- But with proper medical care, HIV can be controlled
- People with HIV who get effective HIV treatment can live long, healthy lives and protect their partners

Where did HIV come from?

- HIV infection in humans came from a type of chimpanzee in Central Africa
- The chimpanzee version of the virus (called simian immunodeficiency virus, or SIV) was probably passed to humans when humans hunted these chimpanzees for meat and came in contact with their infected blood
- Studies show that HIV may have jumped from chimpanzees to humans as far back as the late 1800s
- Over decades, HIV slowly spread across Africa and later into other parts of the world. We know that the virus has existed in the United States since at least the mid to late 1970s

Diagnostic Testing

Antigen/Antibody Tests

These tests usually involve drawing blood from a vein. Antigens are substances on the HIV virus itself and are usually detectable — a positive test — in the blood within a few weeks after exposure to HIV.

Antibodies are produced by your immune system when it's exposed to HIV. It can take weeks to months for antibodies to become detectable. The combination antigen/antibody tests can take two to six weeks after exposure to become positive.

Antibody Tests

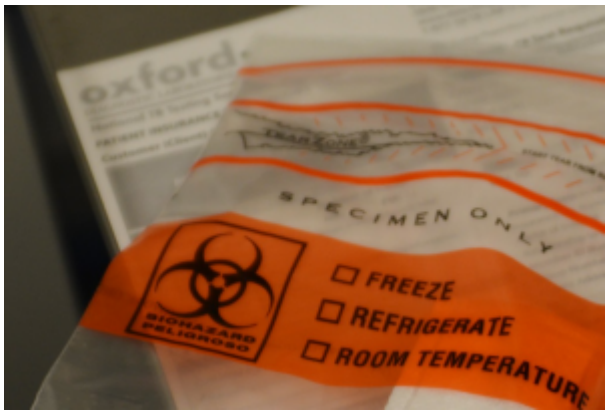
These tests look for antibodies to HIV in blood or saliva. Most rapid HIV tests, including self-tests done at home, are antibody tests. Antibody tests can take three to 12 weeks after you're exposed to become positive.

Nucleic Acid Tests (NATs)

These tests look for the actual virus in your blood (viral load). They also involve blood drawn from a vein. If you might have been exposed to HIV within the past few weeks, your doctor may recommend NAT. NAT will be the first test to become positive after exposure to HIV.

Other Lab Tests

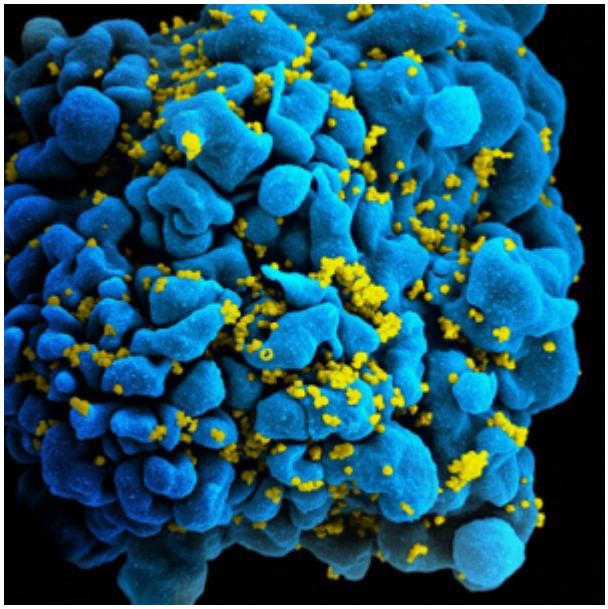
- Tuberculosis
- Hepatitis B or Hepatitis C virus infection
- STIs
- Liver or kidney damage
- Urinary tract infection
- Cervical and anal cancer
- Cytomegalovirus
- Toxoplasmosis



Further Testing

Determines the stage of the disease & the best treatment options.

CD4 T Cell Count



CD4 T cells are white blood cells that are specifically targeted and destroyed by HIV. Even if you have no symptoms, HIV infection progresses to AIDS when your CD4 T cell count dips below 200.

Viral Load (HIV/RNA)

This test measures the amount of virus in your blood. After starting HIV treatment the goal is to have an undetectable viral load. This significantly reduces your chances of opportunistic infection and other HIV-related complications.

Drug Resistance

Some strains of HIV are resistant to medications. This test helps your doctor determine if your specific form of the virus has resistance and guides treatment decisions.

Stages of HIV

Stage 1: Acute HIV Infection

- People have a large amount of HIV in their blood. They are very contagious.
- Some people have flu-like symptoms. This is the body's natural response to infection.
- But some people may not feel sick right away or at all.
- If you have flu-like symptoms and think you may have been exposed to HIV, seek medical care and ask for a test to diagnose acute infection.
- Only antigen/antibody tests or nucleic acid tests (NATs) can diagnose acute infection.

Stage 2: Chronic HIV Infection

- This stage is also called asymptomatic HIV infection or clinical latency.
- HIV is still active but reproduces at very low levels.
- People may not have any symptoms or get sick during this phase.
- Without taking HIV medicine, this period may last a decade or longer, but some may progress faster.
- People can transmit HIV in this phase.
- At the end of this phase, the amount of HIV in the blood (called viral load) goes up and the CD4 cell count goes down. The person may have symptoms as the virus levels increase in the body, and the person moves into Stage 3.
- People who take HIV medicine as prescribed may never move into Stage 3.

Stage 3: Acquired Immunodeficiency Syndrome (AIDS)

- The most severe phase of HIV infection.
- People with AIDS have such badly damaged immune systems that they get an increasing number of severe illnesses, called opportunistic infections.
- People receive an AIDS diagnosis when their CD4 cell count drops below 200 cells/mm, or if they develop certain opportunistic infections.
- People with AIDS can have a high viral load and be very infectious.
- Without treatment, people with AIDS typically survive about three years.

Symptoms of AIDS

- Rapid weight loss
- Recurring fever or profuse night sweats
- Extreme and unexplained tiredness
- Prolonged swelling of the lymph glands in the armpits, groin, or neck
- Diarrhea that lasts for more than a week
- Sores of the mouth, anus, or genitals
- Pneumonia
- Red, brown, pink, or purplish blotches on or under the skin or inside the mouth, nose, or eyelids
- Memory loss, depression, and other neurologic disorders

Risk Factors

Viral Load

- The amount of HIV in the blood of someone who has HIV. Get your viral load checked at least twice a year.
- The goal of HIV treatment is to reduce viral load.
- The higher the viral load, the more likely transmission of HIV is.
- Earliest phase of HIV infection has a very high viral load.
- Taking HIV medications will provide the greatest chance to lower viral load.
- Using a condom the right way every time can protect from transmission.
- Negative partner can take a daily pre-exposure prophylaxis.

Sexually Transmitted Infection (STDs)

- Spread from person to person through contact with genital fluid or through ski-to-skin contact.
- HIV is considered an STD if transmitted through sex.
- If sexually active, get tested for STDs regularly.
- Always use a condom.
- Get vaccinated for hepatitis A or B or HPV.

Sex Partners

- Sexual partners with different HIV status.
- Having more than one partner.
- Power differences in relationships can also make it harder to have safer sex.
- Choose less risky sexual behaviours.
- Use condoms the right way every time.
- Get tested and encourage your partner to get tested (HIV & STDs).

Sharing Needles, Syringes or Other Drug Injection

Equipment

- Using a needle or syringe to inject drugs or medicine, or for tattoos or piercings, after someone else has used it.
- Letting someone else use a needle or syringe after you have used it.
- Never share your needles, syringes or other injection equipment.

Alcohol & Drug Use

- When drunk or high, you are more likely to make decisions that put you at risk.
- There is therapy & other methods available to help stop or cut down on alcohol & drug use.

Prevention

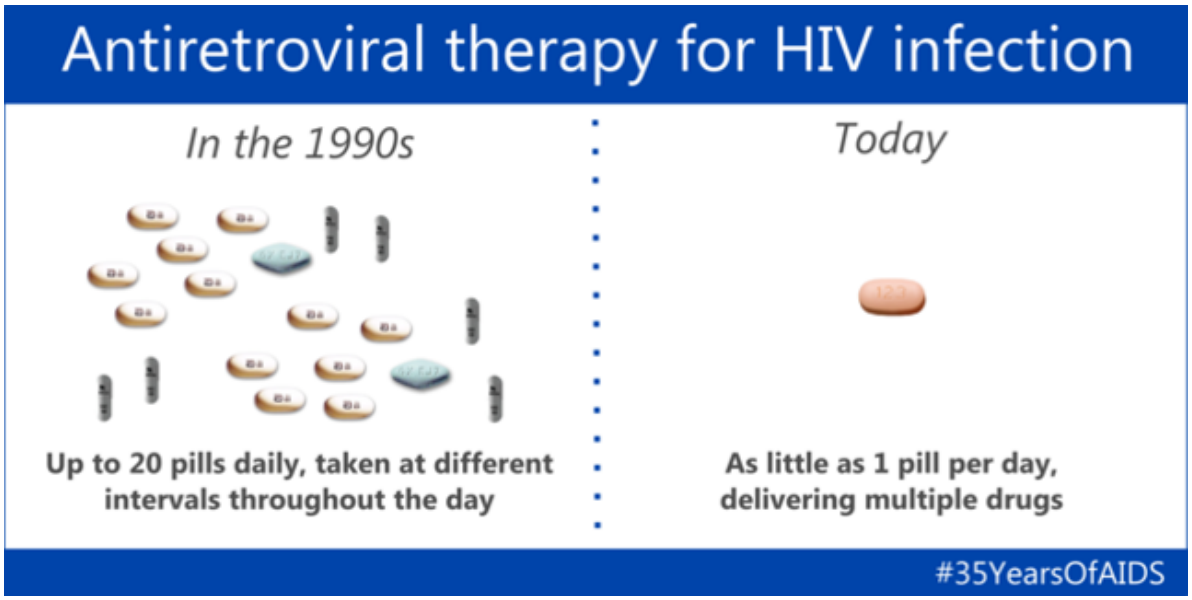
- Abstinence
- Choosing less risky sexual activities
- Taking medicine to prevent or treat HIV
- Using condoms
- Reducing the number of partners
- Partner communication & agreements
- Male circumcision

Philip's Story Continues

- There are many medications that can control HIV & prevent complications.
- These are medications are called **antiretroviral therapy** (ART): a combination of three or

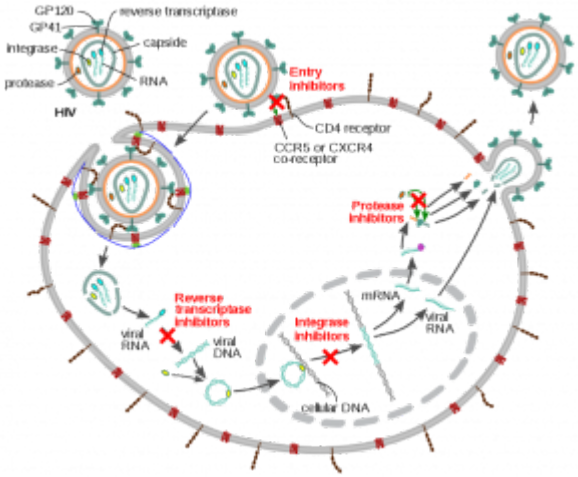
more medications from several different drug classes.

- Philip was started on ART.
- The goal was to lower the amount of HIV in his blood
- Two drugs from one class, plus a third drug from a second class, are typically used.



Classes of Anti-HIV Drugs

- **Non-nucleoside reverse transcriptase inhibitors (NNRTIs)** turn off a protein needed by HIV to make copies of itself.
- **Nucleoside or nucleotide reverse transcriptase inhibitors (NRTIs)** are faulty versions of the building blocks that HIV needs to make copies of itself.
- **Protease inhibitors (PIs)** inactivate HIV protease, another protein that HIV needs to make copies of itself.



- **Integrase inhibitors** work by disabling a protein called integrase, which HIV uses to insert its genetic material into CD4 T cells.
- **Entry or fusion inhibitors** block HIV entry into CD4 T cells.

RESOURCES

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Video Resources

HIV and AIDS timeline

- HIV Basics
- How close are we to eradicating HIV?
- How does your immune system work?
- Lesbian, Gay, Bisexual and Transgender Rights in Canada
- Protect and Support LGBT People

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Feedback

Instructor feedback

Student feedback

CASE 4: NANCY

NANCY'S STORY

Case Study Downloads

- Meet Nancy (PPT)
- Nancy's Story (Single Slide) (PPT)
- Nancy's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Human Anatomy and Physiology
- Human Pathophysiology/Altered Physiology
- Health Research
- Mental Health and Disabilities

Nancy's Story

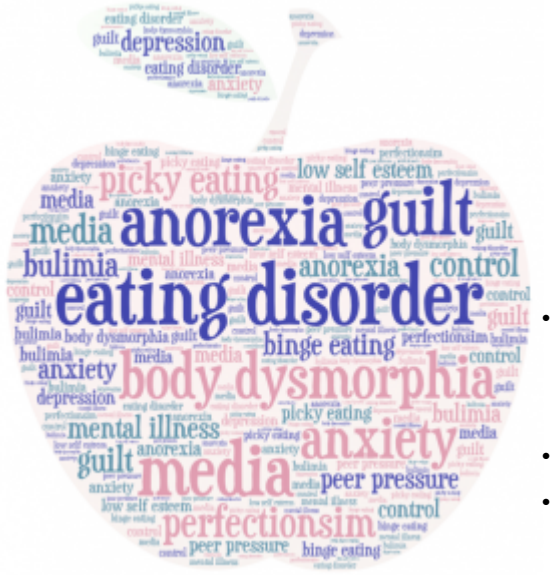
Nancy, born in 1985, was the second child of Mary and Jack. She lived with her parents and older brother, Phillip, in a small rural town in Northern Ontario. She was a very active child, to the point that some would call her a "Tomboy". Nancy played many sports at school and in local leagues. She was quite competitive. Nancy enjoyed the company of her father, spending many days fishing and hunting with him.

Neither Nancy nor Phillip had many friends at school. They never really felt like they 'fit in' with the other kids. She was 'too white' for some kids and 'too native' for others. When she was younger she was often teased and called names. Between not fitting in and the pressure to fulfill her father's desires to have an athlete in the family, Nancy pushed herself physically. She felt comfortable in her father's quiet presence.

When Nancy reached her teenage years, she played basketball, hockey, ran a number of events in track and field, and competed in gymnastics. She loved to win, and had many trophies and ribbons in her bedroom. Her father was very proud of her accomplishments. With these sports taking up much of Nancy's time, her school grades were average due to competing priorities.

Mary was concerned about her daughter's health and wellbeing. She often discussed her concerns with Jack, but was dismissed as being overprotective. One day, Nancy's school called and asked Mary to come and pick her up. Nancy had injured her leg during a 10 km run.

Mary took Nancy to the local emergency department, as Nancy was in considerable pain and unable to bear weight on her left leg. The emergency physician ordered an x-ray of Nancy's left leg, blood work, and did a physical exam. The diagnosis was a stress fracture of the left tibia.



However, the physician was more concerned about Nancy's appearance and her story. The physician followed-up with a more comprehensive history from both Nancy and her mother. What come to light was the following:

- Fatigue (Nancy stated that she always felt tired, and would fall asleep if she sat still for more than 5 minutes)
- Weight loss (Nancy's BMI is 15.7)
- Absent menstrual periods for the last six months (in the last year, Nancy had only 2 very light periods)
- Periods of fasting, binging, and self-induced vomiting (purging)
- Extreme exercise (Nancy ran 10 kilometers each day, had morning and after-school practices, games and competitions, and competed in a number of events each weekend)

Based on the clinical findings, the emergency physician diagnosed Nancy with Female Athlete Triad. It was explained to Nancy and her mother as an interrelationship of menstrual dysfunction, low energy availability (with or without an eating disorder), and decreased bone mineral density. It is relatively common among young women who participate in sports, but has the potential to be a serious condition. Diagnosis and treatment are complicated and often require an interdisciplinary team.

Nancy's story continues...

Nancy met with all of the healthcare specialists that the emergency physician referred her to, and a multidisciplinary team for Nancy's case was formed. They were all in agreement that Nancy should refrain from sports until she was cleared for return-to-play.

Her father did not see what all the fuss was about. He urged Nancy to get back to what she loved to do.

Nancy went to all her appointments to satisfy her mother and family doctor. However, she

continued to binge and purge behind her mother's back. She would often skip class to go running.

It took three years of hard work for Nancy to reach a healthy weight, eat well, and have a healthy outlook on exercise and activity. She continued with oligomenorrhea, however.

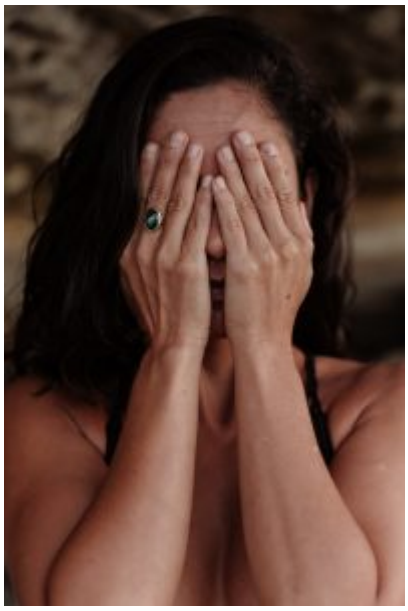
Nancy went away to university and began to work out and run again. After she graduated, she obtained a financial job in Toronto. She was working out and running twice a day to cope with the stress in her life. It was a lifestyle that she could not give up, and now that she was on her own, she had total control over her body. She was obsessed with maintaining an 'ideal weight' and fell back into the binging and purging of food.

She met Paul through mutual friends. They started dating in 2010, eventually marrying in 2012. About two years after they got married, they started talking about having a family. Paul had adopted twin girls from a previous marriage that they saw very infrequently.

Nancy and Paul began trying to conceive in 2013. By 2016, Nancy and Paul had seen fertility specialists. They were not hopeful that Nancy could conceive due to her history and ongoing struggle with exercise and eating, as well as the increased amount of stress in her life.

It was 2019, Nancy was successful in her career, and going to school for her CPA certification. She was relying on Paul to help out around the house, but had some concerns about his use of pain medication. Despite her concerns, Nancy wanted to be a mother and since they had no luck with conceiving or with costly in-vitro fertilization, they decided to adopt. In January 2020, they were notified that a toddler named Sam was available for adoption.

Shortly after Sam arrived to live with them, Jack called and told Nancy that Mary was in hospital. She had fallen and fractured her hip, and would be having a total hip replacement the next day. Jack stated that they would have to come and stay with Nancy and Paul while Mary recuperated from her surgery, as their family home was not suitable for Mary post-operatively. Nancy asked her father about staying with her brother Phillip, but Jack would not consider that as an option.



Nancy had no choice but to book time off work, and arrange for someone to come in and help with Sam, Paul, and the housework while she was away for a few days. She hoped to find the time to continue with her studies while she was away. She was not sure if her parents had internet, so her back-up plan was to go to the local library a few hours each day.

Nancy arrived a few days prior to her mother's discharge to help pack up what her mother and father would need while they stayed at her house. Instead, she found her father in need of medical attention and brought him into the emergency department at the local hospital, where he was quickly admitted.

Nancy was now in a dilemma as both of her parents were in hospital. Her mother was due to be discharged the next day. The plan had been for Nancy to take both of her parents to stay with her while her mother recuperated. She needed to get home to her son, husband, and her studies.

Nancy spoke with the discharge planner and explained the situation. Mary would be transferred to the Alternative Level of Care Unit until Jack was ready for discharge. Nancy then called her husband Paul to discuss what she should do.

Nancy returned home the next day to prepare for her parents' arrival. Over the next week, Nancy was consumed by the sheer amount of preparations required.

Meanwhile, Sam required multiple appointments, extra care, monitoring, and a special diet. Paul was not being helpful, instead often being distant with both Nancy and Sam.

To cope with the significant added stress in her life, Nancy fell back into her old behaviours: binge eating, then feeling guilty and purging. She was extremely stressed by all of the decisions she needed to make for her parents and her new son, along with dealing with her husband's erratic behaviour and narcotics use.

Case Key Words

- Adoption
- Binge eating
- Biracial
- Eating disorders
- Female Athlete Triad
- In Vitro fertilization (IVF)
- Stress eating
- Stress fracture
- Stress response

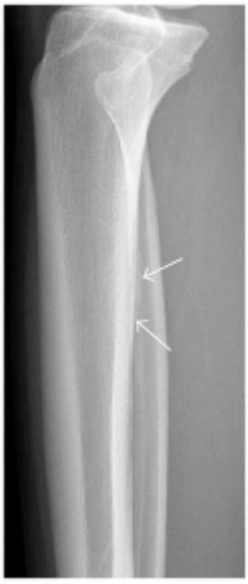
NANCY'S HEALTH: STRESS FRACTURE

At age 15, Nancy injured her leg during a gymnastics practice.

- She was in considerable pain & could not weight bear
- Taken to the local emergency department by her mother
- X-ray & blood work were ordered
- Diagnosis: stress fracture of the left tibia

Causes

Many factors can contribute to stress fractures of the shin. Some can be managed and others can not.



- Repetitive movements in high-intensity activities such as long-distance running, track & field, basketball, soccer, gymnastics, dance
- Improper athletic technique or footwear
- Increasing training or weight-bearing exercises too quickly
- Not getting enough rest between workouts
- Working out on a different type of surface than usual
- Excessive alcohol consumption
- Smoking
- Being over- or underweight
- Osteoporosis
- Eating disorders
- Low vitamin D levels
- Calorie intake imbalance

Treatment

Physician will recommend a combination of treatments & lifestyle changes:

- Taking a break from high-impact activity until you're fully healed
- Elevating your leg and applying ice for 10 minutes to ease pain and swelling
- Taking over-the-counter (OTC) anti-inflammatory medicine
- Using crutches to keep weight off your shin while you heal
- Physical therapy
- Severe stress fractures may require a cast or surgery to ensure proper healing
- Take 4-12 weeks (sometimes longer) to heal
- Increase activity slowly
- Sports medicine specialist or qualified trainer can help redesign workout routine

Additional Tips for Healing

- Rest
- Start cross-training
- Invest in proper footwear
- Elevate and ice
- Maintain a healthy diet
- Manage your weight
- Work with an experienced trainer

RICE

Rest

Ice

Compress

Elevate

NANCY'S HEALTH: FEMALE ATHLETE TRIAD

Nancy's Story Continues...

The emergency physician was more concerned about Nancy's appearance & how she injured herself.

A more comprehensive history & examination followed.

Assessment findings:

- Extreme fatigue (stated she always felt tired, would fall asleep if she sat still for more than 5 minutes)
- Weight loss (Nancy's BMI is 15.7)
- Absence of menstrual periods for the last 6 months (stated she had only 2 very light periods in the last year)
- Eating disorder – fasting, binging, self-induced vomiting (indulged in all of these practices regularly)
- Extreme exercise (Nancy ran 10km each day, had morning & after school practices, games & competitions, & competed in a number of events each weekend)

Based on clinical findings, Nancy was diagnosed with:

Female Athlete Triad

1. Low energy availability
2. Menstrual dysfunction
3. Poor bone health

Triad Screening

Early detection of athletes at risk is critical.

It is recommended that screening for the Triad be part of the Pre-Participation Physical Evaluation.

Screening Questions:

- Have you ever had a menstrual period?
- How old were you when you had your first menstrual period?
- When was your most recent menstrual period?
- How many periods have you had in the past 12 months?
- Are you presently taking any female hormones (oestrogen, progesterone, birth control pills)?
- Do you worry about your weight?
- Are you trying to or has anyone recommended that you gain or lose weight?
- Are you on a special diet or do you avoid certain types of foods or food groups?
- Have you ever had an eating disorder?
- Have you ever had a stress fracture?
- Have you ever been told you have low bone density (osteopenia or osteoporosis)?

Body Mass Index (BMI)

- Person's weight in kg divided by the square of height in meters.
- Can be used to screen for weight categories that may lead to health problems.
- **However**, it is not diagnostic of the body fatness or health of an individual.
- The CDC has a BMI calculation tool if you'd like to check your own results.

Treatment

The three components of the Triad recover at different rates with the appropriate treatment.

Recovery of energy status is typically observed after days or weeks of increased energy intake and/or decreased energy expenditure.

Recovery of menstrual status is typically observed after months of increased energy intake and/or decreased energy expenditure, which improves energy status.

Recovery of bone mineral density may not be observed

Bone Mineral Density & Osteoporosis in Ages 15-19

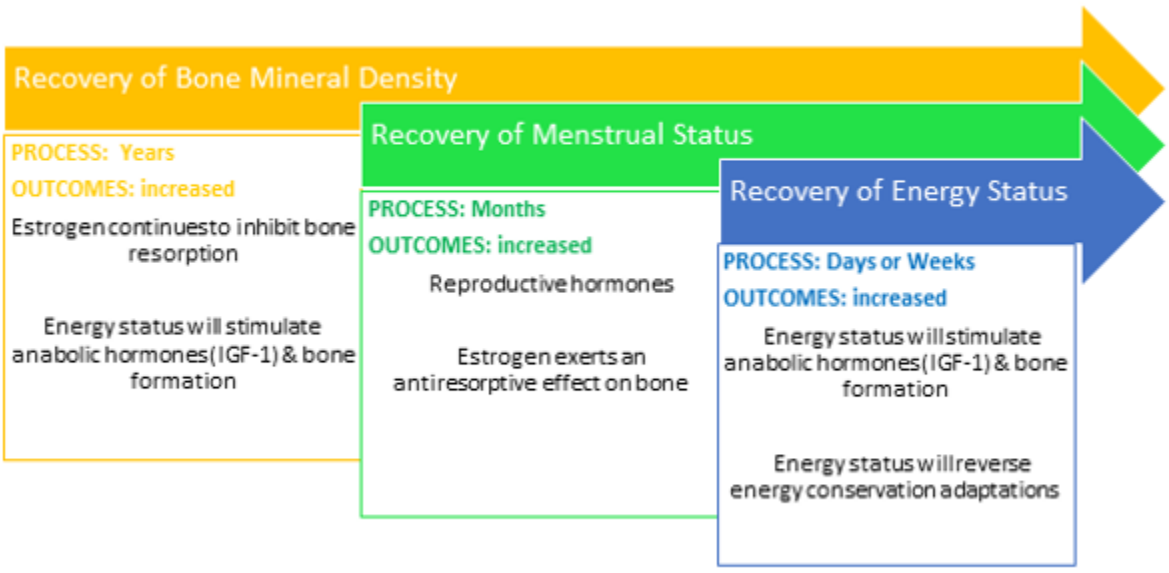
The diagnosis of osteoporosis in children and adolescents requires the presence of both a clinically significant fracture history AND

low bone mineral content or low bone mineral density

A clinically significant fracture history is one or more of the following:

- Long bone fracture of the lower extremities
- Vertebral compression fracture
- Two or more long-bone fractures of the upper extremities

until years after recovery of energy status and menstrual status has been achieved. IGF-1, insulin-like growth factor-1.



NANCY'S HEALTH: EATING DISORDERS

Nancy's Story Continues...

- Nancy met with her multidisciplinary healthcare team as scheduled
- Her mother watched her closely, recording her food intake, physical activity, sleep patterns, and her menstrual cycles
- Her father did not see what all the fuss was about... "go back to doing what you love"
- She went to her appointments to appease her mother and family doctor
- She continued to binge & purge
- She often skipped classes to go running
- It took 3 years of hard work for her to get to a healthy weight, have a realistic view on exercise, & to having monthly menstrual periods

Overview

Eating disorders are persistent eating behaviours that negatively impact your health, emotions, & your ability to function.

- Focuses on weight, body shape & food, leading to dangerous eating behaviours.
- Eating disorders can harm the heart, digestive system, bones, teeth & mouth, & lead to other diseases.

Most common eating disorders are:

- Anorexia nervosa
- Bulimia nervosa
- Binge-eating disorder

Symptoms

Anorexia Nervosa

- Dramatic weight loss
- Dresses in layers to hide weight loss or stay warm
- Preoccupation with weight, food, calories, fat grams, and dieting. Makes frequent comments about feeling "fat"
- Resists or is unable to maintain a body weight appropriate for their age, height, and build
- Maintains an excessive, rigid exercise regime – despite weather, fatigue, illness, or injury

Bulimia Nervosa

- Evidence of binge eating, including disappearance of large amounts of food in short periods of time or lots of empty wrappers and containers indicating consumption of large amounts of food
- Evidence of purging behaviors, including frequent trips to the bathroom after meals, signs and/or smells of vomiting, presence of wrappers or packages of laxatives or diuretics
- Drinks excessive amounts of water or non-caloric beverages, and/or uses excessive amounts of mouthwash, mints, and gum
- Has calluses on the back of the hands and knuckles from self- induced vomiting
- Dental problems, such as enamel erosion, cavities, discoloration of teeth from vomiting, and tooth sensitivity

Binge Eating Disorder

- Secret recurring episodes of binge eating (eating in a discrete period of time an amount of food that is much larger than most individuals would eat under similar circumstances); feels lack of control over ability to stop eating

- Feelings of disgust, depression, or guilt after overeating, and/or feelings of low self-esteem
- Steals or hoards food in strange places
- Creates lifestyle schedules or rituals to make time for binge sessions
- Evidence of binge eating, including the disappearance of large amounts of food in a short time period or a lot of empty wrappers and containers indicating consumption of large amounts of food

Causes

Genetics & biology

Certain people may have genes that increase their risk of developing eating disorders. Biological factors, such as changes in brain chemicals, may play a role in eating disorders.

Psychological & emotional health

People with eating disorders may have psychological and emotional problems that contribute to the disorder. They may have low self-esteem, perfectionism, impulsive behavior and troubled relationships.

Risk Factors

Family history

Eating disorders are significantly more likely to occur in people who have parents or siblings who've had an eating disorder.

Other mental health disorders

People with an eating disorder often have a history of an anxiety disorder, depression or obsessive-compulsive disorder.

Dieting & starvation

Dieting is a risk factor for developing an eating disorder. Starvation affects the brain and influences mood changes, rigidity in thinking, anxiety and reduction in appetite. There is strong evidence that many of the

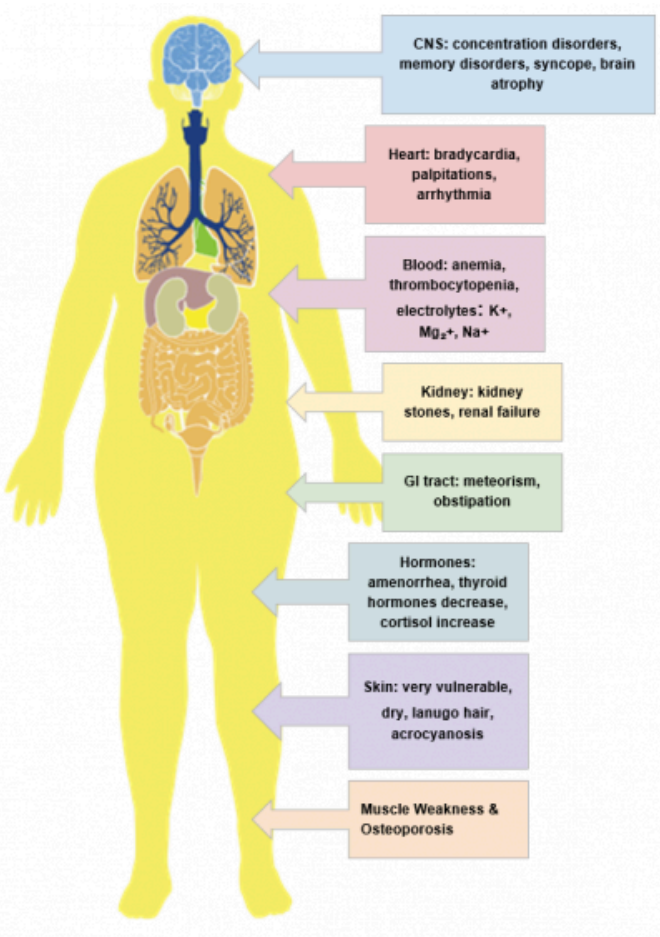
symptoms of an eating disorder are actually symptoms of starvation. Starvation and weight loss may change the way the brain works in vulnerable individuals, which may perpetuate restrictive eating behaviors and make it difficult to return to normal eating habits.

Stress

Whether it's heading off to college, moving, landing a new job, or a family or relationship issue, change can bring stress, which may increase your risk of an eating disorder.

Complications

- Serious health problems
- Depression & anxiety
- Suicidal thoughts or behaviour
- Problems with growth & development
- Social & relationship problems
- Substance use disorders
- Work & school issues
- Death



NANCY'S HEALTH: IN VITRO FERTILIZATION

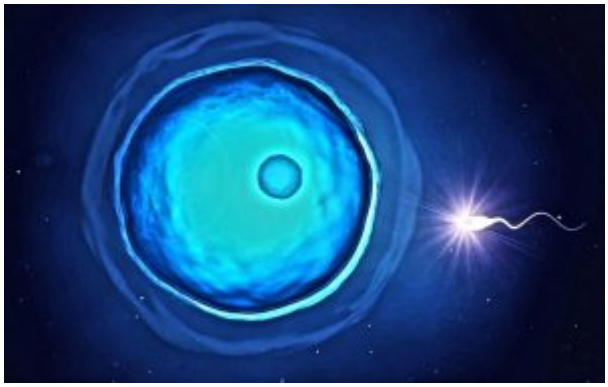
Wanting to Conceive

- Nancy is now in her early 30's
- She came to the point in her life where she wanted to have a baby
- Paul & Nancy tried to conceive for a number of years
- Nancy was unsure as 'whose fault' it was (Paul had adopted children from his first marriage)
- The fertility specialist suggested IVF (in vitro fertilization)
- IVF is the most effective form of assisted reproductive technology
- Chances of conceiving using IVF depend on many factors (e.g. age & cause of infertility)
- Can be time-consuming, expensive & invasive

Overview

- During IVF, eggs are removed from mature follicles within an ovary
- An egg is fertilized by injecting a single sperm into the egg or mixing the egg with sperm in a petri dish
- The fertilized egg (embryo) is transferred into the uterus

Why IVF?



- Fallopian tube damage or blockage
- Ovulation disorders
- Endometriosis
- Uterine fibroids
- Previous tubal sterilization or removal
- Impaired sperm production or function
- Unexplained infertility
- A genetic disorder
- Fertility preservation for cancer or other health conditions

Risks

Multiple births

IVF increases the risk of multiple births if more than one embryo is transferred to your uterus. A pregnancy with multiple fetuses carries a higher risk of early labor and low birth weight than pregnancy with a single fetus does.

Premature delivery and low birth weight

Research suggests that IVF slightly increases the risk that the baby will be born early or with a low birth weight.

Ovarian hyper stimulation syndrome

Use of injectable fertility drugs, such as human chorionic gonadotropin (HCG), to induce ovulation can cause ovarian hyper stimulation syndrome, in which your ovaries become swollen and painful.

Symptoms typically last a week and include mild abdominal pain, bloating, nausea, vomiting and diarrhea. If you become pregnant, however, your symptoms might last several weeks. Rarely, it's possible to develop a more severe form of ovarian hyper stimulation syndrome that can also cause rapid weight gain and shortness of breath.

Miscarriage

The rate of miscarriage for women who conceive using IVF with fresh embryos is similar to that of women who conceive naturally — about 15% to 25% — but the rate increases with maternal age.

Egg-retrieval procedure complications

Use of an aspirating needle to collect eggs could possibly cause bleeding, infection or damage to the bowel, bladder or a blood vessel. Risks are also associated with sedation and general anesthesia, if used.

Ectopic pregnancy

About 2% to 5% of women who use IVF will have an ectopic pregnancy — when the fertilized egg implants outside the uterus, usually in a fallopian tube. The fertilized egg can't survive outside the uterus, and there's no way to continue the pregnancy.

Birth defects

The age of the mother is the primary risk factor in the development of birth defects, no matter how the child is conceived. More research is needed to determine whether babies conceived using IVF might be at increased risk of certain birth defects.

Cancer

Although some early studies suggested there may be a link between certain medications used to stimulate egg growth and the development of a specific type of ovarian tumor, more-recent studies do not support these findings. There does not appear to be a significantly increased risk of breast, endometrial, cervical or ovarian cancer after IVF.

Stress

Use of IVF can be financially, physically and emotionally draining. Support from counselors, family and friends can help you and your partner through the ups and downs of infertility treatment.

Preparing for IVF

Ovarian reserve testing

To determine the quantity and quality of your eggs, your doctor might test the concentration of follicle-stimulating hormone (FSH), estradiol (estrogen) and anti-mullerian hormone in your blood during the first few days of your menstrual cycle. Test results, often used together with an ultrasound of your ovaries, can help predict how your ovaries will respond to fertility medication.

Semen analysis

If not done as part of your initial fertility evaluation, your doctor will conduct a semen analysis shortly before the start of an IVF treatment cycle.

Infectious disease screening

You and your partner will both be screened for infectious diseases, including HIV.

Practice (mock) embryo transfer

Your doctor might conduct a mock embryo transfer to determine the depth of your uterine cavity and the technique most likely to successfully place the embryos into your uterus.

Uterine exam

Your doctor will examine the inside lining of the uterus before you start IVF. This might involve a sonohysterography — in which fluid is injected through the cervix into your uterus — and an ultrasound to create images of your uterine cavity. Or it might include a hysteroscopy — in which a thin, flexible, lighted telescope (hysteroscope) is inserted through your vagina and cervix into your uterus.

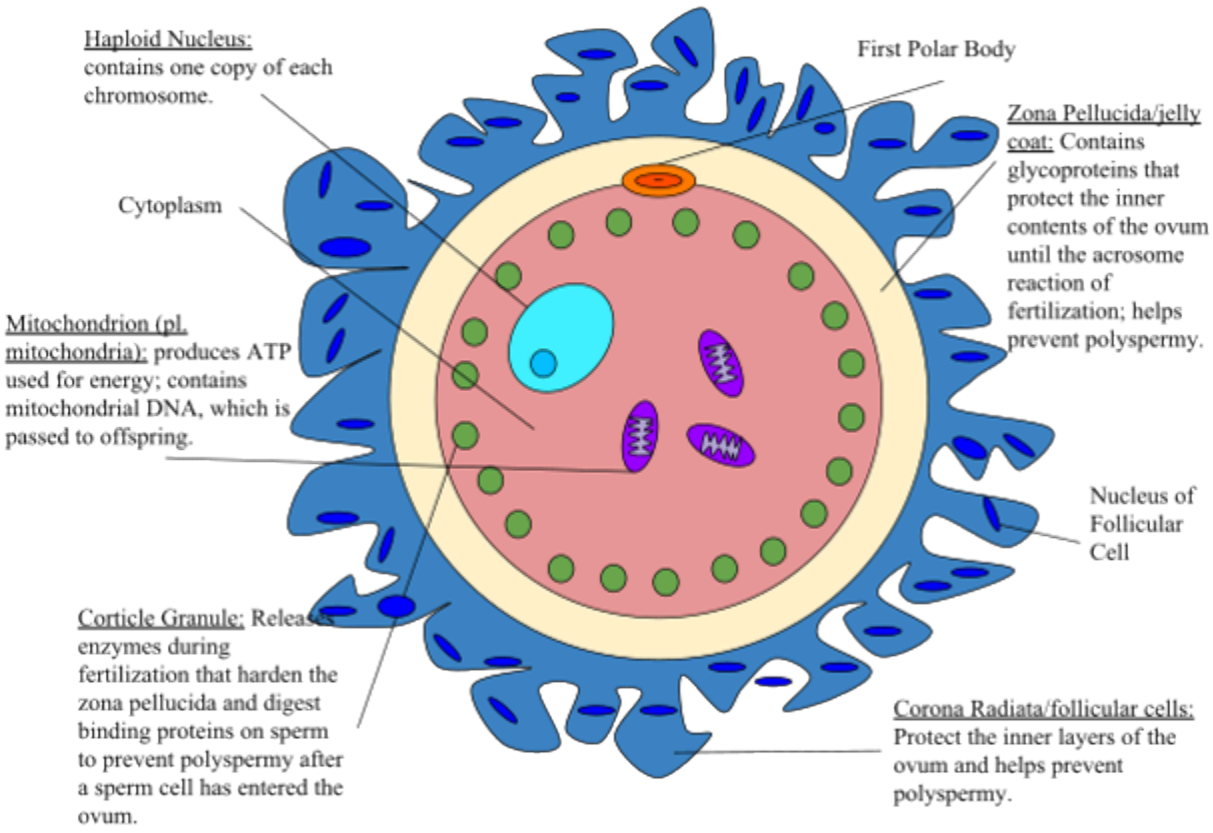
Important questions to discuss prior to beginning a cycle of IVF:

- How many embryos will be transferred?
- What will you do with any extra embryos?
- How will you handle a multiple pregnancy?
- Have you considered the potential complications associated with using donor eggs, sperm or embryos, or a gestational carrier?

What to Expect

Ovulation induction

At the start of a cycle, synthetic hormones are given to stimulate the ovaries to produce multiple eggs-rather than the single egg that normally develops each month.
Multiple eggs are needed, some eggs won't fertilize or develop normally after fertilization.



Different medications that may be needed:

Medications for ovarian stimulation

- To stimulate your ovaries, you might receive an injectable medication containing a follicle-stimulating hormone (FSH), a luteinizing hormone (LH) or a combination of both. These medications stimulate more than one egg to develop at a time.

Medications for oocyte maturation

- When the follicles are ready for egg retrieval — generally after eight to 14 days — you will take human chorionic gonadotropin (HCG) or other medications to help the eggs mature.

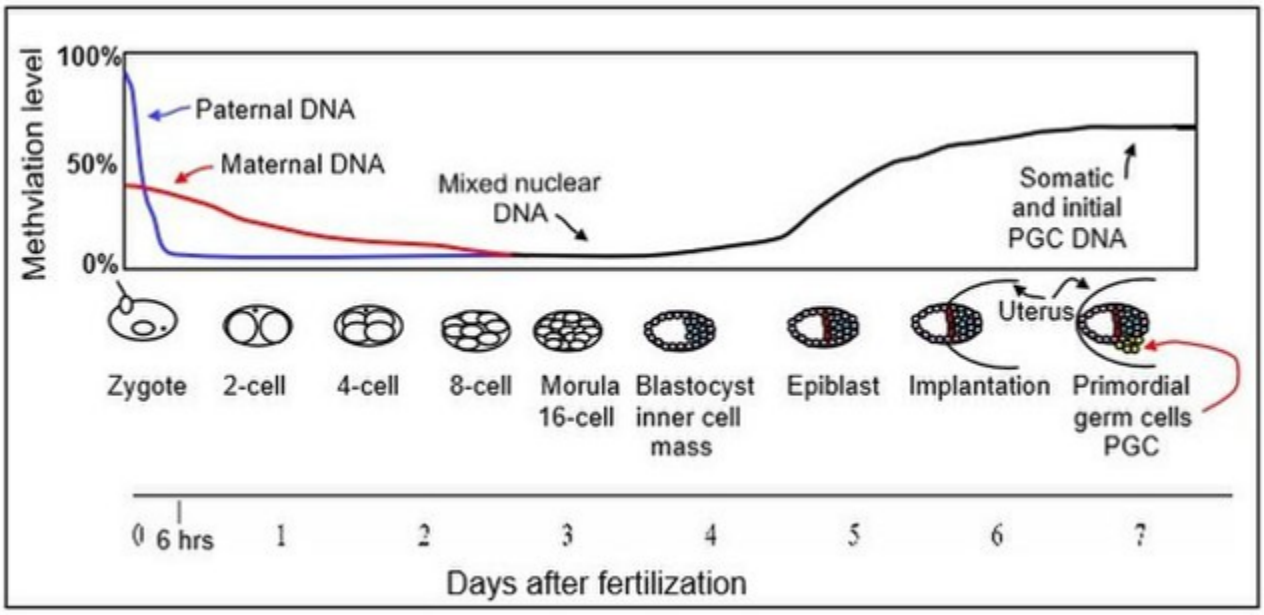
Medications to prevent premature ovulation

- These medications prevent your body from releasing the developing eggs too soon.

Medications to prepare the lining of your uterus

- On the day of egg retrieval or at the time of embryo transfer, your doctor might recommend that you begin taking progesterone supplements to make the lining of your uterus more receptive to implantation.

- Three days after fertilization, a normally developing embryo will contain about six to 10 cells.
- By the fifth or sixth day, the fertilized egg is known as a blastocyst — a rapidly dividing ball of cells.
- The inner group of cells will become the embryo.
- The outer group will become the cells that nourish and protect it.



After the Procedure

After the embryo transfer, you can resume normal daily activities. However, your ovaries may still be enlarged. Consider avoiding vigorous activity, which could cause discomfort.

Typical side effects include:

- Passing a small amount of clear or bloody fluid shortly after the procedure — due to the swabbing of the cervix before the embryo transfer
- Breast tenderness due to high estrogen levels
- Mild bloating
- Mild cramping
- Constipation

If you develop moderate or severe pain after the embryo transfer, contact your doctor. He or she will evaluate you for complications such as infection, twisting of an ovary (ovarian torsion) and severe ovarian hyperstimulation syndrome.

About 12-14 days after egg retrieval, a blood test will detect whether you are pregnant

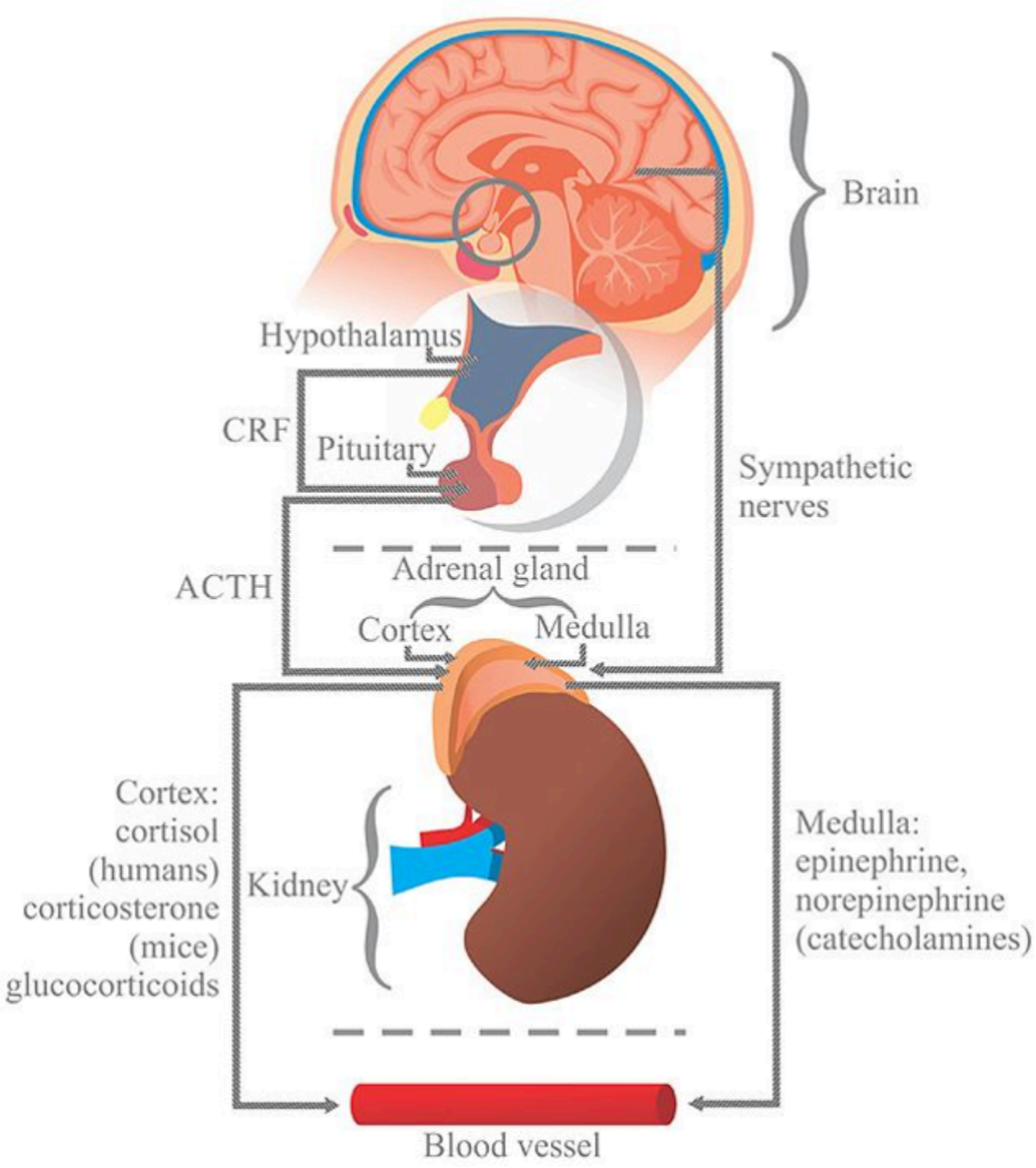
NANCY'S HEALTH: STRESS

Nancy's Story Continues…

- IVF was unsuccessful
- Nancy's stress levels were rising
- After extensive discussions with Paul, they decided to adopt
- They did not have to wait long
- The adoption agency had a 2 year old boy – Sam
- At about the same time Nancy's mother fell and fractured her hip
- She traveled north to assist her parents
- She was shocked at the physical disarray her father was in
- Her stress levels continued increasing with everything "on her plate"
- She fell back into old eating habits
- Eating was the one thing she felt she had control over

Overview

- Stress is a natural physical & mental reaction to life experiences.
- The body responds to stress by releasing hormones that increase your heart & breathing rates & ready your muscles to respond.
- If your stress response doesn't stop firing, it can take a toll on your health & overall well-being.
    - Irritability
    - Anxiety
    - Depression
    - Headaches
    - Insomnia

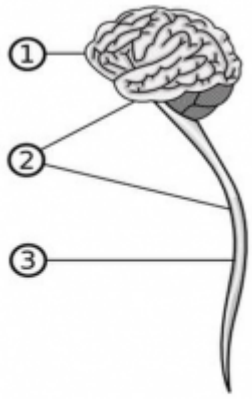


In response to stress, the hypothalamus (H) releases the corticotrophin releasing factor (CRF) into the anterior pituitary (P), causing the release of adrenocorticotropic hormone (ACTH) into the blood flow. ACTH stimulates the generation of glucocorticoids (cortisol in humans and corticosterone in mice) in the cortex of the adrenal gland (A), which are then released into the blood. Stress also activates the autonomic sympathetic nerves in the medulla of the adrenal gland to elicit the production of catecholamines, norepinephrine and epinephrine, which are then released into the blood. Glucocorticoids and catecholamines influence the generation of interleukins, which are involved in the viability and proliferation of immunocompetent gut cells via receptors.

Effects of Stress on the Body

Central Nervous and Endocrine Systems

- CNS is in charge of the "fight or flight" response
- The hypothalamus triggers the adrenal glands to release the stress hormones adrenaline & cortisol
- Increasing heart rate & sending blood to the areas that need it the most (muscles, heart, other important organs)
- When the perceived fear is gone, the hypothalamus tells all systems to go back to normal
- If the stressor does not go away, the response will continue
- Chronic stress is also a factor in behaviours such as overeating, not eating enough, alcohol, drug abuse, and social withdrawal



A diagram showing the CNS:
1. Brain
2. Central nervous system (brain and spinal cord)
3. Spinal cord

Respiratory and Cardiovascular Systems

- Stress hormones affect the respiratory & cardiovascular systems
- Breathing increases in an effort to quickly distribute oxygen-rich blood to the body
- The heart pumps faster
- Stress hormones cause the blood vessels to constrict & divert more oxygen to muscles
- May also increase blood pressure
- Frequent & chronic stress will make the heart work too hard for too long
- Increase risk of stroke or heart attack

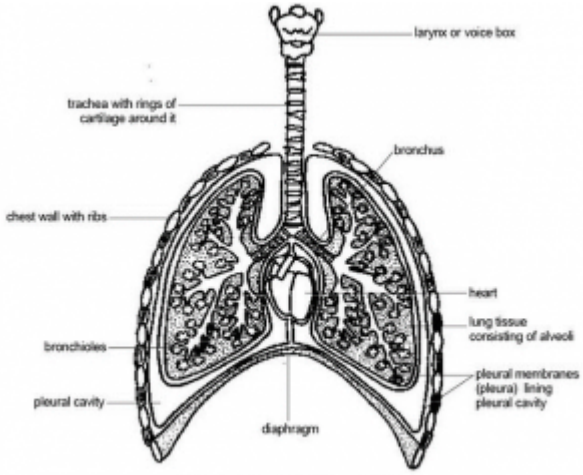
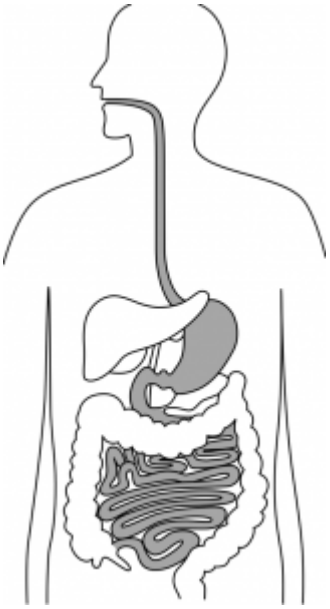


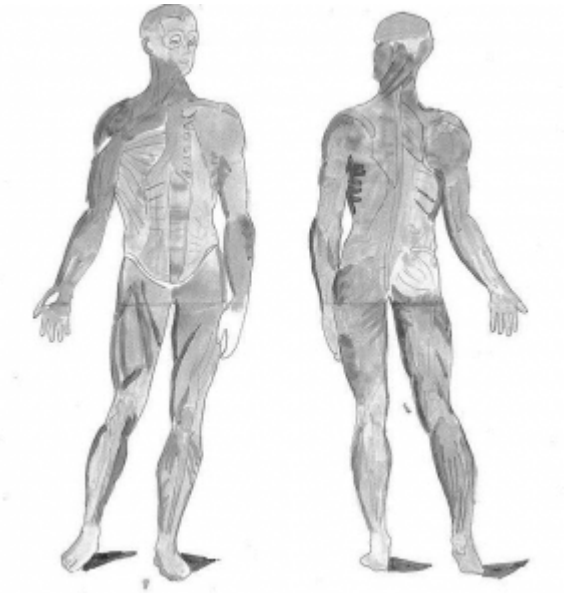
Diagram 9.3 - The respiratory system

Digestive System



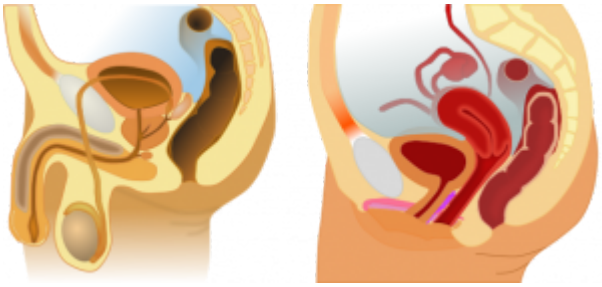
- The liver produces extra blood sugar (glucose) to give a boost of energy
- Under chronic stress, the body may not be able to keep up with the extra glucose surge
- Chronic stress may increase the risk of developing type II diabetes
- Rush of hormones, rapid breathing, increased heart rate may upset your digestive system
- Can increase the risk for ulcers or cause existing ones to act up (ulcers are caused by a bacterium called H. pylori)
- Stress may also affect the way food moves through the body, leading to diarrhea or constipation
- May experience nausea, vomiting, stomachache

Muscular System



- Muscles tense up to protect themselves from injury during stress
- Once you relax they tend to release
- Chronic stress may not give your muscles the chance to relax
- Tight muscles cause headaches, back & shoulder pain, body aches
- Over time this unhealthy cycle may affect your ability to exercise, & pain medication for relief may be used

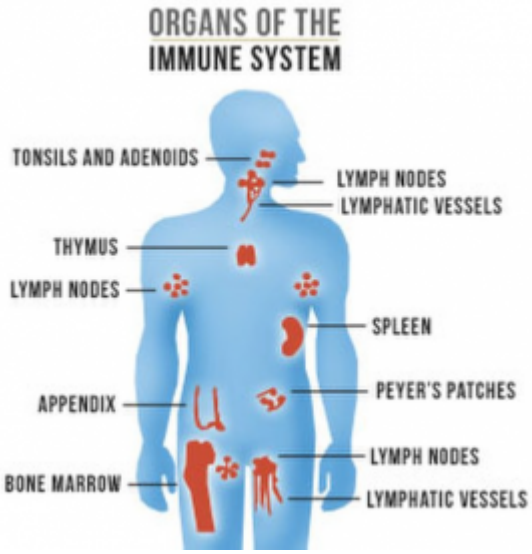
Sexuality & Reproductive System



- Not unusual to lose desire when under constant stress
- Short-term stress may cause men to produce more testosterone, the effect doesn't last long
- Chronic stress will cause a man's testosterone levels to drop
- This can interfere with sperm production & cause erectile dysfunction or impotence
- Chronic stress may increase risk of infection of male reproductive organs
- For women, stress can affect the menstrual cycle
- Irregular, heavier, or more painful menstrual periods
- Chronic stress can also magnify the physical symptoms of menopause

Immune System

- Stimulates the immune system, which is good for immediate situations
- Over time, stress hormones weaken the immune system & reduce the body's response to foreign invaders
- Chronic stress causes more susceptibility to viral illnesses & other infections
- Can increase the time it takes to recover from an illness or injury



Sandwich Generation

- Nancy is now looking after a toddler & her parents
- She is still working & going to school
- Women often feel overextended

Strategies to help manage stress:

- Identify stressors
- Recognize how you deal with stress
- Find healthy ways to manage stress
- Take care of yourself
- Ask for professional support

RESOURCES

Text Resources

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Video Resources

Eating Disorders from the inside out

- Eating disorders through developmental, not mental, lens
- Female Athlete Triad
- How do pregnancy tests work?
- How do vitamins work?
- How do your hormones work?
- How in vitro fertilization (IVF) works
- How menstruation works.

How stress affects your body

The Surprising reason our muscles get tired.

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Feedback

Instructor feedback

Student feedback

CASE 5: SAM

SAM'S STORY

Case Study Downloads

- Meet Sam (PPT)
- Sam's Story (Single Slide) (PPT)
- Sam's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Human Anatomy and Physiology
- Human Pathophysiology/Altered Physiology
- Health Research
- Mental Health and Disabilities

Sam's Story

Sam was born in 2017, and adopted by Nancy and Paul when he was two. He is a typical toddler: good-natured and very inquisitive. Typically, before the finalization of an adoption, children are required to undergo a routine examination by a physician. However, the required examination is not meant to be a complete health screening, and many conditions are not even checked.

Patient History

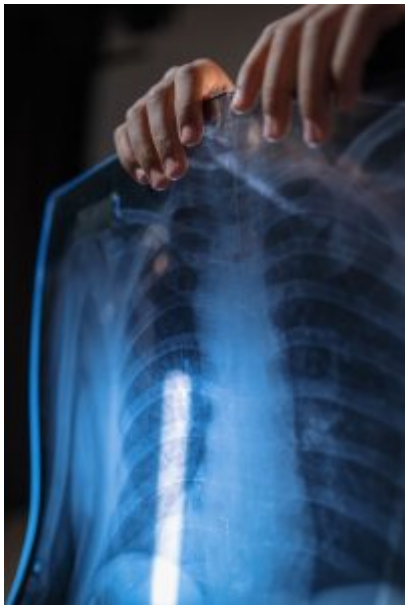
There was little information available about Sam's biological parents. However, it was known that they died in an automobile accident when Sam's father suffered a massive heart attack, just before Sam turned 2. In the past two weeks since Sam was adopted, he has done very well adjusting to his new environment. Moreover, he has had all the proper immunizations for his age.

Sam's adoptive parents have noticed some greasy/oily stools in his diapers. In addition, they are concerned about his wheezing when breathing. Nancy calls her family physician and gets a referral for Sam to see a pediatrician.

Initial visit

The initial visit with the pediatrician consisted of a physical examination, blood work, and a chest x-ray.

Follow-up visit



The weather was very hot and humid, which made it almost unbearable to be outside. Sam's parents parked their car and brought Sam into the air-conditioned comfort of the Medical Centre pediatric clinic. Sam appears to be breathing easier once he is in the cool air.

They were immediately seen by the pediatrician, and Nancy expressed her concern over the colour of Sam's sputum. She was upset that she had forgotten to tell the pediatrician the other day about this fact. The sputum Sam has been coughing up was green and viscid.

While talking with Nancy and Paul about Sam's sputum, the pediatrician looked over at Sam and noticed a white 'frosting' on his face, an indication of salty build-up on the drying edge of sweat. The pediatrician asked Nancy and Paul if they had noticed this salty-build-up before.

"That must be why his skin tastes a bit salty when I kiss him on the cheek," Nancy replied.

The pediatrician then went over the blood count and chest x-ray results with Nancy and Paul.

After describing the chest x-ray results to them, the pediatrician had a hypothesis about Sam's condition. To test her hypothesis, the pediatrician ordered a sweat chloride test.

Sam was diagnosed with cystic fibrosis. Nancy and Paul would have to make many adjustments to care for Sam. He would require chest physical therapy, exercise, medications, digestive support, and psychosocial care.

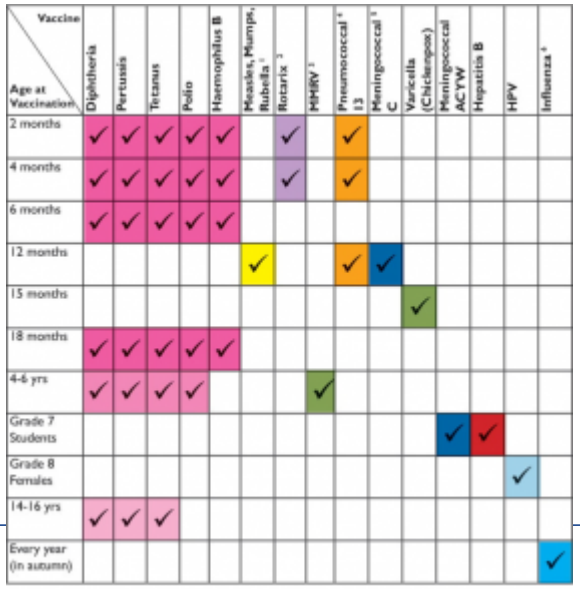
Sam will most likely face significant challenges: frequent hospitalizations, complications such as CF-related diabetes, depression, anxiety, and time-consuming treatment plans that can take 2-3 hours each day.

Case Key Words

- Adoption
- Chest Physio
- Cystic Fibrosis
- Genetics
- Immunizations
- Lungs

SAM'S HEALTH: CYSTIC FIBROSIS

Sam is a happy, energetic child and fully up to date on his immunizations.



Vaccine / Age at Vaccination	Diphtheria	Pertussis	Tetanus	Polio	Haemophilus B	Measles, Mumps, Rubella [1]	Rotarix [2]	MMRV [2]	Pneumococcal [3] 13	Meningococcal [3] C	Varicella (Chickenpox)	Meningococcal ACYW	Hepatitis B	HPV	Influenza [4]
2 months	✓	✓	✓	✓	✓		✓		✓						
4 months	✓	✓	✓	✓	✓		✓		✓						
6 months	✓	✓	✓	✓	✓										
12 months						✓			✓	✓					
15 months											✓				
18 months	✓	✓	✓	✓	✓										
4-6 yrs	✓	✓	✓	✓				✓							
Grade 7 Students												✓	✓		
Grade 8 Females														✓	
14-16 yrs	✓	✓	✓												
Every year (in autumn)															✓

Some Concerns

Nancy & Paul were concerned about the following:

- They could hear Sam wheeze when he was breathing
- Greasy/oily stools in his diaper

Family physician referred Sam to a pediatrician.

Initial Visit

- Physical examination
- Blood work
- Chest x-ray

Physical Examination

Vital Signs

- Age: 2 years, 6 months
- Weight: 28 lbs. (lower 10%-tile)
- Height: 3 ft. 1 inch
- Pulse: 115 BPM
- Respirations: 30 breaths per minute

- Blood pressure: 95/60 mmHg

General Appearance

- Happy, energetic child

Head and Neck

- Runny nose but his ears are clear of fluid
- No enlarged lymph nodes in neck

Lungs

- Crackling sounds are present
- Coughing and wheezing are audible

Cardiovascular

- Normal

Abdominal

- No swelling present

Genitourinary

- Not assessed

Extremities

- Full mobility is present
- Pulse found in arms and legs

Neurological

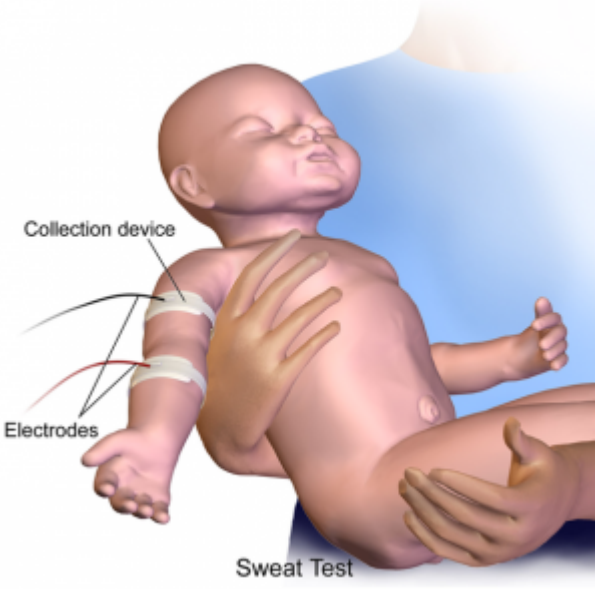
- Normal reflexes

Follow-up appointment scheduled for the next day.

Lab & Diagnostic Results

- White blood cell count: values within normal limits
- WBC differential: lymphocytes, monocytes, eosinophils, & basophils are within normal limits. There is a slight elevation of neutrophils.
- Red blood cell count: values within normal limits
- Hematocrit: values within normal limits
- Platelet count: values within normal limits
- Sweat chloride test: 40 mmol/L
- Chest x-ray: some hyperinflation & bronchial wall thickening

Understanding Sweat Test Results



- People with CF have more chloride in their sweat
- Sweat chloride test will confirm the diagnosis
- Enough sweat is needed to do the test
- Full-term babies usually produce enough sweat by 2 weeks of age
- To understand what the sweat test results mean, a chloride level of:
- Less than or equal to 29 mmol/L = CF is unlikely regardless of age
- Between 30 – 59 mmol/L = CF is possible and additional testing is needed
- Greater than or equal to 60 mmol/L = CF is likely to be diagnosed

When sweat chloride test results fall between the range of 30-59 mmol/L, the sweat test is usually repeated.

Diagnosis

Cystic Fibrosis

- Life-threatening genetic disease
- Causes the body to create thick mucus
- Mucus builds up & obstructs ducts U tubes in the lungs, digestive track & pancreas
- May cause fatal infections & digestive issues
- Affects the sweat glands & male reproductive system

Newborn Screening

Newborn screening (NBS) for cystic fibrosis is done in the first few days after birth. By diagnosing CF early, CF health care providers can help parents learn ways to keep their child as healthy as possible and delay or prevent serious, lifelong health problems related to CF.

Research shows that children who receive CF care early in life have better nutrition and are healthier than those who are diagnosed later. Early diagnosis and treatment can:

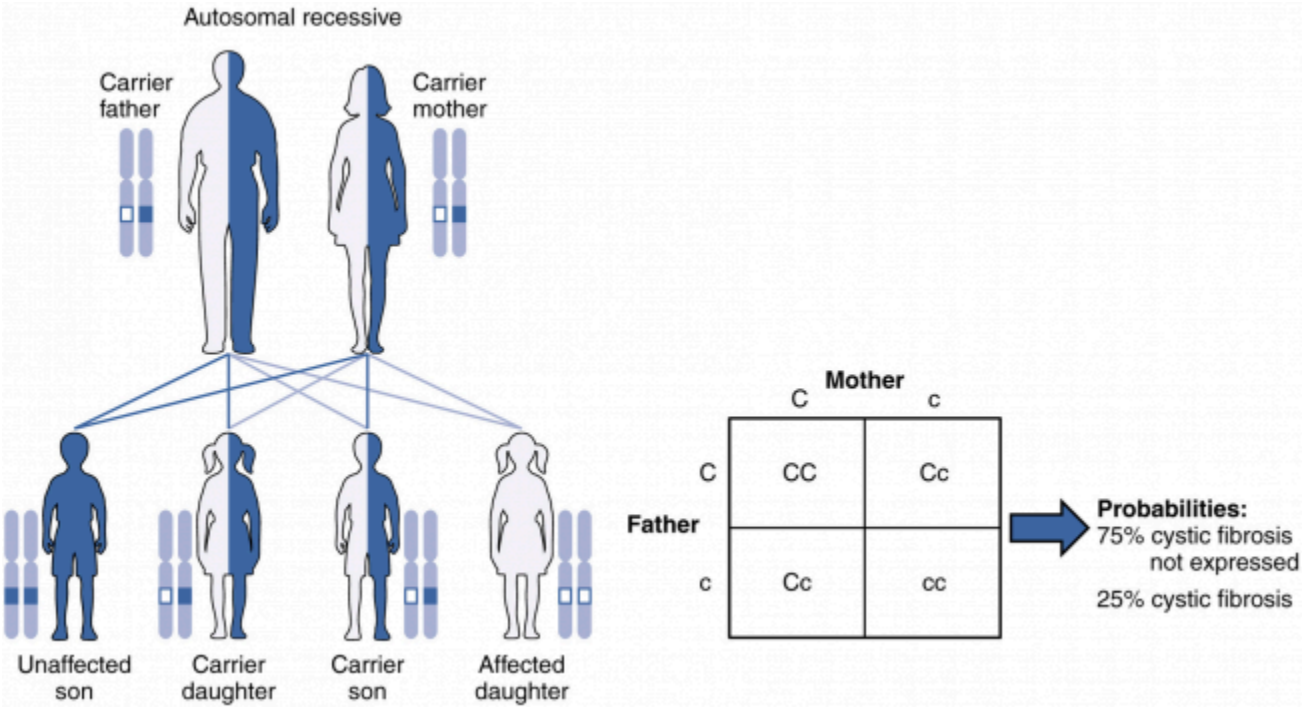
- Improve growth
- Help keep lungs healthy
- Reduce hospital stays
- Add years to life

Timing

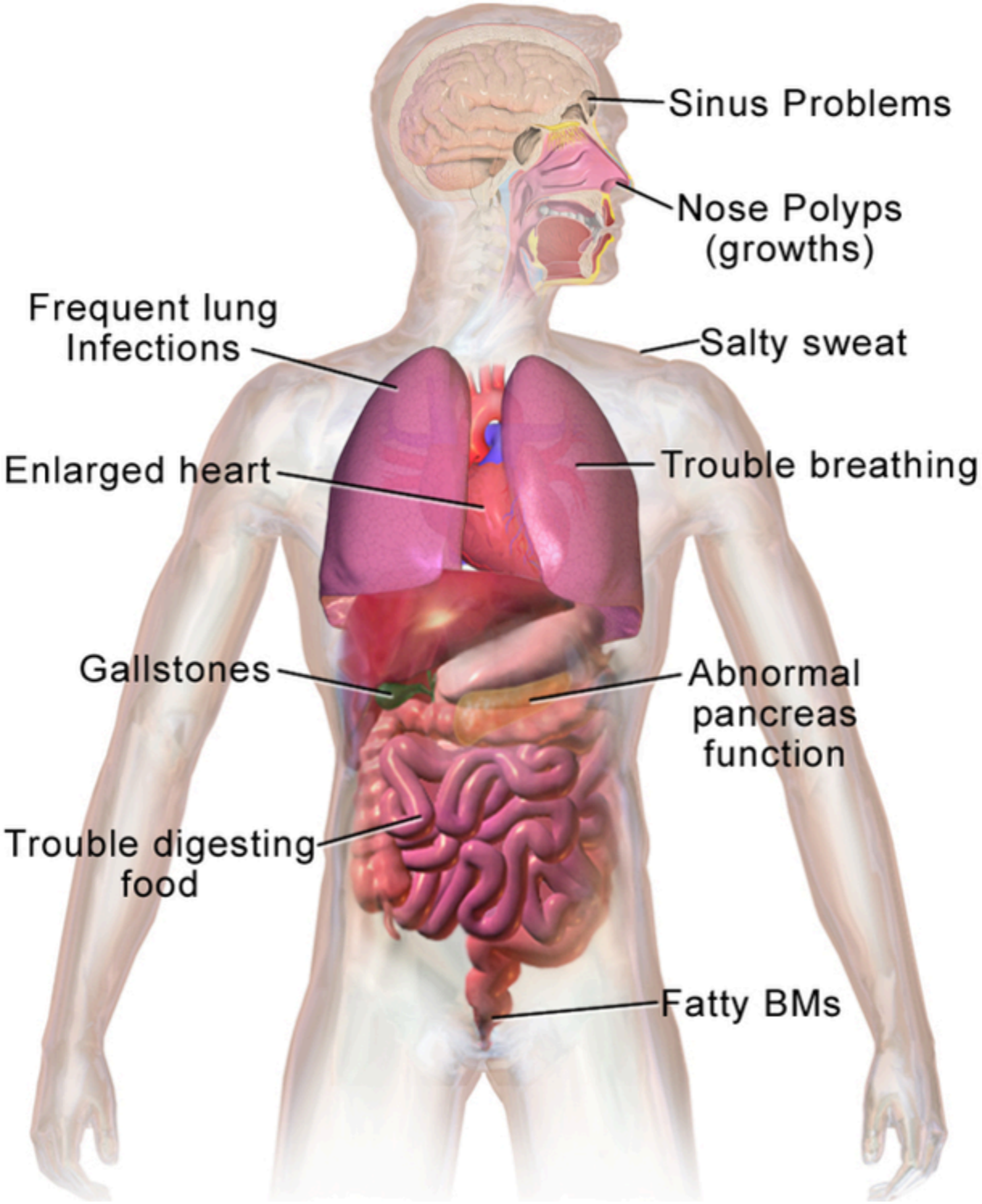
Newborn screening is done during the first few days of a baby's life — usually by a health care provider in the hospital. A few drops of blood from a heel prick are placed on a special card, called a Guthrie card.

This card with the baby's information is mailed to a special state laboratory that will test the blood sample for certain health conditions, including CF. In some states, newborn screening involves two blood samples, one at birth and one a few weeks later.

Genetics of Cystic Fibrosis



Symptoms


Sinus Problems
Nose Polyps (growths)
Frequent lung Infections
Salty sweat
Enlarged heart
Trouble breathing
Gallstones
Abnormal pancreas function
Trouble digesting food
Fatty BMs

Complications

Respiratory System

- Recurrent attack of bronchitis & pneumonia
- Damage to the airways → bronchiectasis
- Nasal polyps
- Coughing of blood (hemoptysis)
- Pneumothorax
- Respiratory failure

Digestive System

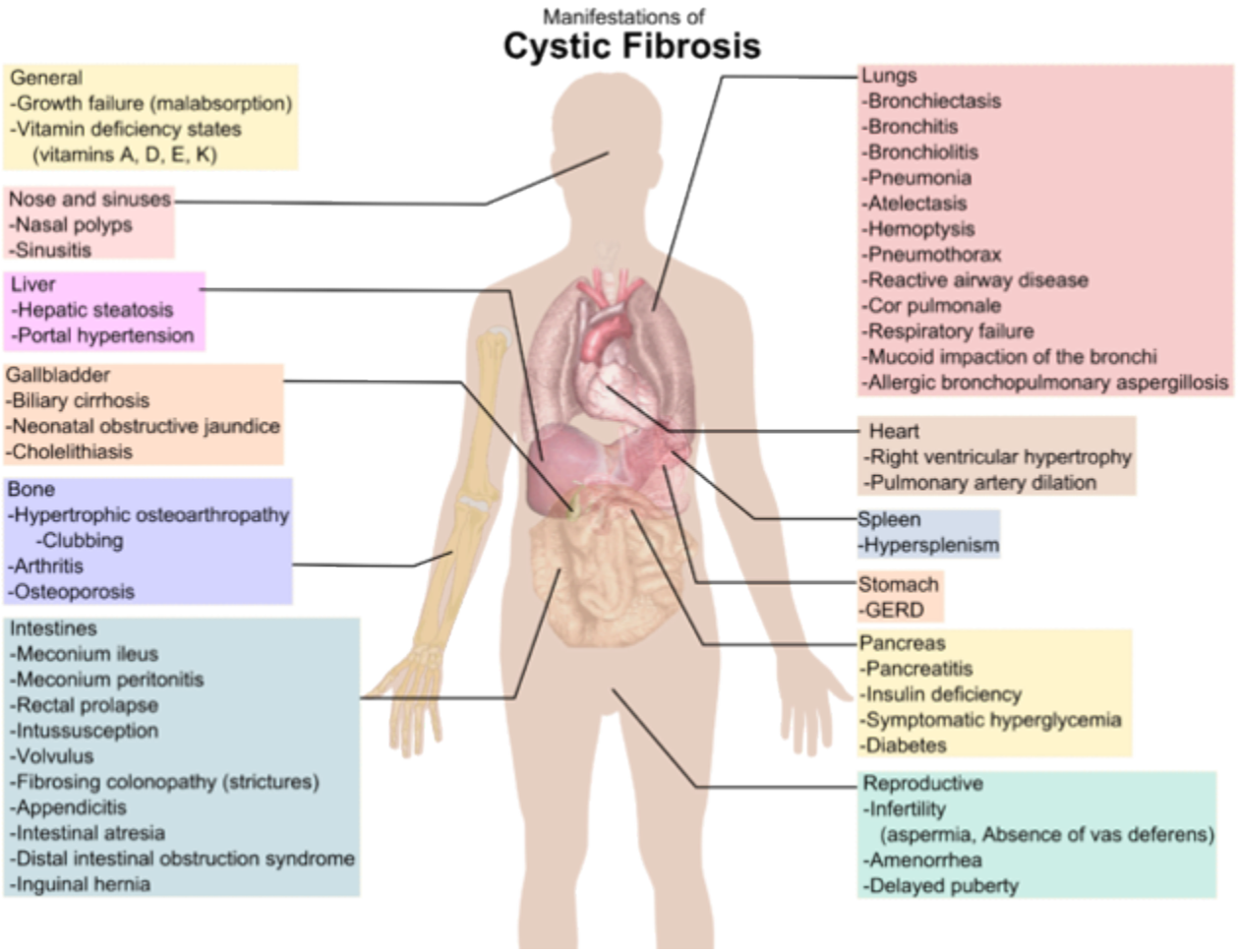
- Malabsorption of nutrients
- Diabetes mellitus (pancreatic damage)
- Blockage of bile duct
- Intestinal obstruction
- Distal intestinal obstruction syndrome

Reproductive System

- Infertility
- Pregnancy may exacerbate the disease & cause complications

Other Systems

- Increased risk of osteoporosis
- Dehydration & electrolyte imbalances
- Clubbing of fingers & toes



Treatment

At present there is no cure for CF. Treatment aims at alleviating the symptoms & reducing the incidence of complications. Careful follow-up & early & aggressive intervention is essential. It is advisable to obtain treatment at a centre that specializes in CF.

Aims of Treatment

- Reducing incidence & successful treatment of respiratory infections
- Providing sufficient nutrition
- Removal of & loosening mucus plugs in lung & airways
- Avoiding & treating intestinal obstruction

Chest Physical Therapy

- Loosens thick mucus & aids in expectoration
- Tapping the front & back of the chest with cupped hands
- May be done up to 4 times a day
- Patient can be sitting or lying on his abdomen
- Breathing exercises – coughing or huffing
- Aerobic exercise helps to loosen the mucus
    - increases loss of salt & minerals

Nutritional Therapy

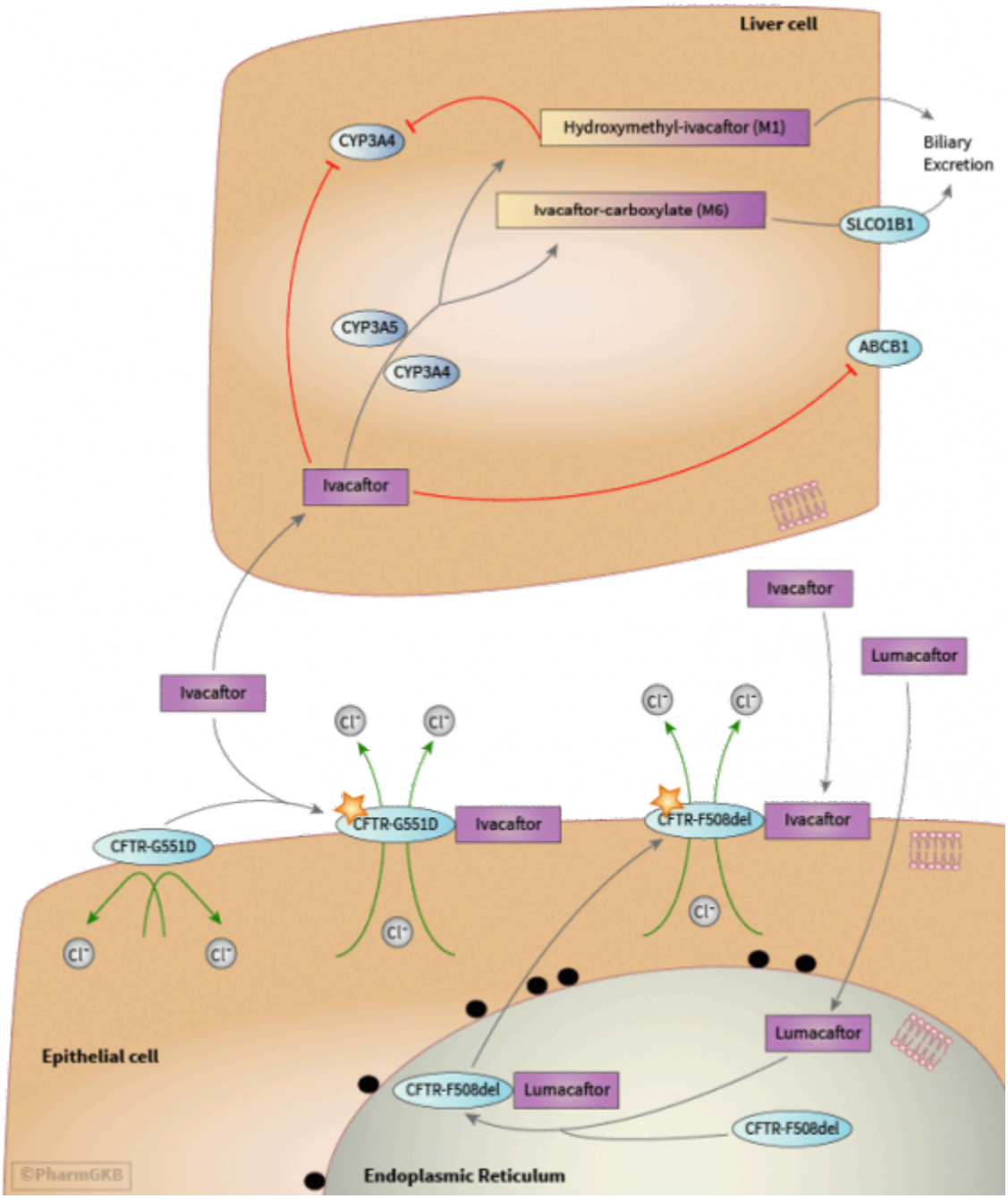
Nutritional therapy can take care of the malnutrition & vitamin deficiency that is common to CF patients. It involves:

- A well-balanced diet
- Intake of oral pancreatic enzymes to help in digestion & absorption
- Vitamin A, D, E, & K supplements
- High-calorie nutrient-filled shakes
- A high-salt diet or salt supplements (usually before exercise)
- A feeding tube may be used at night to give more calories

Medication

- Antibiotics – treating & preventing respiratory infections
- Mucolytics – aid in coughing out mucus, improves lung function
- Bronchodilators – keep airways patent & facilitate easier breathing
- Pancreatic enzyme supplements – improve absorption & digestion
- Vitamin supplements – including fat soluble vitamins
- New agents that improve chloride transport – IVACAFTOR

Disease Modifying Drug	
Kalydeco G511D	(ivacaftor) a pill for people ages 6 and older who have the G551D mutation of CF which helps the defective CFTR protein work at the surface of the cell
Symptom Management	
PULMOZYME (Dornase Alfa)	is an inhaled medication used to help thin the mucus
Hypertonic Saline	to draw more water into the airways and make it easier to cough out the mucus.
Ibuprofen	anti-inflammatory to slow the rate of lung function decline
CREON	pancreatic enzymes to help people with CF digest their food
COTAZYM	pancreatic enzymes to help people with CF digest their food
FLOVENT	inhaled steroid treatment Open benefit
ADVAIR	inhaled steroid treatment for asthma
Salbutamol (MDI or Nebules)	bronchodilator
Infection Control	
CAYSTON	(aztreonam) inhaled antibiotic for the treatment of CF
Zithromax (Azithromycin)	is a commonly used antibiotic to treat pneumonia
COLY-MYCIN	antibiotic
TOBI Podhaler	(tobramycin) inhaled antibiotic with Podhaler device to help fight the germ *Pseudomonas aeruginosa*
TOBI Inhaled Tobramycin 300mg	(tobramycin) inhaled antibiotic to help fight the germ *Pseudomonas aeruginosa*



Ivacaftor increases the activity of the CFTR protein, while Lumacaftor improves protein folding of the CFTR protein.

Surgical Treatment

- Removal of nasal polyps
- Removal of mucus obstructing airways (endoscope)
- Oxygen therapy

- Alimentation through feeding tube
- Relieving intestinal obstruction
- Lung transplant

Caregiver Suggestions

- CF symptoms may worsen over time
- Managing CF takes a team approach
- Staying organized makes treatment easier
- Preventing infection is essential
- Focusing on nutrition is a must
- Exercise can keep everyone healthy
- Emotional distress is real
- Your loved one may need a lung transplant someday
- It's important to take steps to help your child transition to adulthood
- You need to make time to take care of yourself, too

RESOURCES

Text Resources

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Video Resources

Cystic Fibrosis

- Immune System
- Immunizations
- Cystic Fibrosis: Sweat Test
- The Science of Skin Colour
- Lung Sounds

Additional Resources

Nutrition Pancreatic Enzyme Replacement in People with Cystic Fibrosis

Publicly Funded Immunization Schedules for Ontario 2021

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Feedback

Instructor feedback

Student feedback

CASE 6: HUGH

HUGH'S STORY

Case Study Downloads

- Meet Hugh (PPT)
- Hugh's Story (Single Slide) (PPT)
- Hugh's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Social Determinants of Health
- Health Promotion and Active Living
- Anatomy & Physiology
- Pathophysiology
- Altered Physiology
- Perspectives in Aging
- Health Research

Hugh's Story

Hugh was born in 1945 and grew up near Sunnybrook in Toronto. He went to private school

and did well in his studies, with the goal of becoming a lawyer. He articled at a prestigious law firm in Toronto where he met Gladys, the daughter of one of the firm's partners. He joined the law firm once he passed his bar exam and married Gladys shortly after.

Hugh worked long hours and within three years made junior partner. In 1971, he and Gladys's son, Paul, was born. Hugh continued to work long hours and weekends, often missing out on Paul's milestones.

Due to the demands of Hugh's job and the couple's social status, it was decided that Paul would be sent to boarding school once he started kindergarten.

Hugh and Gladys entertained often, socializing with the elite of Toronto. Rich foods and large amounts of alcohol were an everyday occurrence for this couple.

In 1990, Hugh was seen by his family physician for headaches, vision problems, fatigue, and occasional nose bleeds. Hugh was diagnosed with Stage 2 hypertension (blood pressure 150/90) and given instructions to change his lifestyle.

Diagnostics

- 24-hour blood pressure monitor
- Routine tests: urinalysis, CBC, electrolytes, BUN, creatinine, cholesterol test, ECG, echocardiogram

Hugh was put on a diuretic and angiotensin converting enzyme (ACE) inhibitor. He was able to manage his hypertension with these medications. However, he did not change his lifestyle as recommended by his physician.

Medications:

- Furosemide (Lasix) – loop diuretic
- Ramipril (Altace) – ACE inhibitor

In 2011, Hugh retired. Due to her cognitive and physical deterioration, Gladys required his attention. He needed to be home more to facilitate her care. Over time, Gladys had to move into a long-term care institute.

Hugh was now experiencing urinary issues that he had attributed to the normal aging process:

- Frequent or urgent need to urinate
- Increased frequency of urination at night (nocturia)
- Difficulty starting urination
- Weak urine stream or a stream that stops and starts
- Dribbling at the end of urination
- Inability to completely empty the bladder

Once again, Hugh decided to see his family physician. Physical examination and mildly elevated serum prostate-specific antigen (PSA) confirmed that Hugh had benign prostatic hyperplasia (BPH). BPH is a common condition as men age. An enlarged prostate gland can cause uncomfortable urinary symptoms, such as urine flow blockage out of the bladder. It can also cause bladder, urinary tract or kidney problems. His physician wanted Hugh to have a routine colonoscopy as Hugh's fecal immunochemical test (FIT) was back positive.

FIT is a screening test for colon cancer. It tests for hidden blood in the stool, which can be an early sign of cancer. FIT only detects human blood from the lower intestines. Medications and food do not interfere with the test.

Given Hugh's symptoms, he was scheduled for a transurethral resection of the prostate (TURP). A lighted scope is inserted into the urethra, and the surgeon removes all but the outer part of the prostate. TURP generally relieves symptoms quickly, and most men have a stronger urine flow soon after the procedure. After TURP a catheter may be temporarily needed to drain the bladder.

Hugh no longer had urinary issues, was sleeping better, had more energy, and was relieved that it was "nothing much". Two months after his TURP, Hugh went in for his routine colonoscopy.

A colonoscopy lets a doctor look at the lining of the entire colon and rectum using an endoscope.

Abnormal results may show:

- diverticulosis (abnormal pouches in the lining of the colon)
- hemorrhoids
- inflammatory bowel disease (ulcerative colitis or Crohn's disease)
- bleeding in the colon or rectum
- polyps
- cancer of the colon or rectum

Biopsies were taken during the colonoscopy for testing in the lab. The pathologist reported Stage I colon cancer. Hugh required a bowel resection which left him with a colostomy. With Gladys in long-term care, Hugh was living alone. Home care was instructed to teach him proper ostomy care.

Hugh's self-image was suffering. He did not go out, and was not eating properly due to fear of leakage at the ostomy site. He led a very sedentary life. He also had concerns about the welfare of his son, Brian, who had Down syndrome and lived with Hugh at home: who would look after him once Hugh was gone? Hugh considered reaching out to his older son, Paul, but the two of them had not spoken in years. Ultimately, Hugh was unable to get Paul's help in caring for Brian and himself.

Instead, Hugh spent time researching institutions where Brian could live. The only option Hugh could see for Brian's wellbeing was sending him to a home for "people like him."

Case Key Words

- Alcohol
- Cancer
- Cardiovascular-circulation
- Colon Cancer
- Colostomy
- High Blood Pressure
- Hypertension
- Prostate
- Urinary System

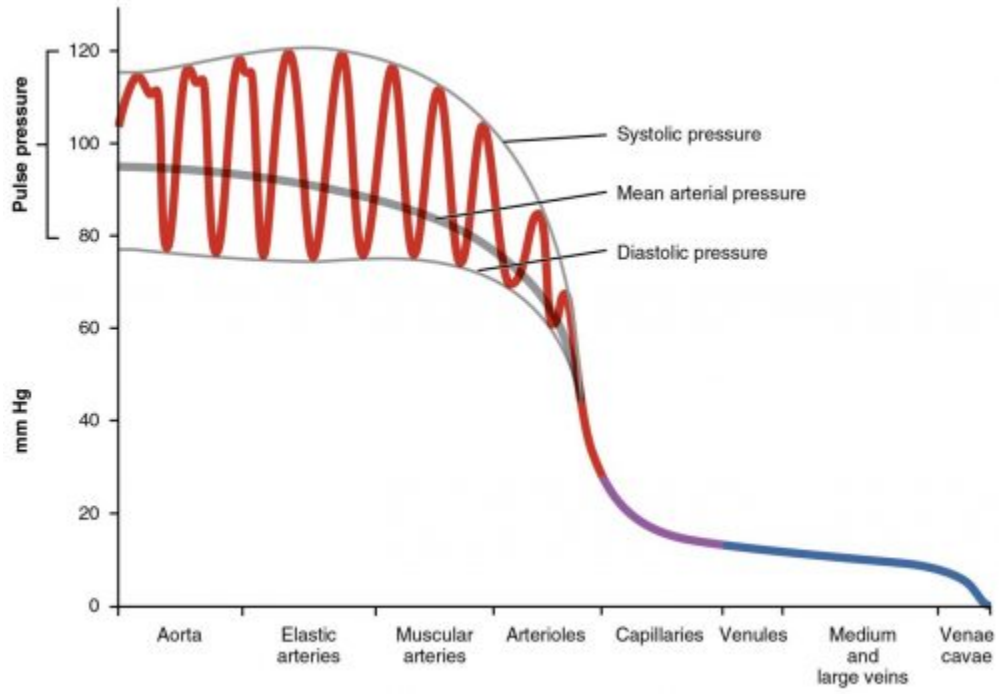
HUGH'S HEALTH: HYPERTENSION

Hugh was diagnosed with hypertension in 1990.

Components of Arterial Blood Pressure

The **systolic pressure** is the higher value and reflects the arterial pressure resulting from the ejection of blood during ventricular contraction, or systole.

The **diastolic pressure** is the lower value and represents the arterial pressure of blood during ventricular relaxation, or diastole.



Hypertension Medications

	Systolic	Diastolic
Normal	90 – 129	60 – 79
Stage 1	130 – 139	80 – 89
Stage 2	140 – 179	90 – 109
Critical	Over 180	Over 110

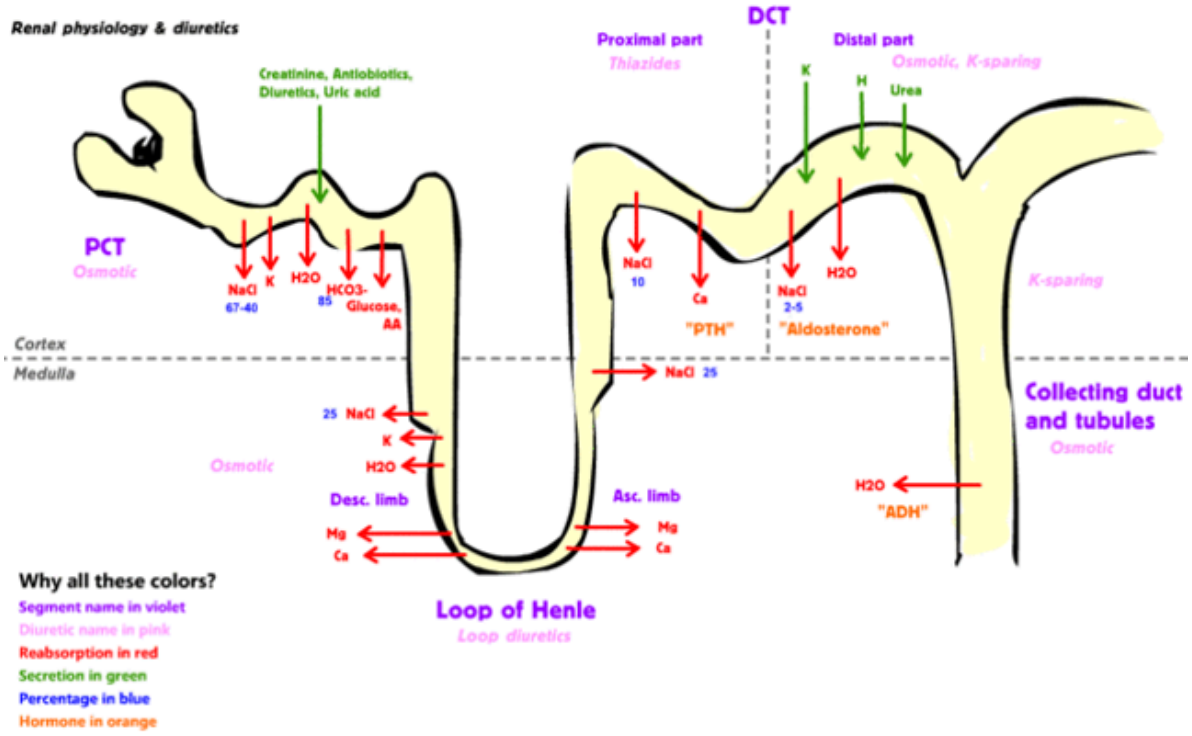
- **Diuretics**: get rid of excess sodium and water, often used with additional prescription therapies
  - Thiazide diuretics, potassium-sparing diuretics, combination diuretics
- **Beta-blockers**: reduce heart rate, workload, and output
- **ACE inhibitors**: help to produce less angiotensin, blood vessels relax and open up
- **Angiotensin II receptor blockers**: block the receptors so angiotensin fails to constrict blood vessels
- **Calcium channel blockers**: prevents calcium from entering the smooth muscle cells of the heart & arteries and open up narrowed blood vessels
- **Alpha blockers**: reduce artery resistance, relaxing the muscle tone of the vascular wall
- **Alpha-2 receptor agonists**: decreasing the activity of the sympathetic portion of the involuntary NS
- **Combined alpha and beta-blockers**: used IV for hypertensive crisis
- **Central agonists**: decrease blood vessels' ability to tense up or contract (different nerve pathway than α & β-blockers)
- **Peripheral adrenergic inhibitors**: blocks neurotransmitters in the brain for smooth muscle contraction
- **Vasodilators**: muscle in the blood vessel walls to relax → vessel dilation

Hugh's Blood Pressure Medications

Furosemide (Lasix)-loop diuretic

- Inhibits the NKCC2 cotransporter.
- Inhibits the reabsorption of sodium.
- The interstitium will lose its tonicity.

- Affecting how much water is reabsorbed by the Loop of Henle and collecting ducts.
- More water leaves via the filtrate rather than go back into the blood.



Ramipril (Altace)-ACE inhibitor

- Reduce the activity of angiotensin-converting enzyme.
- ACE is responsible for hormones that help control BP.
- Narrowing effect on blood vessels that ↑BP.
- ACE inhibitors limit this enzyme, making the blood vessels relax and widen.
- Lowering BP and improving blood flow to the heart muscle.

Managing Hypertension

- Exercising regularly
- Eating a healthy diet
- Decrease the salt in your diet
- Maintain a healthy weight
- Managing your stress
- Limit alcohol
- Don't smoke

HUGH'S HEALTH: BENIGN PROSTATIC HYPERPLASIA

Hugh was diagnosed with benign prostatic hyperplasia (BPH) in 2011, and underwent a transurethral resection of the prostate.

Risk Factors

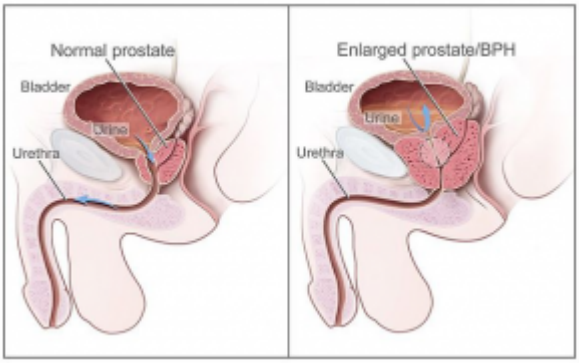
- Aging
- Family history
- Diabetes or heart disease
- Lifestyle

Diagnostics


Normal Prostate


Enlarged Prostate

- **Digital rectal exam**. The doctor inserts a finger into the rectum to check your prostate for enlargement.
- **Urine test**. Analyzing a sample of your urine can help rule out an infection or other conditions that can cause similar symptoms.
- **Blood test**. The results can indicate kidney problems.
- **Prostate-specific antigen (PSA) blood test**. PSA is a substance produced in your prostate. PSA levels increase when you have an enlarged prostate. However, elevated PSA levels can also be due to recent procedures, infection, surgery or prostate cancer.



- **Urinary flow test**. You urinate into a receptacle attached to a machine that measures the strength and amount of your urine flow. Test results help determine over time if your condition is getting better or worse.
- **Post void residual volume test**. This test measures whether you can empty your bladder completely. The test can be done using ultrasound or by inserting a catheter into your bladder after you urinate to measure how much urine is left in your bladder.
- **24-hour voiding diary**. Recording the frequency and amount of urine might be especially helpful if more than one-third of your daily urinary output occurs at night.

Complications

- Sudden inability to urinate
- Urinary tract infection (UTI)
- Bladder calculi
- Bladder damage
- Kidney damage

Medications

- **Alpha blockers**. These medications relax bladder neck muscles and muscle fibers in the prostate, making urination easier. Alpha blockers — which include alfuzosin (Uroxatral), doxazosin (Cardura), tamsulosin (Flomax) and silodosin (Rapaflo) — usually work quickly in men with relatively small prostates. Side effects might include dizziness and a harmless condition in which semen goes back into the bladder instead of out the tip of the penis (retrograde ejaculation).
- **5-alpha reductase inhibitors**. These medications shrink your prostate by preventing hormonal changes that cause prostate growth. These medications — which include finasteride (Proscar) and dutasteride (Avodart) — might take up to six months to be effective. Side effects include retrograde ejaculation.
- **Combination drug therapy**. Your doctor might recommend taking an alpha blocker and a 5-alpha reductase inhibitor at the same time if either medication alone isn't effective.
- **Tadalafil (Cialis)**. Studies suggest this medication, which is often used to treat erectile dysfunction, can

also treat prostate enlargement.

Surgical Intervention

Under what circumstances is surgery a viable treatment for BPH?

- Your symptoms are moderate to severe
- Medication hasn't relieved your symptoms
- You have a urinary tract obstruction, bladder stones, blood in your urine or kidney problems
- You prefer definitive treatment
- **Transurethral Resection of the Prostate (TURP)**

HUGH'S HEALTH: COLON CANCER

In 2011, after a routine colonoscopy, Hugh was diagnosed with Stage I colon cancer. To treat it, he underwent a colostomy.

Stages of Colon Cancer

Stage 0 (Carcinoma in Situ)

- Abnormal cells found in the mucosa of the colon wall.
- These cells may become cancer and spread into nearby normal tissue.

Stage I Colon Cancer

- Cancer has formed in the mucosa of the colon wall.
- Has spread to the submucosa or to the muscle layer of the colon wall.

Stage II Colon Cancer

Is divided into stages IIA, IIB, and IIC:

Stage IIA

- Cancer has spread through the muscle layer of the colon to the serosa of the colon wall.

Stage IIB

- Cancer has spread through the serosa of the colon wall to the tissue that lines the organs in the abdomen.

Stage IIC

- Cancer has spread through the serosa of the colon wall to nearby organs

Stage III Colon Cancer

Is divided into stages IIIA, IIIB, and IIIC:

Stage IIIA

- Spread through the mucosa to the submucosa or the muscle layer and spread into 1 to 3 nearby lymph nodes or cancer cells have formed in tissue near the lymph nodes.
- Or through the mucosa to the submucosa and spread to 4 to 6 nearby lymph nodes.

Stage IIIB

- Spread through the muscle layer to the serosa or has spread through the serosa to the tissue that lines the organs in the abdomen.
- Spread to 1 to 3 nearby lymph nodes or cancer cells have formed in tissue near the lymph nodes.
- Spread to the muscle layer or to the serosa and to 4 to 6 nearby lymph nodes.
- Through the mucosa to the submucosa or to the muscle layer and spread to 7 or more nearby lymph nodes.

Stage IIIC

- Spread through the serosa to the tissue that lines the abdominal organs and spread to 4 to 6 nearby lymph nodes.
- Through the muscle layer to the serosa or spread through the serosa to the tissue that lines the abdominal organs and spread to 7 or more nearby lymph nodes.
- Spread through the serosa to nearby organs and spread to 1 or more nearby lymph nodes or cancer cells have formed in tissue near the lymph nodes.

Stage IV colon cancer

Is divided into stages IVA, IVB, and IVC:

Stage IVA

- Spread to one area or organ that is not near the colon or a distant lymph node.

Stage IVB

- Spread to more than one area or organ that is not near the colon or a distant lymph node.

Stage IVC

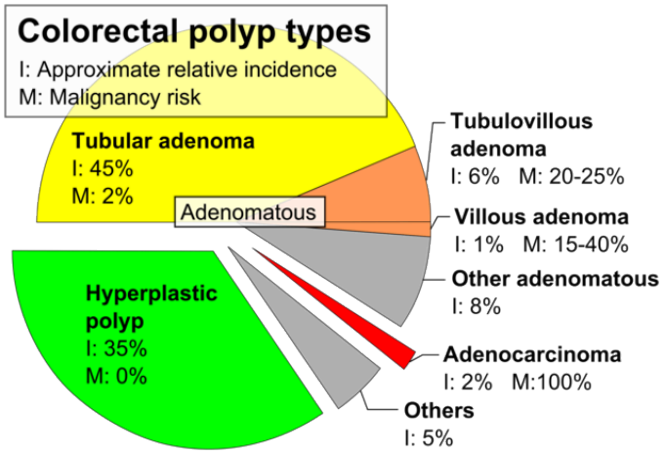
- Spread to the tissue that lines the wall of the abdomen and may have spread to other areas or organs.

Risk Factors for Colorectal Cancer

- Family history of colon or rectal cancer in a first-degree relative
- A personal history of cancer of the colon, rectum, or ovary
- Personal history of high-risk adenomas (colorectal polyps that are 1 cm or larger, or have abnormal cells)
- Inherited changes in certain genes that increase the risk (familial adenomatous polyposis or Lynch syndrome)
- Personal history of chronic ulcerative colitis or Crohn disease for 8 or more years
- 3 or more alcoholic drinks per day
- Smoking cigarettes
- Being black
- Being obese
- Older age

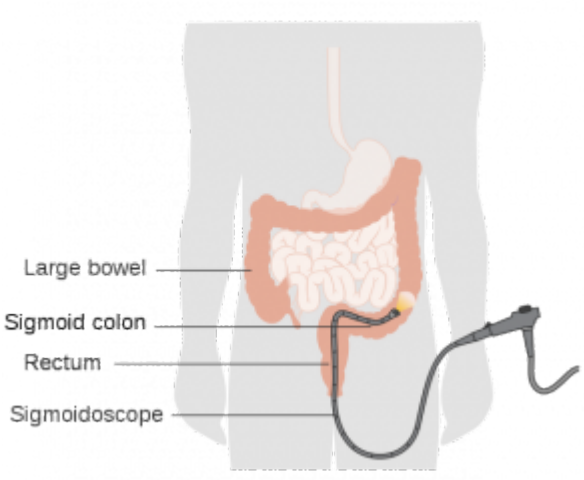
Symptoms

- Change in bowel habits
- Blood (either bright red or very dark) in the stool
- Diarrhea, constipation, or feeling that the bowel does not empty



- Stools that are narrower than usual
- Frequent gas pains, bloating, fullness, or cramps
- Weight loss for no known reason
- Feeling very tired
- Vomiting

Diagnostic Tests



- Physical exam and health history
- Digital rectal exam
- Fecal occult blood test (FOBT)
    - Guaiac FOBT
    - Immunochemical FOBT
- Barium enema
- Sigmoidoscopy

Surgical Treatment

- Resection of the colon with colostomy
- Unable to sew the 2 ends of the colon together
- A stoma (an opening) is made outside the body
- Waste passes through this opening a bag is placed around the stoma to collect the waste
- It can be reversed

Life Post-Colostomy

- Monitor your medications. Some meds can cause constipation or diarrhea.
- Eat a well-balanced diet. Avoid foods that cause a lot of gas.
- Live your life.

Concerns:

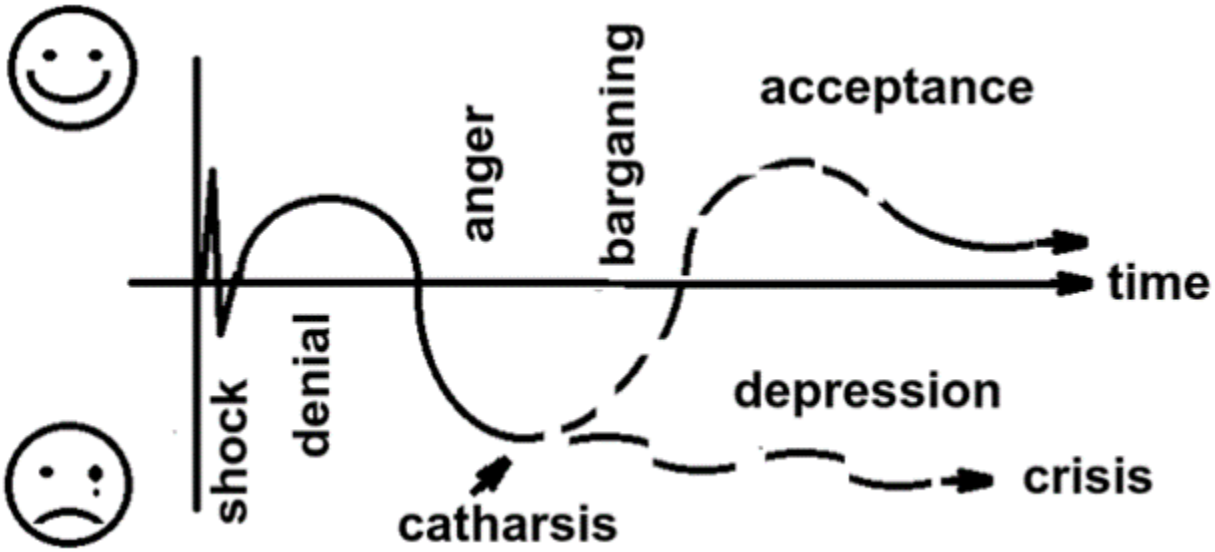
- Body image/self-esteem
- Relationships
- Self-care

Phases of Psychological Adaptation

Almost every patient goes through 4 phases of recovery following an accident or illness that results in loss of function of an important part of the body.

The patient and family go through these phases, varying only in the time required for each phase.

Some people may skip certain phases entirely and some may move up and down at different times.



1. **Shock or panic**: tearful, anxious and forgetful.
2. **Defense/retreat/denial**: denies or minimizes the significance of the event, defends themselves against the implications of the event.
3. **Acknowledgement**: begins to face the reality of the situation. Gives up the old life, and may enter a period of depression, of apathy, of agitation, of bitterness, and of high anxiety.
4. **Adaptation/resolution**: acute grief begins to subside. Coping in a constructive manner and begins to establish new structures. Develops a new sense of worth.

RESOURCES

Text Resources

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Video Resources

Cancer

- How does alcohol make you drunk?
- How does blood pressure work?
- Who's at risk for colon cancer?

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Feedback

Instructor feedback

Student feedback

CASE 7: GLADYS

GLADYS' STORY

Case Study Downloads

- Meet Gladys (PPT)
- Gladys' Story (Single Slide) (PPT)
- Gladys' Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Anatomy & Physiology
- Pathophysiology
- Altered Physiology
- Perspectives in Aging
- Health Research
- Mental Health & Disabilities

Gladys' Story

Gladys was born in 1949 and grew up in the Bridle Path neighbourhood of Toronto. She was an

only child whose parents provided her with everything she could ask for. She went to private schools, vacationed in foreign destinations, and never really had any worries.

Gladys met her future husband at a party in 1965 when she was home from school. Hugh was a friend of a friend, and part of Gladys's socio-economic class. They got to know one another over the summer, and promised to stay in touch while Gladys was away finishing school. Despite her parents' disapproval over her relationship with Hugh, she married him.

Gladys started smoking when she was 16 years old and continued to smoke over one pack per day until recently. She also continued her tradition of afternoon cocktails throughout her adult life. Gladys did not work outside of the home, hired a cleaning lady to come in once per week, and had a full-time cook. After their son Paul was born, Gladys and Hugh hired a nanny, who stayed with them until Paul started school.

Life was going well until 1989, when Gladys found out that she was pregnant again. Gladys continued to smoke and have afternoon cocktails during both pregnancies. Brian was born in late 1989 and diagnosed with Down syndrome. Shortly after his birth, Brian required a number of surgeries and he remained in hospital for approximately the first year of his life.

Gladys and Hugh visited Brian infrequently during his hospitalization. Brian was discharged home, where he had private care around the clock. Gladys went to see her son once each day, but did not interact with him.

Gladys was diagnosed with stage 2 COPD in 1999 and told to

quit smoking. She tried many times without any success. In 2015, her illness worsened and she was prescribed oxygen therapy for stage 3 COPD.

Medications:

- Formoterol and budesonide (Sybicort) – bronchodilator and inhaled steroid

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As early as 2010, Hugh started noticing changes in Gladys. She was becoming increasingly forgetful and would often behave in ways that were not normal for her:

- Memory loss
- Poor judgment leading to bad decisions
- Loss of spontaneity and sense of initiative
- Taking longer to complete normal daily tasks
- Repeating questions
- Trouble handling money and paying bills
- Wandering and getting lost
- Losing things or misplacing them in odd places
- Mood and personality changes
- Increased anxiety and/or aggression

Hugh took her to see her family physician who diagnosed Gladys with Alzheimer's disease.

Diagnosis of Alzheimer's disease:

Physical and neurological examination

Reflexes, muscle tone and strength, coordination, balance, ability to sit, stand up, and move around the room, sense of sight, and hearing are all examined to study overall neurological health.

Laboratory test

Blood samples are collected to help detect if there are any alternative explanations for memory loss or confusion, such as vitamin deficiency or a thyroid disorder.

Brain imaging

Magnetic resonance imaging (**MRI**): Radio waves and a strong magnetic field are used to produce detailed images of the brain. MRI scans may also show brain shrinkage.

Computerized tomography (**CT**): It is a specialized X-ray technology that produces cross-section images of the brain.

Positron emission tomography (**PET**): A low-level radioactive tracer that is injected into the blood to reveal particular features of the brain.

Treatment of Alzheimer's disease:

- **Cholinesterase inhibitor**: boosts the level of cell-to-cell coordination which usually gets depleted in the brain. This drug helps to preserve a chemical messenger. Although improvement is modest, agitation and depression levels are moderated well.
- **Memantine (Namenda)**: slows the progression of symptoms and is at times combined with a cholinesterase inhibitor. This drug functions in another brain cell communication network, and in rare cases may cause side effects such as dizziness and signs of confusion.
- **Anti-depressants**: to help control behavioural changes

Over the next few years, Gladys continued to deteriorate:

- Increased memory loss and confusion
- Inability to learn new things
- Difficulty with language and problems with reading, writing, and working with numbers
- Difficulty organizing thoughts and thinking logically
- Shortened attention span
- Problems coping with new situations

- Difficulty carrying out multi step tasks, such as getting dressed
- Problems recognizing family and friends
- Hallucinations, delusions, and paranoia
- Impulsive behavior, such as undressing at inappropriate times or places or using vulgar language
- Inappropriate outbursts of anger
- Restlessness, agitation, anxiety, tearfulness, and wandering – especially in the late afternoon or evening
- Repetitive statements or movement, occasional muscle twitches

Hugh discussed Gladys's care with her family physician as he wanted to keep Gladys at home. It was decided that the familiar surroundings of home would be beneficial to Gladys, however additional supervision and care would be necessary.

By 2018, Gladys' symptoms had become even more severe:

- Inability to communicate
- Weight loss
- Seizures
- Skin infections
- Difficulty swallowing
- Groaning, moaning, or grunting
- Increased sleeping
- Loss of bowel and bladder control

A care conference was called with her primary care team, Hugh and Paul. It was decided that it was best for Gladys to be placed in a long-term care facility. Approximately nine months after admission, Gladys was diagnosed with aspiration pneumonia. The facility's physician presented Hugh with the options of antibiotics to treat the pneumonia, and a feeding tube to provide Gladys with nutritional input while lowering the risk of aspiration.

Hugh weighed the benefits and risks of these treatment options. Based on what Hugh knew of

Gladys's values, however, he decided to withdraw all treatment and signed a DNR. Two weeks later, Gladys passed away in her sleep.

Case Key Words

- Alzheimer's Disease
- Chronic Obstructive Pulmonary Disease (COPD)
- Do-Not-Resuscitate (DNR)
- Long-Term Care
- Lungs
- Pneumonia
- Respiratory System

GLADYS' HEALTH: CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

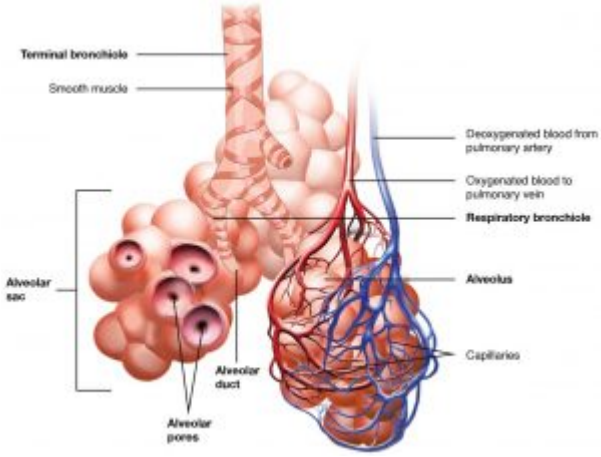
Gladys, a daily smoker since she was 16, was diagnosed with chronic obstructive pulmonary disease (COPD) in 1999. Her symptoms worsened over time, and she eventually began oxygen therapy in 2015.

Diagnosis

COPD is diagnosed through pulmonary (or lung) function tests. The most common of these tests is spirometry, which measures the amount of air you can inhale and exhale, and whether your lungs deliver enough oxygen to your blood.

During the test, you blow into a large tube connected to a small machine to measure how much air your lungs can hold and how fast you can blow the air out of your lungs.

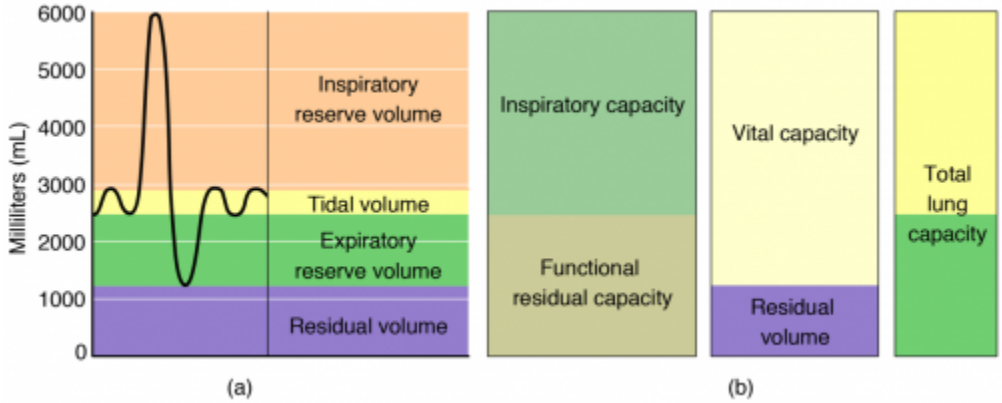
Other pulmonary function tests include:



- Pulse oximetry
- Blood gases
- End tidal CO_2
- Peak expiratory flow rate
- Bronchial challenge testing
- Exercise tests
- Respiratory muscle pressure measurement
- Lung volumes by helium dilution
- Diffusing capacity

Gladys's Pulmonary Function Test Results

- FEV^1 – the forced expiratory volume in 1 second
- FVC – the forced vital capacity
- Your FEV^1 is influenced by other factors including age, sex, height, and ethnicity. The FEV^1/FVC ratio is used to define obstructive defect and used to diagnose the disease progression.



Pulmonary Function Test	Instrument	Measures	Function
Spirometry	Spirometer	Forced vital capacity (FVC)	Volume of air that is exhaled after maximum inhalation
		Forced expiratory volume (FEV)	Volume of air exhaled during one forced breath
		Forced expiratory flow, 25-75 percent	Air flow in the middle of exhalation
		Peak expiratory flow (PEF)	Rate of exhalation
		Maximum voluntary ventilation (MVV)	Volume of air that can be inspired and expired in 1 minute
		Slow vital capacity (SVC)	Volume of air that can be slowly exhaled after inhaling past the tidal volume
		Total lung capacity (TLC)	Volume of air in the lungs after maximum inhalation
		Functional residual capacity (FRC)	Volume of air left in the lungs after normal expiration
		Residual volume (RV)	Volume of air in the lungs after maximum exhalation
		Total lung capacity (TLC)	Maximum volume of air that the lungs can hold
		Expiratory reserve volume (ERV)	Volume of air that can be exhaled beyond normal exhalation
Gas diffusion	Blood gas analyzer	Arterial blood gases	Concentration of oxygen and carbon dioxide in the blood

GOLD System of Grading COPD

GOLD stands for the Global Initiative for Chronic Obstructive Lung Disease. The National Heart, Lung, and Blood Institute, National Institutes of Health, and the World Health Organization started it in 1997.

The GOLD system bases the stage of COPD on several things:

- Symptoms
- How many times your COPD has gotten worse
- Hospitalizations for COPD exacerbation
- Spirometry results

COPD Stages

Severity	FEV_1/FVC %	FEV_1 %
At risk	> 0.7	> 80
1-Mild COPD	< 0.7	> 80
2-Moderate COPD	< 0.7	50-80
3-Severe COPD	< 0.7	30-50
4-Very Severe COPD	< 0.7	< 30

COPD Risk Factors Among Women

- 3.17 million deaths (5% of all global deaths) were caused by COPD in 2015
- WHO reports a prevalence of 251 million cases of COPD in 2016
- More women are being diagnosed with COPD
- Higher mortality rates than men

Most common risk factors:

- Smoking
- Exposure to secondhand smoke
- Air pollution
- Occupational dust and fumes

Influence of sex on COPD involves several factors:

- Differential susceptibility to the effects of tobacco
- Anatomic, hormonal, and behavioural differences
- Differential response to therapy

COPD and Food

- The process of changing food to fuel in the body is called metabolism.
- Oxygen and food are the raw materials of the process.
- Energy and carbon dioxide are the finished products.
- Carbon dioxide is a waste product that is exhaled.
- Metabolism of carbohydrates produces the most carbon dioxide for the amount of oxygen used.
- Metabolism of fat produces the least.
- For some COPD patients, eating a diet with fewer carbohydrates and more fat helps them breathe easier.

Nutritional Guidelines

- Choose complex carbohydrates.
- Limit simple carbohydrates.
- Eat 20 to 30 grams of fiber each day.
- Eat a good source of protein.
- Choose mono- and polyunsaturated fats.
- Limit foods that contain trans fats and saturated fats.
- Drink plenty of water – keeps you hydrated and keeps the mucus thin
- Vitamins and minerals:
    - Steroids may increase your need for calcium
    - Calcium carbonate or calcium citrate with vitamin D
    - Sodium may cause edema and may increase blood pressure

Diet Tips

- Rest before eating.
- Eat more food early in the day if you are usually too tired to eat later on.

- Avoid foods that cause gas or bloating. Tends to make breathing more difficult.
- Eat 4 to 6 small meals a day. Enables the diaphragm to move freely and lets the lungs fill and empty more easily.
- Drinking fluids with meals may make you feel too full. Drink an hour before or after meals.
- Consider adding nutritional supplements at night to avoid feeling full during the day.

COPD and Exercise

Moderate exercise can improve:

- The body's use of oxygen
- Energy levels
- Anxiety, stress, and depression
- Sleep
- Self-esteem
- Cardiovascular fitness
- Muscle strength
- SOB

Exercises help blood circulate, help your heart send oxygen to your body, and strengthen your respiratory muscles.

Types of Exercises for COPD

Pulmonary Rehabilitation consists of education and exercise classes that teach about lungs, the disease, and how to exercise and be more active with less SOB.

Examples include:

- Stretching
- Aerobic
- Resistance

COPD and Emotional Health

Most COPD patients experience feelings of sadness, fear, and worry.

If those feelings start to affect ability to keep up with normal activities and life enjoyment, they may be symptoms of anxiety and depression.

Managing anxiety and depression can increase ability to stick with treatment, improve physical health, and reduce medical costs.

Things to do:

- Talk to your healthcare team about your feelings
- Take care of yourself
- Connect with others who understand

Medications for COPD

Bronchodilators

- Relax the muscles around the airways (short- and long-acting)
- Beta$_2$-Agonists relax tightened muscles around airways, opening the airways, making breathing easier
- Anticholinergics prevent the muscles around the airways from tightening, helps clear mucus from lungs

Anti-inflammatories

- Known as corticosteroids or steroids
- Inhaler device or oral pill
- Reduces swelling and mucus production
- Long-term use of steroids have serious side effects

Combination Medications

- A corticosteroid, an anticholinergic, and a beta$_2$-agonist
- Most common combinations:
    - Short-acting beta$_2$-agonist & short-acting anticholinergic
    - Long-acting beta$_2$-agonist and corticosteroid
    - Long-acting anticholinergic and corticosteroid
    - Long-acting beta$_2$-agonist and long-acting anticholinergic
    - Long-acting beta$_2$-agonist, long-acting anticholinergic, and corticosteroid

Vaccinations

- Influenza
- Pneumonia

GLADYS' HEALTH: ALZHEIMER'S

1999 – Diagnosed with COPD

2010 – Cognitive changes – diagnosed with Alzheimer's disease

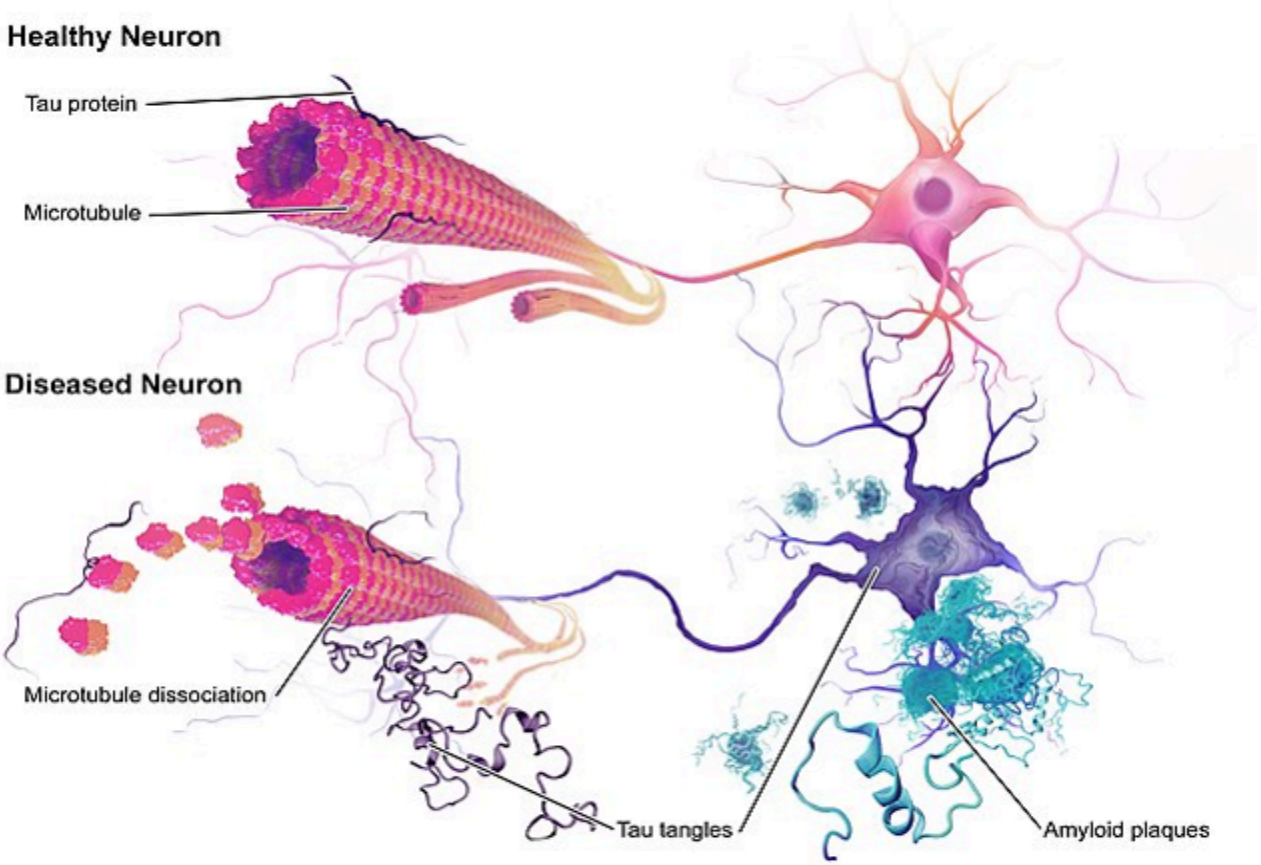
2015 – Oxygen therapy for COPD

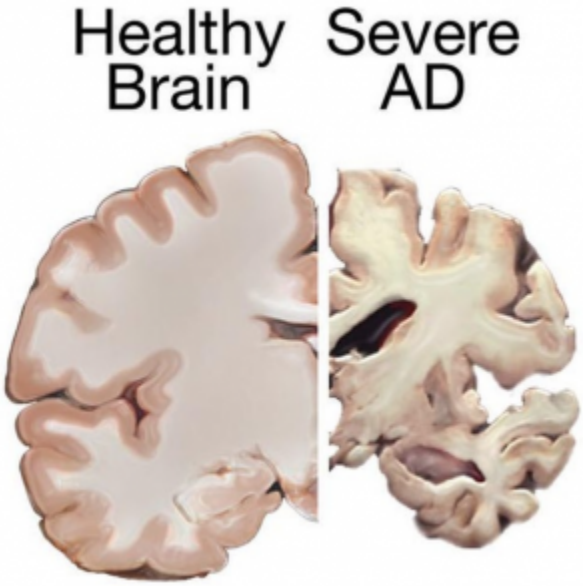
2018 – Health and wellbeing deteriorated – placed in LTC facility

2019 – Dies due to complications of Alzheimer's disease

Causes of Alzheimer's Disease

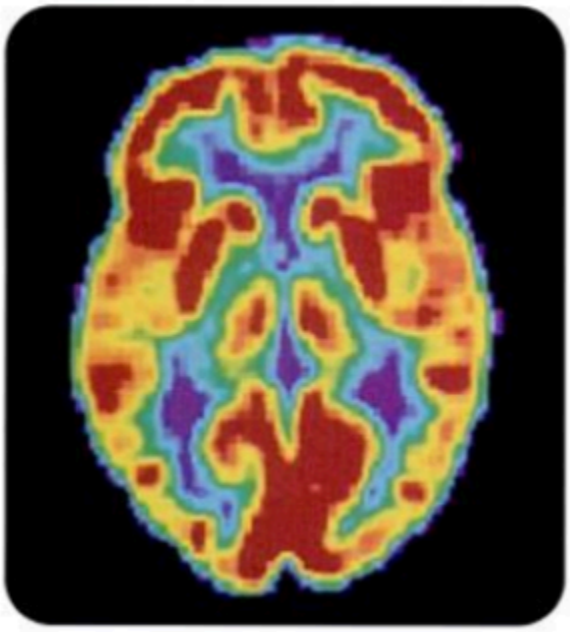
People with AD gradually suffer memory loss and a decline in thinking abilities, as well as major personality changes. These losses in cognitive function are accompanied by changes in the brain, including the build-up of amyloid plaques and tau-containing neurofibrillary tangles, which result in the death of brain cells and the breakdown of the connections between them.



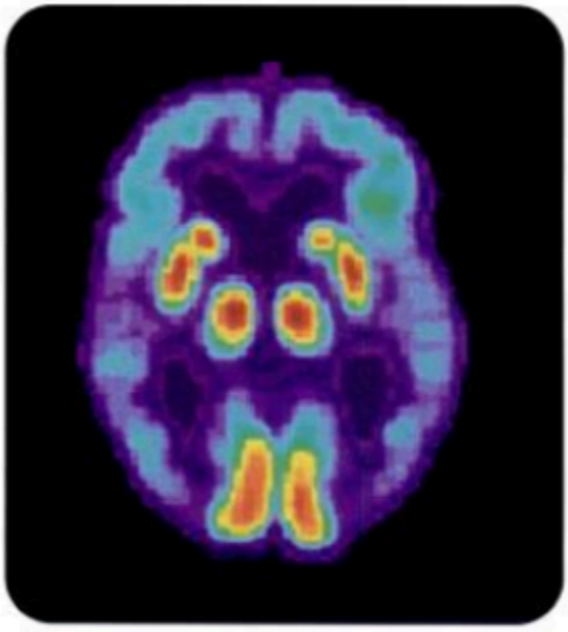


Amyloid plaques and neurofibrillary tangles are the primary hallmarks of Alzheimer's disease. Plaques are dense deposits of protein and cellular material outside and around the brain's nerve cells. Tangles are twisted fibers that build up inside the nerve cells. Scientists have known about plaques and tangles since 1906, when

a German physician, Dr. Alois Alzheimer, first identified them in the brain of woman who had died after suffering paranoid delusions and psychosis.



PET Scan of Normal Brain



PET Scan of Alzheimer's Disease Brain

Personality and Behaviour Changes

Common Changes in Personality & Behaviour

- Getting upset, worried, and angry more easily
- Acting depressed or not interested in things
- Hiding things or believing other people are hiding things
- Imagining things that aren't there
- Wandering away from home
- Pacing a lot
- Showing unusual sexual behaviour
- Hitting others
- Misunderstanding what they see or hear
- Stops caring about how they look

Managing Personality Changes

- Keep things simple; Ask or say one thing at a time
- Have a daily routine
- Reassurance that they are safe and you are there to help
- Focus on their feelings rather than their words
- Don't argue or try to reason with them
- Try not to show frustration or anger
- Use humor when appropriate
- Allow a safe environment for pacing
- Try using music, singing, or dancing for distraction
- Ask them to help ("let's set the table" or "I need help folding the clothes")

Changes in Communication Skills

Persons with Alzheimer's may have problems with:

- Finding the right word or losing their train of thought when speaking
- Understanding what words mean
- Paying attention during long conversations
- Remembering the steps in common activities
- Blocking out background noises
- Frustration if communication is not working
- Being very sensitive to the tone and loudness of voices

Making Communication Easier

Understand that Alzheimer's causes changes in communication skills.

Try some tips that may make communication easier:

- Make eye contact and use their name
- Beware of your tone, loudness of voice, and body language
- Encourage two-way conversation for as long as possible
- Use other methods besides speaking, such as gentle touch
- Try distraction if communication creates problems
- Be patient

- Offer simple step-by-step instructions
- Try not to interrupt
- Don't talk to the person using "baby talk" or a "baby voice"

Medications

Drug Name	Drug Type & Use	How It Works	Common Side Effects	Manufacturer's Recommended Dosage
Aricept® (donepezil)	Cholinesterase inhibitor prescribed to treat symptoms of mild, moderate, and severe Alzheimer's	Prevents the breakdown of acetylcholine in the brain	Nausea, vomiting, diarrhea, muscle cramps, fatigue, weight loss	• Tablet*: Initial dose of 5 mg once a day; may increase dose to 10 mg/day after 4-6 weeks if well tolerated, then to 23 mg/day after at least 3 months • Orally disintegrating tablet*: Same dosage as above (not available in 23 mg)
Exelon® (rivastigmine)	Cholinesterase inhibitor prescribed to treat symptoms of mild to moderate Alzheimer's (patch is also for severe Alzheimer's)	Prevents the breakdown of acetylcholine and butyrylcholine (a brain chemical similar to acetylcholine) in the brain	Nausea, vomiting, diarrhea, weight loss, indigestion, muscle weakness	• Capsule*: Initial dose of 3 mg/day (1.5 mg twice a day); may increase dose to 6 mg/day (3 mg twice a day), 9 mg/day (4.5 mg twice a day), and 12 mg/day (6 mg twice a day) at minimum 2-week intervals if well tolerated • Patch*: Initial dose of 4.6 mg once a day; may increase dose to 9.5 mg once a day and 13.3 mg once a day at minimum 4-week intervals if well tolerated
Namenda® (memantine)	N-methyl D-aspartate (NMDA) antagonist prescribed to treat symptoms of moderate to severe Alzheimer's	Blocks the toxic effects associated with excess glutamate and regulates glutamate activation	Dizziness, headache, diarrhea, constipation, confusion	• Tablet*: Initial dose of 5 mg once a day; may increase dose to 10 mg/day (5 mg twice a day), 15 mg/day (5 mg and 10 mg as separate doses), and 20 mg/day (10 mg twice a day) at minimum 1-week intervals if well tolerated • Oral solution*: Same dosage as above • Extended-release capsule*: Initial dose of 7 mg once a day; may increase dose to 14 mg/day, 21 mg/day, and 28 mg/day at minimum 1-week intervals if well tolerated

Namzaric® (memantine and donepezil)	NMDA antagonist and cholinesterase inhibitor prescribed to treat symptoms of moderate to severe Alzheimer's	Blocks the toxic effects associated with excess glutamate and prevents the breakdown of acetylcholine in the brain	Headache, nausea, vomiting, diarrhea, dizziness, anorexia	• Extended-release capsule*: Initial dose of 28 mg memantine/10 mg donepezil once a day if stabilized on memantine and donepezil • If stabilized on donepezil only, initial dose of 7 mg memantine/10 mg donepezil once a day; may increase dose to 28 mg memantine/10 mg donepezil in 7 mg increments at minimum 1-week intervals if well tolerated • Only 14 mg memantine/10 mg donepezil and 28 mg memantine/10 mg donepezil available as generic
Razadyne® (galantamine)	Cholinesterase inhibitor prescribed to treat symptoms of mild to moderate Alzheimer's	Prevents the breakdown of acetylcholine and stimulates nicotinic receptors to release more acetylcholine in the brain	Nausea, vomiting, diarrhea, decreased appetite, dizziness, headache	• Tablet*: Initial dose of 8 mg/day (4 mg twice a day); may increase dose to 16 mg/day (8 mg twice a day) and 24 mg/day (12 mg twice a day) at minimum 4-week intervals if well tolerated • Extended-release capsule*: Same dosage as above but taken once a day

DNR and DNH Orders

- Ontario nursing home DNR & DNH orders reduce inappropriate hospitalizations, but not entirely
- 3 in 5 nursing home residents had a DNR recorded on admission (Do Not Resuscitate)
- 1 in 7 had a DNH (Do Not Hospitalize)
- Residents with a DNR or DNH were less likely to experience hospitalization or in-hospital death

Hospitalization:

- DNR: 13% less likely
- DNH: 30% less likely

In-hospital death:

- DNR: 40% less likely

- DNH: 60% less likely

RESOURCES

Text Resources

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Video Resources

Alzheimer's disease

- How do cigarettes affect the body?
- How do lungs work?
- Why is pneumonia so dangerous?

Additional Resources

COPD Medications

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Feedback

Instructor feedback

Student feedback

CASE 8: PAUL

PAUL'S STORY

Case Study Downloads

- Meet Paul (PPT)
- Paul's Story (Single Slide) (PPT)
- Paul's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion and Active Living
- Social Determinants of Health
- Anatomy & Physiology
- Pathophysiology
- Altered Physiology
- Health Research
- Mental Health and Disabilities

Paul's Story

Paul was born to Gladys and Hugh in 1971 and grew up in an affluent area of Toronto. He had a nanny for his early years. Then, when it came time for him to attend school, he was sent away to a local boarding school. He only came home during summer and Christmas vacations. Once he was in high school, Paul was sent away again.

Paul had a large allowance during his high school years which allowed him the freedom to buy whatever he wanted. He started buying alcohol during his senior year when he went out with his friends. He partied a lot and his grades suffered. He did manage to graduate high school, however, and was accepted to a university in Quebec.

The party life continued, but Paul found that alcohol was no longer enough to give him the "high" that he craved. He started smoking marijuana and hashish during his second year at university. He no longer came home for summer vacation and spent that time with friends. By third year, Paul was using cocaine and alcohol on a daily basis. He was also struggling with the birth of his younger brother. In 1993, he dropped out of university before the end of third year, as he was failing all of his courses.

Paul's parents intervened and sent Paul to a rehabilitation facility. Paul completed the program and went home to his parents. He wandered aimlessly through life over the next number of years, drinking, taking drugs, and revisiting rehabilitation facilities. It was in one of these facilities that he met his first wife in 1999. At the beginning of their relationship, they felt that they truly understood each other and could support each other's efforts as they both struggled with addictions.

In 2002, Paul and his first wife adopted twin girls: Ella and Olivia. Paul worked odd jobs, but struggled to pay the bills while funding his cocaine habit. Paul's parents wanted nothing to do with him or his young family. His first wife left him in 2008, taking the girls with her. This

seemed to be the wake-up call Paul needed to get his life in order. He joined Narcotics Anonymous in 2009.

Paul was clean and sober for just over a year when he met Nancy. They started dating in 2010. Paul provided Nancy with a full disclosure about his past substance misuse, his previous marriage, and his twin girls. He worked for a construction company and seemed to enjoy it, stating that the physicality of the job helped him to stay clean. Paul and Nancy married in 2012. Shortly after they married, they decided to start trying to conceive. Life was going well for them.

In 2018, Paul had an accident at work, falling from scaffolding 2 stories high. He was taken by ambulance to the local hospital and diagnosed with injury to the ligaments and muscles in his back, along with three torn discs. One of the tears was quite large and required Paul to have a follow-up CT scan in six weeks.

Due to Paul's history of substance abuse, Flexeril (muscle relaxant) and Ketoprofen (NSAID) were prescribed. He was sent home to rest and recuperate. Paul was not receiving adequate pain management from his prescription medications, so he called his family physician requesting something stronger. After much discussion, Paul's doctor prescribed Tylenol 3 (acetaminophen 300 mg and codeine 30 mg). Paul was instructed to continue taking his prescribed medications and only take the Tylenol 3 if absolutely necessary. The physician also put the stipulation on the prescription that the pharmacy could only dispense four tablets each day. That meant that Nancy needed to stop by the pharmacy each night on her way home.

Upon arriving home at 7:30 pm on the third day after Paul started the Tylenol 3, Nancy found Paul agitated, sweating, and complaining that his back hurt more. When asked, Paul stated that he had his last Tylenol 3 at 9:00 am. He stated that he had needed them through the night, which left him only one for the day.

Over the next couple of years, Paul struggled with chronic back pain. He started self-medicating with alcohol and any prescription drugs he could get from walk-in clinics, eventually turning to the streets to obtain stronger pain medications. Paul was on long-term disability through WSIB. He was to begin a return to work program in a couple of weeks.

When Nancy's parents, Jack and Mary, came to stay with them while Mary recovered from her surgery, Paul discovered that Mary had been prescribed Oxycodone-Acetaminophen (2.5 mg-325 mg) for pain. Her physician had prescribed 60 tablets, as she would be out of town for a number of weeks. Paul started sneaking a few pills a day from Mary's prescription.

It was about two weeks after her parents' arrival that Nancy noticed that the number of oxycodone tablets was much less than what it should have been. She couldn't believe that Paul was back to using drugs. Nancy confronted Paul with her suspicions. After arguing for hours, Paul finally confessed to taking the pills.

He stated that he felt overwhelmed with everything going on in his life at the moment:

- Out of work
- Chronic back pain
- Insomnia
- The addition of Sam
- Sam's diagnosis
- Mary and Jack living there
- Lack of contact and support from his parents
- Nancy going to school and working so much

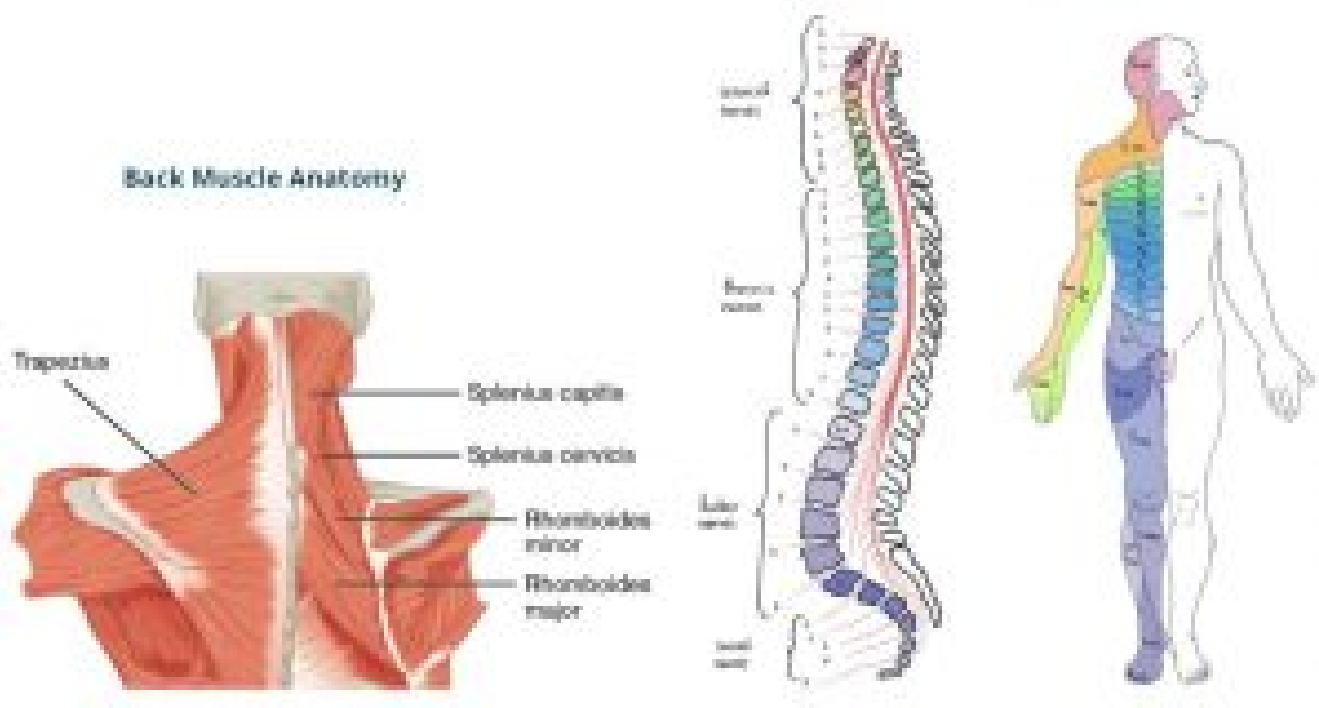
Despite his relapse, Paul denied having a 'pill problem.' Nancy called Paul's old NA sponsor for suggestions on what to do. Paul was angry at the world, blaming everyone else around him for how his life turned out.

Case Key Words

- Addiction
- Adoption

- Alcoholism
- Back Injury
- Central Nervous System
- Divorce
- Muscles
- Muscular System
- Opioid Addiction
- Opioid Crisis
- Skeletal System
- Support Groups
- Vertebrae

PAUL'S HEALTH: BACK INJURIES

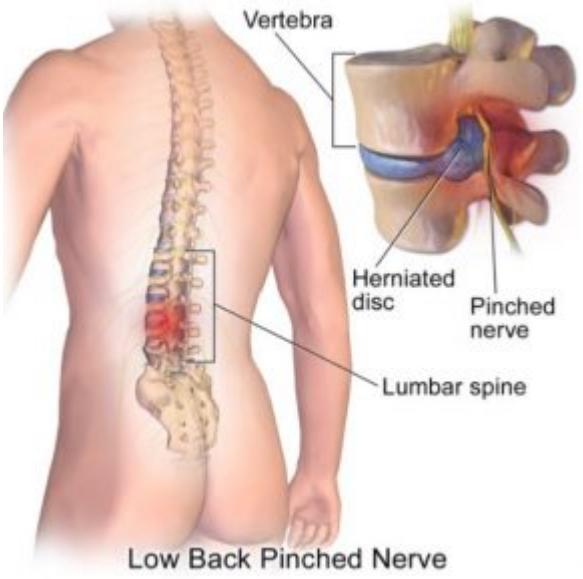


After falling off of a 2 stories in 2018, he was diagnosed with back ligament and muscle injury. He ended up with three torn discs, one being quite large. He had a follow-up CT scan 6 weeks later, where he was told he had prescribed muscle relaxant & NSAID, due to substance abuse history. He did not receive adequate pain management, and Tylenol #3 was prescribed to him only when it became absolutely necessary. He was dispensing stipulation of 4 tablets each day.

Back Pain

Paul's pack pain continued, was severe and did not improve with rest. He went to see a doctor, where he found out that it could possibly spread down one or both legs, especially if the pain extends below the knee. This

causes weakness, numbness or tingling in one or both legs. These symptoms are accompanied by unexplained weight loss, fever, causes new bowel or bladder problems.



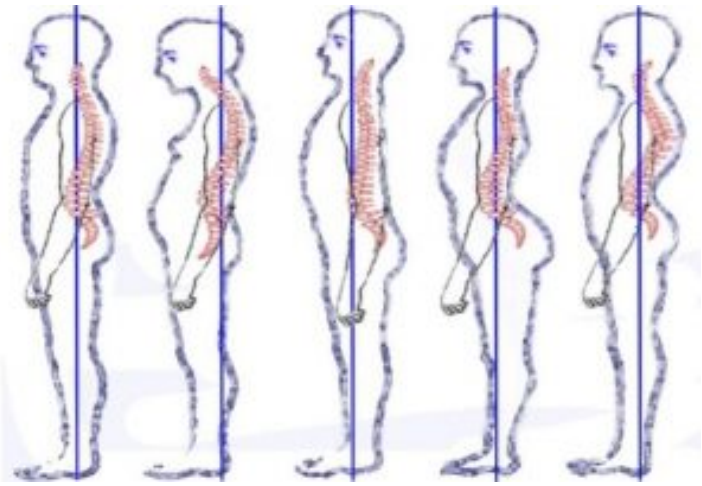
Causes of the pain

- Muscle or ligament strain
- Bulging or ruptured discs (leaking)
- Arthritis
- Osteoporosis

Risk factors of back injury

- Age
- Lack of exercise
- Excessive weight
- Diseases
- Improper lifting
- Psychological conditions (depression & anxiety will increase risk)

Prevention

- Exercise 
- Build muscle strength & flexibility
- Maintain a healthy weight
- Quit smoking
- Stand- sit- and lift smart

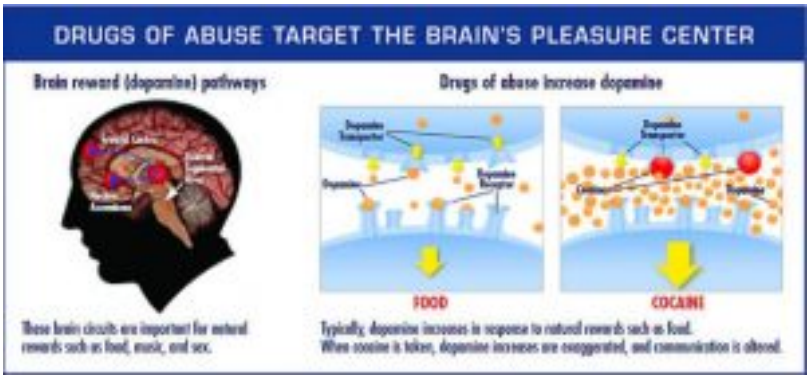
PAUL'S HEALTH: DRUG ADDICTION

Due to the results of substance abuse, Paul was often agitated, sweating, complaining of back pain. He was self-medicating with alcohol and prescription drugs, first from walk in clinics and eventually from the streets. At this point, he had long term disability. He was taking his mother-in-law's post-op medications and denied having a "pill problem". He stated that he was feeling overwhelmed with everything going on in his life.

What is drug addiction?

Drug addiction is an initial decision to take drugs is voluntary. Repeated drug use overwhelms receptor cells and can lead to brain changes that challenge self-control & resist urges. The natural capacity to produce dopamine in the reward center is reduced. Addictive drugs provide a shortcut to the brain's reward center. Addicts may require higher doses and quicker passage into the brain.

The Brain's Reward System

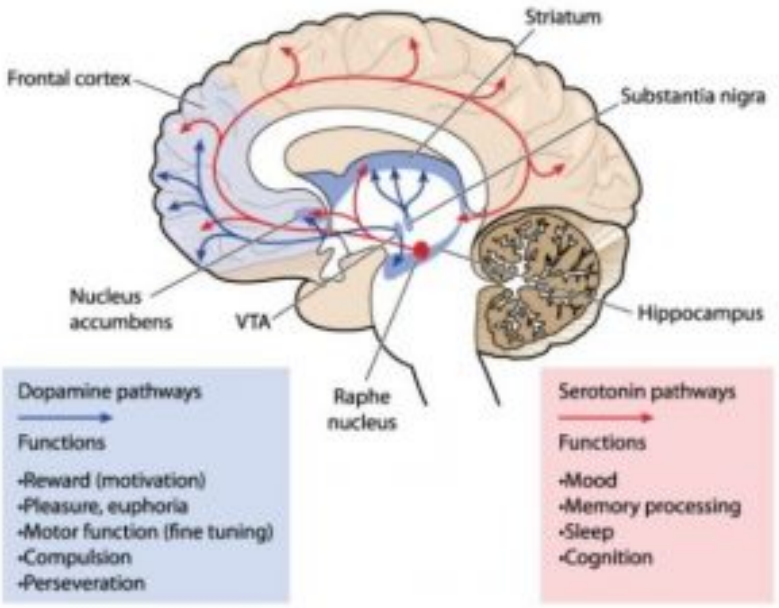


Addictive drugs provide a shortcut to the brain's reward system by flooding the nucleus accumbens with dopamine. The hippocampus lays down memories of this rapid sense of satisfaction, and the amygdala creates a conditioned response to certain stimuli. The reward system may be more vulnerable, responses to stress more intense, or the formation of addictive habits quicker in some people, especially those suffering from depression, anxiety, or schizophrenia, and those with disorders like antisocial and borderline personality.

Why?

Biology

- Genes account for about half of a person's risk for addiction
- Gender, ethnicity, and presence of other mental disorders



Environment

- Family & friends
- Economic status & general quality of life
- Peer pressure, physical & sexual abuse
- Early exposure to drugs, stress, and parental guidance

Development

- Genetic & environmental factors interact with critical developmental stages
- The earlier drug use begins, the more likely to become addicted
- Teens' brains are still developing (decision-making, judgment, and self-control)

Overcoming A Drug

- Recognize you have a problem
- Decide to make a change

Committing to sobriety involves changing:

- The way you deal with stress
- Who you allow in your life
- What you do in your free time
- How you think about yourself

Treatment options:

- Detoxification
- Behavioral counseling
- Medication
- Long-term follow-up

RESOURCES

Text Resources

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Video Resources

How do nerves work?

Opioids

The mysterious science of pain

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Feedback

Instructor feedback

Student feedback

CASE 9: BRIAN

BRIAN'S STORY

Case Study Downloads

- Meet Brian (PPT)
- Brian's Story (Single Slide) (PPT)
- Brian's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Health Promotion & Active Living
- Social Determinants of Health
- Anatomy & Physiology
- Pathophysiology
- Health Research
- Mental Health & Disabilities

Brian's Story

Brian was born in 1989 to affluent parents, Hugh and Gladys, who were in their early forties. Brian also had an older brother, Paul, who was away at boarding school when he was born.

When Gladys found out she was pregnant in her forties, her doctor suggested that Gladys be tested for Down syndrome. Gladys refused to have an amniocentesis done. Brian was diagnosed with Trisomy 21, one of the three types of Down syndrome. The diagnosis was suspected based on Brian's physical appearance at birth, and confirmed by analysis of his chromosomes.

Gladys and Hugh were devastated by the news that their child was "less than perfect". At first, they believed that a child with Down syndrome would require too much time and care for their lifestyle. And what would their friends and business associates think? They could not possibly bring this child home. Their view evolved and changed after reading about Down syndrome, learning the benefits of therapies like early intervention, and long discussions with peer groups (e.g. other parents of children with Down syndrome).

Brian had difficulty breathing and the physician noticed Brian had blue-tinged skin, and a heart murmur (an abnormal whooshing sound caused by turbulent blood flow). Several tests were ordered:

- Echocardiogram
- Electrocardiogram
- Chest x-ray
- Oxygen level measurement
- Cardiac catheterization

Brian was diagnosed with Tetralogy of Fallot, a rare condition caused by a combination of four defects that are present at birth (congenital). These defects cause oxygen-poor blood to flow out of the heart and to the rest of the body.

Tetralogy of Fallot occurs during fetal growth, when the baby's heart is developing. While factors such as poor maternal nutrition, viral illness, or genetic disorders might increase the risk of this condition, in most cases the cause of Tetralogy of Fallot is unknown.

The lungs of children with Down syndrome do not develop as fully as they do in the general population. Consequently, the growth of blood vessels throughout the lungs is limited. The narrowed arteries of the lungs hold potential for lasting consequences due to the increased pressure and flow of blood through the lungs.

Treatment

Surgery is the only effective treatment for Tetralogy of Fallot. Brian was two weeks old when he required temporary surgery due to his underdeveloped pulmonary arteries (hypoplastic). A bypass (shunt) was created between a large artery that branches off from the aorta and the pulmonary artery.

After six months, the cardiologist deemed Brian strong enough to undergo 'intracardiac repair'. This is an open-heart surgery that involves several repairs:

- Removal of the shunt
- Patch over the ventricular septal defect to close the hole between the ventricles

- Repair or replace the narrowed pulmonary valve and widens the pulmonary arteries to increase blood flow to the lungs

The surgery was a success and Brian was eventually discharged home. He had around-the-clock care which included:

- Nursing
- Physiotherapist
- Occupational therapist
- Play workers
- Respiratory therapist
- Tutor

Brian required regular medical follow-up to maintain good health:

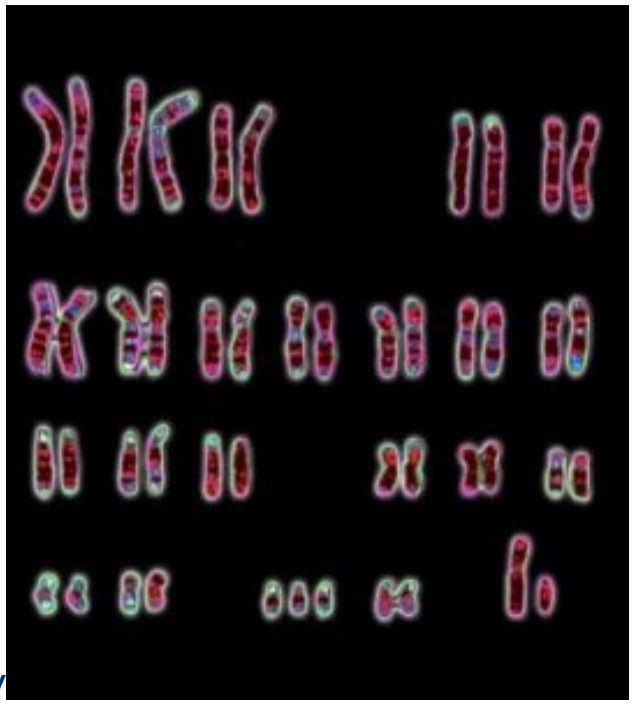
- Routine follow-up care – regular check-ups with a cardiologist, routine exams with his primary physician, prescription medications, routine dental care
- Heart-healthy lifestyle – heart-healthy eating, physical activity, maintaining healthy weight
- Emotional health – may feel isolation, sadness, and frustration

Growing up, Brian's only interactions were with the "hired help". As a pre-teen and teen, he formed strong bonds with his workers and struggled with changes in staff and routine. This led to frustration and anger.

Case Key Words

- Cardiovascular-circulation
- Cardiovascular-heart
- Down Syndrome
- Fetal Development
- Genetic Disorder
- Heart Surgery
- Intellectual Disability
- Physical and Developmental Problems

BRIAN'S HEALTH: DOWN SYNDROME



Down Syndrome Overview

- There are 23 pairs of chromosomes, for a total of 46.
- Half the chromosomes come from the egg, and the other half from the sperm.
- This XY chromosome pair includes the X chromosome from the egg and the Y chromosome from the sperm.
- In Down's syndrome, there is an additional copy of chromosome 21, resulting in three copies instead of the normal two copies.
- Trisomy 21 (also known by the karyotype 47,XX,+21 for females, 47,XY,+21 for males) is caused by a failure of the 21st chromosome to separate during egg and sperm development (nondisjunction).

Three Genetic Variations

Trisomy 21

About 95 percent of the time, Down syndrome is caused by trisomy 21 — the person has three copies of chromosome 21, instead of the usual two copies, in all cells. This is caused by abnormal cell division during the development of the sperm cell or the egg cell.

Mosaic Down syndrome

In this rare form of Down syndrome, a person has only some cells with an extra copy of chromosome 21. This mosaic of normal and abnormal cells is caused by abnormal cell division after fertilization.

Translocation Down syndrome

Down syndrome can also occur when a portion of chromosome 21 becomes attached (translocated) onto another chromosome, before or at conception. These children have the usual two copies of chromosome 21, but they also have additional genetic material from chromosome 21 attached to another chromosome.

Risk Factor

- Advancing maternal age. A woman's chances of giving birth to a child with Down syndrome increase with age because older eggs have a greater risk of improper chromosome division. A woman's risk of conceiving a child with Down syndrome increases after 35 years of age. However, most children with Down syndrome are born to women under age 35 because younger women have far more babies.
- Being carriers of the genetic translocation for Down syndrome. Both men and women can pass the genetic translocation for Down syndrome on to their children.
- Having had one child with Down syndrome. Parents who have one child with Down syndrome and parents who have a translocation themselves are at an increased risk of having another child with Down syndrome. A genetic counselor can help parents assess the risk of having a second child with Down syndrome.

Screening During Pregnancy

- First trimester combined two step test:

- Blood test-measures levels of pregnancy-associated plasma protein-A (PAPP-A) and human chorionic gonadotropin (HCG). Abnormal levels of both may indicate a problem with the baby.

- Nuchal translucency test-an ultrasound is used to measure a specific area on the back of the fetus's neck. When abnormalities are present, more fluid tends to collect in this neck tissue.

Second trimester:

- Blood test-measures four pregnancy-associated substances: alpha fetoprotein, estriol, HCG, and inhibin A.

- If screening test results are positive or you are at high risk, more testing to confirm the diagnosis may be done.

- Chorionic villus sampling (CVS)-cells are taken from the placenta and analyzed. Usually done in the 1st trimester. The risk of miscarriage is very low.
- Amniocentesis-sample of amniotic fluid is withdrawn using a needle inserted into the uterus to analyze the fetus chromosomes. Done in 2nd trimester, risk of miscarriage is very low.

BRIAN'S HEALTH: TETRALOGY OF FALLOT

Electrical Conduction System of the Heart

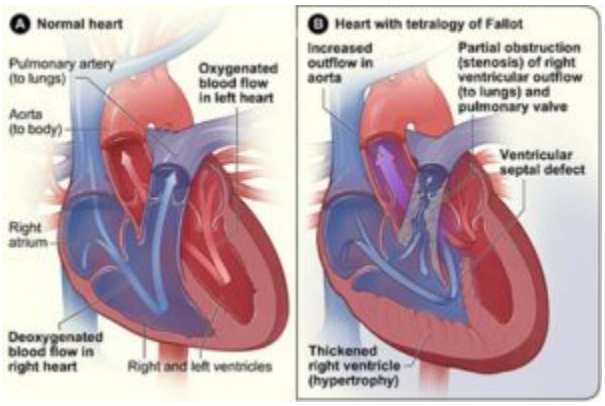
- Sinoatrial node
- Atrioventricular node
- Bundle of His
- Left bundle branch
- Left posterior fascicle
- Left anterior fascicle
- Left ventricle
- Ventricular septum
- Right ventricle
- Right bundle branch

Chambers & Circulation Through the Heart

- Blood flows from the right atrium to the right ventricle, where it is pumped into the pulmonary circuit.
- The blood in the pulmonary artery branches is low in oxygen but relatively high in carbon dioxide.
- Gas exchange occurs in the pulmonary capillaries (oxygen into the blood, carbon dioxide out), and blood high in oxygen and low in carbon dioxide is returned to the left atrium.
- From here, blood enters the left ventricle, which pumps it into the systemic circuit.

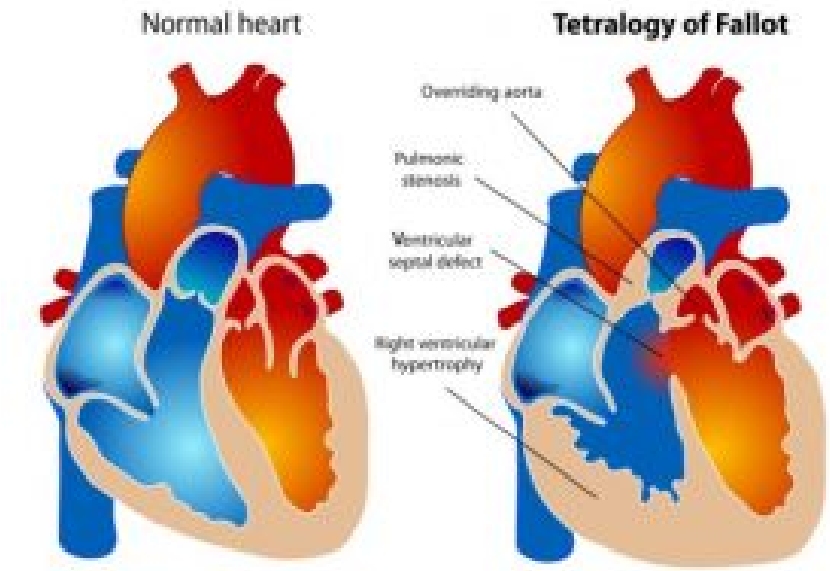
- Following exchange in the systemic capillaries (oxygen and nutrients out of the capillaries and carbon dioxide and wastes in), blood returns to the right atrium and the cycle is repeated.

Facts About Tetralogy of Fallot



- Birth defect that affects normal blood flow through the heart.
- Happens when the heart does not form correctly as the baby grows & develops in the womb.
- Made up of 4 defects of the heart and its blood vessels.

The 4 Abnormalities



Pulmonary valve stenosis

Pulmonary valve stenosis is a narrowing of the pulmonary valve — the valve that separates the lower right chamber of the heart (right ventricle) from the main blood vessel leading to the lungs (pulmonary artery).

Narrowing (constriction) of the pulmonary valve reduces blood flow to the lungs. The narrowing might also affect the muscle beneath the pulmonary valve. In some severe cases, the pulmonary valve doesn't form properly (pulmonary atresia) and causes reduced blood flow to the lungs.

Ventricular septal defect

A ventricular septal defect is a hole (defect) in the wall (septum) that separates the two lower chambers of the heart — the left and right ventricles. The hole allows deoxygenated blood in the right ventricle — blood that has circulated through the body and is returning to the lungs to replenish its oxygen supply — to flow into the left ventricle and mix with oxygenated blood fresh from the lungs.

Blood from the left ventricle also flows back to the right ventricle in an inefficient manner. This ability for blood to flow through the ventricular septal defect reduces the supply of oxygenated blood to the body and eventually can weaken the heart.

Overriding aorta

Normally the aorta branches off the left ventricle. In tetralogy of Fallot, the aorta is shifted slightly to the right and lies directly above the ventricular septal defect.

In this position the aorta receives blood from both the right and left ventricles, mixing the oxygen-poor blood from the right ventricle with the oxygen-rich blood from the left ventricle.

Right ventricular hypertrophy

When the heart's pumping action is overworked, it causes the muscular wall of the right ventricle to thicken. Over time this might cause the heart to stiffen, become weak and eventually fail.

Treatment

- Surgery is the only effective treatment for tetralogy of Fallot.
- Intracardiac repair:
    - Usually done within the 1st year after birth, involves several repairs
    - Patch over the ventricular septal defect to close the hole between the ventricles
    - Repairs or replaces the narrowed pulmonary valve and widens the pulmonary arteries
    - The right ventricle will go back to normal thickness (doesn't need to work as hard)
- Temporary surgery:
    - May be done if premature birth or pulmonary arteries are undeveloped (hypoplastic)
    - A shunt is inserted between a large artery that branches off the aorta and the pulmonary artery
    - Intracardiac surgery will be performed when baby is ready and shunt will be removed

After Surgery

- Long-term complications are common:
- Chronic pulmonary regurgitation (right ventricle)
- Other heart valve problems
- Continued leaks after the patch repair, may require a re-repair

- Enlarged right ventricle or left ventricle
- Arrhythmias
- Coronary artery disease
- Aortic root dilation (ascending aorta enlarges)
- Sudden cardiac death

On-going Care

- Lifelong care with a cardiologist trained in treating congenital heart disease
- Routine follow-up appointments which include physical exam, blood tests, echocardiogram, ECG
- Monitor physical activity if there is any pulmonary leakage or obstruction or arrhythmias
- Antibiotics for dental procedures to prevent endocarditis

Coping and Support

- Support groups-provide hope, encouragement and support
- Family physician-provide local resources
- Family & friends-give you a break

Keep a written record of:

- Diagnosis
- Medications
- Surgeries and dates

- Cardiologist's name and number

RESOURCES

Text Resources

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Video Resources

How the heart actually pumps blood

Sex determination: more complicated than you thought

What happens when your DNA is damaged?

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Feedback

Instructor feedback

Student feedback

CASE 10: ELLA AND OLIVIA

ELLA AND OLIVIA'S STORY

Case Study Downloads

- Meet Ella and Olivia (PPT)
- Ella and Olivia's Story (Single Slide) (PPT)
- Ella and Olivia's Story (DOCX)
- Teaching Notes (In Progress)

Applicable Courses

- Social Determinants of Health
- Human Anatomy & Physiology
- Human Patholphysiology/Altered Physiology
- Health Research
- Mental Health & Disabilities

Ella and Olivia's Story

During his first marriage to an African-Canadian woman, Paul adopted identical twin Asian daughters: Ella and Olivia. The girls were 5 years old when their adopted parents divorced. Since that time, Paul has seen the girls sporadically. Ella is in her first year of university. She is on the bus heading home to spend Thanksgiving and reading week with her mom and sister. She is planning on a quick visit with her dad and his new family during the holidays.

Ella and Olivia used to have so much fun together, but things have changed recently. Ella is worried about Olivia and the serious health troubles she had been having for over a year and a half. Ella can't help but wonder if these same troubles are heading her way.

The Diagnosis

Ella stared out the bus window as it traveled down the highway. She recalled last June when her mother shared the fateful news about Olivia: "Olivia has been diagnosed with schizophrenia," was what her mother had said.

She had known that something was wrong with her sister. Over a year ago, Ella had started to notice changes in Olivia's behaviour. Olivia had quit a job that she loved. She seemed withdrawn and unmotivated, and had also unexpectedly decided not to attend university despite Ella's and their mother's efforts to convince her otherwise. But Ella had left in the summer for university and had not seen the worst of Olivia's behaviours. Olivia had begun having hallucinations, and could not seem to carry on a coherent conversation in the way that she used to.

Ella had done some research about schizophrenia after hearing of her sister's diagnosis. She did not like what she found. Apparently, schizophrenia had a tendency to run in families. In fact,

studies indicated that a sibling of a schizophrenic was 10 times more likely to develop schizophrenia than the general population. Ella began to worry about her own mental health. She decided she would do some further investigation into the disease once she was home for reading week.

Just how "identical" are we?

Ella had been home from university for a couple of days and was still preoccupied with Olivia's diagnosis and her own potential risk for mental illness. Ella expressed her anxiety and concerns to her mother one night after dinner. "Ella," her mother said, "your concerns are perfectly valid and you have every reason to want to get more information. Why don't we make an appointment to consult with a psychiatrist?" Ella made the appointment the next day.

Ella left Dr. Jacobson's office feeling that some of the weight had been lifted from her shoulders. On the car ride home, she thought about the things that Dr. Jacobson had said to her during their consultation.

"It was good of you to come in to see me, Ella. You are absolutely right to have concerns for yourself when your identical twin has been diagnosed with schizophrenia. Research shows that schizophrenia is almost 50% heritable, and since you share nearly identical DNA with your sister, that puts you at a higher risk for developing this disease as well."

"Fifty percent may sound like a scary number, but remember that schizophrenia is a very complex disease, and 50% of what causes schizophrenia is due to things other than your DNA."

"Like what? What else could be contributing to Olivia's schizophrenia that wouldn't necessarily affect me?" Ella asked.

Dr. Jacobson replied, "There are many, many environmental influences that seem to play a role in the development of this disease, such as increased stress and anxiety, or difficult relationships with other people. Interestingly, there is some research that suggests that the environment itself might even play a role at influencing one's DNA at the molecular level. It's a concept called epigenetics. An example of epigenetics in nature is the calico cat. Each calico cat has a unique orange and black fur colour pattern because of alterations, called epigenetic changes, which occur within the cells that produce coat colour during the cat's development. Research in the field of epigenetics suggests that individuals with schizophrenia appear to have

some of these epigenetic changes to their DNA that are due to environmental influences, and that these alterations could be contributing to their development of mental illness."

"But wouldn't I also have these 'epigenetic alterations' in my DNA?" Ella asked.

"Not necessarily, because you and Olivia have not experienced completely identical environments throughout your lives. For example, you and Olivia have had different teachers and jobs throughout high school. And I also understand that you spent many childhood summers with a friend and her family out in the Rocky Mountains, while your sister was off at swim camps. If you are interested, I can give you some literature to read about this subject."

Ella was definitely interested. She took the articles and headed home.

What really is "epigenetics"?

Ella felt like she was back in school. The more she read about the topic of epigenetics, the more fascinated she became, and she found herself spending most of her days on the Internet doing research. Ella had learned about genetics in her general biology class and thought she had a pretty good idea of how the Laws of Mendel worked, but this whole field of epigenetics seemed to take the idea of inheritance to another level. She was particularly fascinated by an article that Dr. Jacobson had given her regarding epigenetic differences between identical twins. The article suggested that during one's lifetime, epigenetic changes occur to one's DNA that can affect gene expression, and therefore whether or not one will express a certain trait. These epigenetic changes are influenced by one's environment and behaviors, so despite having identical DNA, identical twins will not always have the same epigenetic changes, and therefore, will not always express the same traits.

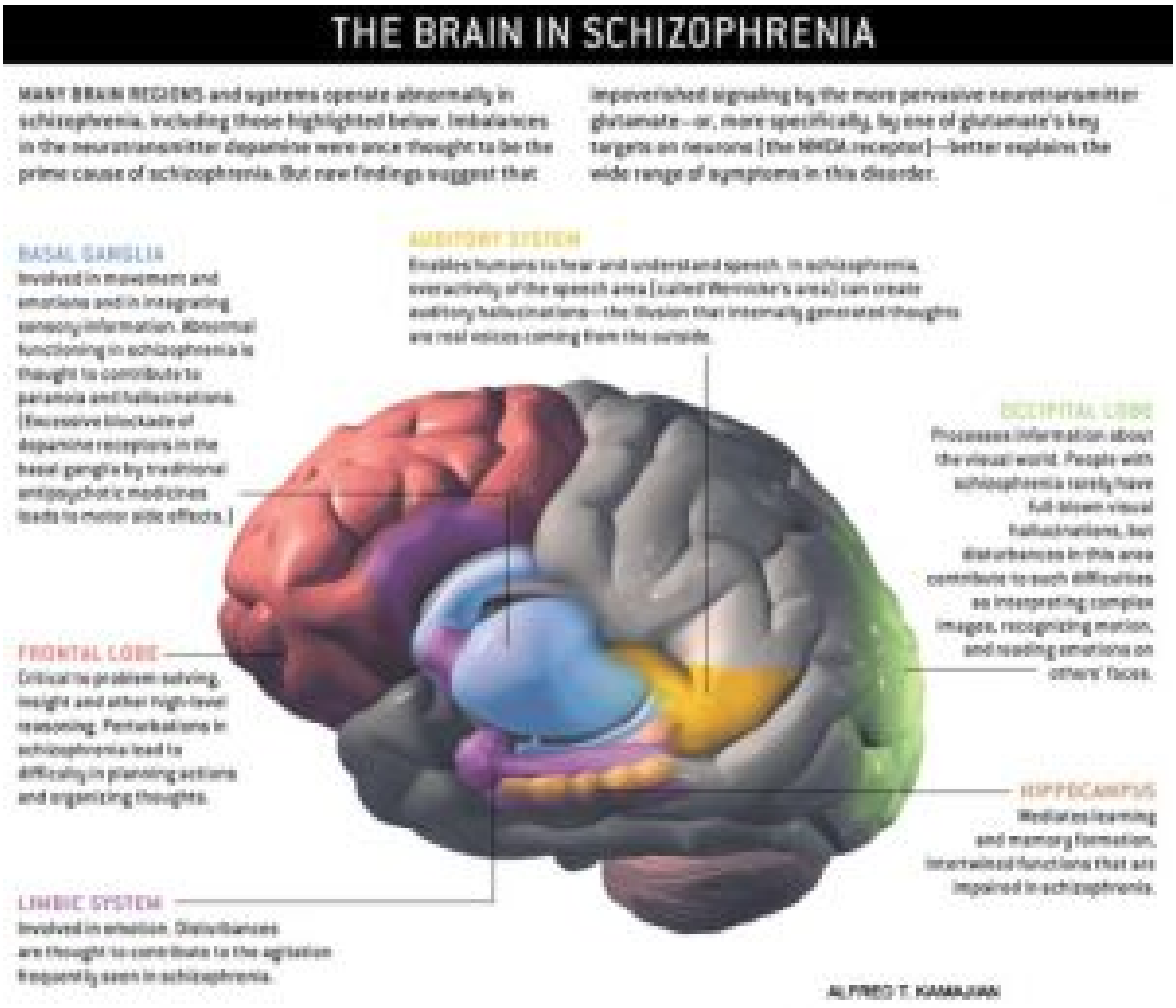
Case Key Words

- Central Nervous System
- Epigenetics
- Inheritance
- Mental Health
- Schizophrenia

ELLA AND OLIVIA'S HEALTH: SCHIZOPHRENIA

Olivia's Diagnosis

Olivia was diagnosed with Schizophrenia. Schizophrenia is classified as a psychotic disorder, in which a person goes into an abnormal state of consciousness. The higher functions of the mind are disrupted. Some combination of a person's perceptions, thought processes, beliefs, and emotions become disconnected from reality. Symptoms may come and go.



Positive Symptoms of Schizophrenia

Positive symptoms are those that are present in someone with schizophrenia that someone without schizophrenia or another mental health condition would not experience.

Delusions:

- False beliefs that don't make sense in context to a person's culture. Obsessive quality.

Hallucinations:

- False sensory experiences that have no basis in the external world. Fully awake and not under the influence of alcohol or drugs. (auditory, visual, tactile).

Disorganized speech:

- Words are linked together based on sound, rhyme, puns, or free association.

Disorganized behaviour:

- Not goal-directed. Laughing inappropriately. Adopting strange postures or freezing (catatonic behaviours).

Negative Symptoms of Schizophrenia

The person is experiencing an absence or reduction of certain traits that are often present in healthier individuals. Feels like something is being taken away or disappearing.

- Flattened affect
- Anhedonia
- Reduced speech
- Lack of initiative

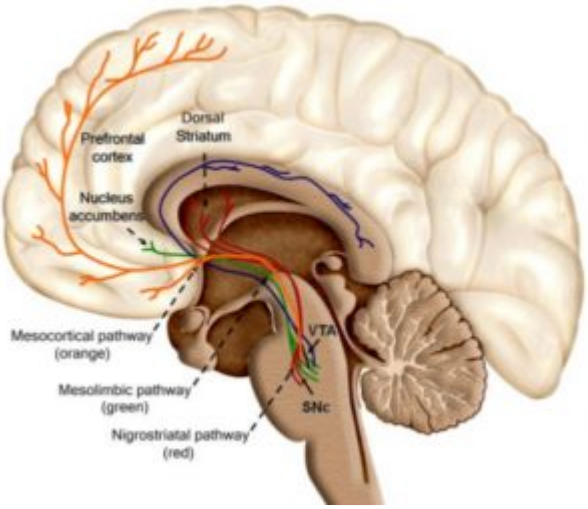
Cognitive Symptoms of Schizophrenia

Cognitive symptoms are not used to diagnose schizophrenia.

- Difficulty maintaining attention
- Memory problems
- Difficulty planning and structuring activities
- Lack of insight

Dopaminergic Pathways: Outline

- Mesolimbic pathway (positive symptoms)
- Mesocortical pathway (negative symptoms)
- Nigrostriatal pathway (extrapyramidal symptoms & tardive dyskinesia)
- Tuberoinfundibular pathway (hyperprolactinemia)



Treatment and Self Help

Tip 1: Get involved in treatment & self-help

- Accept your diagnosis
- Don't buy into the stigma of schizophrenia
- Communicate with your doctor
- Pursue self-help & therapy that helps you manage your symptoms
- Set and work towards the goal

Tip 2: Get active

- Aim for 30 minutes per day
- Rhythmic exercise that uses both arms and legs
- Focus on how your body feels as you move

Tip 3: Seek fact-to-face support

- Turn to trusted friends & family
- Stay involved with others
- Meet new people
- Find a supportive living environment
- Take advantage of support services

Tip 4: Manage Stress

- Know your limits
- Use relaxation techniques
- Manage your emotions

Tip 5: Take care of yourself

- Get plenty of sleep
- Avoid alcohol & drugs
- Eat healthy, balanced diet

Tip 6: Understand the role of medication

- Medication is not a cure
- Only treats some of the symptoms
- Don't put up with disabling side effects

ELLA AND OLIVIA'S HEALTH: EPIGENETICS

What is Epigenetics?

Genes play an important role in your health; So do your behaviours and environment. Epigenetics is the study of how your behaviours and environment can cause changes that affect the way your genes work. Epigenetic changes are reversible and do not change your DNA sequence. They change how your body reads a DNA sequence. Gene expression refers to how often or when proteins are created from the instructions within your genes. While genetic changes can alter which protein is made, epigenetic changes affect gene expression to turn genes "on" and "off."

How Does Epigenetics Work?

Epigenetic changes affect gene expression in different ways. Types of epigenetic changes include:

DNA Methylation

DNA methylation works by adding a chemical group to DNA. Typically, this group is added to specific places on the DNA, where it blocks the proteins that attach to DNA to "read" the gene. This chemical group can be removed through a process called demethylation. Typically, methylation turns genes "off" and demethylation turns genes "on."

Histone modification

DNA wraps around proteins called histones. DNA wrapped tightly around histones cannot be accessed by proteins that "read" the gene. Some genes are wrapped around histones and are turned "off" while some genes are not wrapped around histones and are turned "on." Chemical groups can be added or removed from histones and change whether a gene is unwrapped or wrapped ("on" or "off").

Non-coding RNA

Your DNA is used as instructions for making coding and non-coding RNA. Coding RNA is used to make proteins. Non-coding RNA helps control gene expression by attaching to coding RNA, along with certain

proteins, to break down the coding RNA so that it cannot be used to make proteins. Non-coding RNA may also recruit proteins to modify histones to turn genes "on" or "off."

How Can Epigenetics Change?

Your epigenetics change as you age, both as part of normal development and aging and in response to your behaviours and environment.

Epigenetics and Development

Epigenetic changes begin before you are born. All your cells have the same genes but look and act differently. As you grow and develop, epigenetics helps determine which function a cell will have, for example, whether it will become a heart cell, nerve cell, or skin cell.

Epigenetics and Age

Your epigenetics change throughout your life. Your epigenetics at birth is not the same as your epigenetics during childhood or adulthood.

Epigenetics and Reversibility

Not all epigenetic changes are permanent. Some epigenetic changes can be added or removed in response to changes in behavior or environment.

Epigenetics & Health

Epigenetic changes can affect your health in different ways:

Infections

Germs can change your epigenetics to weaken your immune system. This helps the germ survive.

Cancer

Certain mutations make you more likely to develop cancer. Likewise, some epigenetic changes increase your cancer risk. Epigenetics can be used to help determine which type of cancer a person has or can help to

find hard to detect cancers earlier. Epigenetics alone cannot diagnose cancer, and cancers would need to be confirmed with further screening tests.

Nutrition During Pregnancy

A pregnant woman's environment and behavior during pregnancy, such as whether she eats healthy food, can change the baby's epigenetics. Some of these changes can remain for decades and might make the child more likely to get certain diseases.

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Video Resources

How the nerves work

The science of skin colour

What happens when your DNA is damaged?

Additional Resources

Questions and DNA Sequencing

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