



The BC Research Institute for Children's and Women's Health



Mini Med School 4

Fall 2004

Diabetes:

Diagnosis, management and emerging treatments



Research Education
training • support • opportunities

THE BC RESEARCH INSTITUTE FOR CHILDREN'S & WOMEN'S HEALTH

Welcome to the Mini Med School at the BC Research Institute for Children's and Women's Health

On behalf of the Faculty and Staff at the BC Research Institute for Children's and Women's Health (BCRI), we would like to take this opportunity to welcome you to BCRI's 4th Mini Med School. We are looking forward to again offering you an engaging program of activities and insights on cutting edge health research.

This semester, you will be studying topics in **Diabetes: management, diagnosis and emerging treatments** with some of the leading researchers and clinicians in the field, all of them based right here in Vancouver! The curriculum of 6 sessions was designed by this term's Mini Med School Dean, Dr. Bruce Verchere, along with members of the Mini Med School faculty. The Research Institute is pleased to support Dr Verchere, along with all of the investigators and research fellows who are donating their time and expertise over the next six weeks.

We are also pleased to welcome so many local high school students into our program this term and sincerely hope that Mini Med School might inspire these young and curious minds on to a future in health research. In fact, we invite high school students with good attendance records at the Mini Med School to apply for a summer studentship through the program. The studentship is an opportunity to gain research experience in a lab setting during the summer break. Details on this competition will be announced during the series.

As health researchers and clinicians, we know that the public is keenly interested in our work and you want to know more about its impact on social wellbeing of children and families. It is not always easy to find the time and the best ways to convey this information. We hope that the Mini Med School series will be a step in this direction.

Enjoy your studies with us!

Sincerely,

Dr. Bruce Verchere
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and Laboratory Medicine UBC

Director, Diabetes Research Program,
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1. Mini Med School Objectives

The broad objectives of BCRI's Mini Med School Initiative are the following:

- To present knowledge in accessible ways that capture the imagination, motivate further learning and foster public dialogue;
- To engage members of the public at large, including highly motivated high school students and the clinical community, in participatory learning and discussion around topics in scientific research;
- To provide BCRI/UBC health science researchers and research trainees with opportunities to discuss their work, its context and its implication in a public forum.

2. Diabetes – Glossary of Key Terms



ACE inhibitor: A type of drug used to lower blood pressure. Studies indicate that it may also help prevent or slow the progression of kidney disease in people with diabetes. ACE is an acronym for angiotensin-converting enzyme.

Acetohexamide: A pill taken to lower the level of glucose (sugar) in the blood. Only some people with noninsulin-dependent diabetes take these pills. See also: Oral hypoglycemic agents.

Acetone: A chemical formed in the blood when the body uses fat instead of glucose (sugar) for energy. If acetone forms, it usually means that the cells do not have enough insulin, or cannot use the insulin that is in the blood, to use glucose for energy. Acetone passes through the body into the urine. Someone with a lot of acetone in the body can have breath that smells fruity and is called "acetone breath." See also: Ketone bodies.

Acidosis: Too much acid in the body. For a person with diabetes, this can lead to diabetic ketoacidosis. See also: Diabetic ketoacidosis.

Adult-Onset Diabetes: Former term for noninsulin-dependent or type 2 diabetes. See also: Noninsulin-dependent diabetes mellitus.

Albuminuria: More than normal amounts of the protein albumin in the urine. Albuminuria may be a sign of kidney disease, a problem that can occur in people who have had diabetes for a long time.

Aldose Reductase Inhibitor: A class of drugs being studied as a way to prevent eye and nerve damage in people with diabetes. Aldose reductase is an enzyme that is normally present in the eye and in many other parts of the body. It helps change glucose (sugar) into a sugar alcohol called sorbitol. Too much sorbitol trapped in eye and nerve cells can damage these cells, leading to retinopathy and neuropathy. Drugs that prevent or slow (inhibit) the action of aldose reductase are being studied as a way to prevent or delay these complications of diabetes.

Alpha Cell: A type of cell in the pancreas (in areas called the islets of Langerhans). Alpha cells make and release a hormone called glucagon, which raises the level of glucose (sugar) in the blood.

Amino Acid: The building blocks of proteins; the main material of the body's cells. Insulin is made of 51 amino acids joined together.

Angiopathy: Disease of the blood vessels (arteries, veins, and capillaries) that occurs when someone has diabetes for a long time. There are two types of angiopathy: macroangiopathy and microangiopathy. In macroangiopathy, fat and blood clots build up in the large blood vessels, stick to the vessel walls, and block the flow of blood. In microangiopathy, the walls of the smaller blood vessels become so thick and weak that they bleed, leak protein, and slow the flow of blood through the body. Then the cells, for example, the ones in the center of the eye, do not get enough blood and may be damaged.

Antidiabetic Agent: A substance that helps a person with diabetes control the level of glucose (sugar) in the blood so that the body works as it should. See also: Insulin; oral hypoglycemic agents.

Arteriosclerosis: A group of diseases in which the walls of the arteries get thick and hard. In one type of arteriosclerosis, fat builds up inside the walls and slows the blood flow. These diseases often occur in people who have had diabetes for a long time. See also: Atherosclerosis.

Atherosclerosis: One of many diseases in which fat builds up in the large- and medium-sized arteries. This buildup of fat may slow down or stop blood flow. This disease can happen to people who have had diabetes for a long time.

Autoimmune Disease: Disorder of the body's immune system in which the immune system mistakenly attacks and destroys body tissue that it believes to be foreign. Insulin-dependent diabetes is an autoimmune disease because the immune system attacks and destroys the insulin-producing beta cells.

Autonomic Neuropathy: A disease of the nerves affecting mostly the internal organs such as the bladder muscles, the cardiovascular system, the digestive tract, and the genital organs. These nerves are not under a person's conscious control and function automatically. Also called visceral neuropathy. See also: Neuropathy.

B **Background Retinopathy:** Early stage of diabetic retinopathy; usually does not impair vision. Also called "nonproliferative retinopathy."

B **Beta Cell:** A type of cell in the pancreas in areas called the islets of Langerhans. Beta cells make and release insulin, a hormone that controls the level of glucose (sugar) in the blood.

Beta Cell Transplantation: See: Islet cell transplantation.

Biosynthetic Human Insulin: A form of human insulin that is in wide use today, biosynthetic human insulin is chemically identical to normal human insulin but is DNA-derived (made by genetic engineering) rather than synthesised chemically or purified from pancreas tissue.

Biphasic Insulin: A type of insulin that is a mixture of intermediate- and fast-acting insulin.

Blood Glucose: The main sugar that the body makes from the three elements of food—proteins, fats, and carbohydrates—but mostly from carbohydrates. Glucose is the major source of energy for living cells and is carried to each cell through the bloodstream. However, the cells cannot use glucose without the help of insulin.

Blood Glucose Metre: A machine that helps test how much glucose (sugar) is in the blood. A specially coated strip containing a fresh sample of blood is inserted in a machine, which then calculates the correct level of glucose in the blood sample and shows the result in a digital display. Some metres have a memory that can store results from multiple tests.

Bolus: An extra boost of insulin given to cover expected rise in blood glucose (sugar) such as the rise that occurs after eating.

Bronze Diabetes: A genetic disease of the liver in which the body takes in too much iron from food. Also called "hemochromatosis."

C

C-Peptide: A substance that the pancreas releases into the bloodstream in equal amounts to insulin. A test of C-peptide levels will show how much insulin the body is making.

Calorie: Energy that comes from food. Some foods have more calories than others. Fats have many calories. Most vegetables have few. People with diabetes are advised to follow meal plans with suggested amounts of calories for each meal and/or snack. See also: Meal plan; exchange lists.

Carbohydrate: One of the three main classes of foods and a source of energy. Carbohydrates are mainly sugars and starches that the body breaks down into glucose (a simple sugar that the body can use to feed its cells). The body also uses carbohydrates to make a substance called glycogen that is stored in the liver and muscles for future use. If the body does not have enough insulin or cannot use the insulin it has, then the body will not be able to use carbohydrates for energy the way it should. This condition is called diabetes. See also: Fats; protein.

Cataract: Clouding of the lens of the eye. In people with diabetes, this condition is sometimes referred to as "sugar cataract."

Cholesterol: A fat-like substance found in blood, muscle, liver, brain, and other tissues in people and animals. The body makes and needs some cholesterol. Too much cholesterol, however, may cause fat to build up in the artery walls and cause a disease that slows or stops the flow of blood. Butter and egg yolks are foods that have a lot of cholesterol.

Complications of Diabetes: Harmful effects that may happen when a person has diabetes. Some effects, such as hypoglycemia, can happen any time. Others develop when a person has had diabetes for a long time. These include damage to the retina of the eye (retinopathy), the blood vessels (angiopathy), the nervous system (neuropathy), and the kidneys (nephropathy). Studies show that keeping blood glucose levels as close to the normal, nondiabetic range as possible may help prevent, slow, or delay harmful effects to the eyes, kidneys, and nerves.

Coxsackie B4 Virus: An agent that has been shown to damage the beta cells of the pancreas in lab tests. This virus may be one cause of insulin-dependent diabetes.

Creatinine: A chemical found in the blood and passed in the urine. A test of the amount of creatinine in blood or in blood and urine shows if the kidney is working right or if it is diseased. This is called the creatinine clearance test.

CSII: Continuous Subcutaneous Insulin Infusion: See: Insulin pump.

D Dawn Phenomenon: A sudden rise in blood glucose levels in the early morning hours. This condition sometimes occurs in people with insulin-dependent diabetes and (rarely) in people with noninsulin-dependent diabetes. Unlike the Somogyi effect, it is not a result of an insulin reaction. People who have high levels of blood glucose in the mornings before eating may need to monitor their blood glucose during the night. If blood glucose levels are rising, adjustments in evening snacks or insulin dosages may be recommended. See also: Somogyi effect.

Delta Cell: A type of cell in the pancreas in areas called the islets of Langerhans. Delta cells make somatostatin, a hormone that is believed to control how the beta cells make and release insulin and how the alpha cells make and release glucagon.

Dextrose: A simple sugar found in the blood. It is the body's main source of energy. Also called glucose. See also: Blood glucose.

Diabetes Insipidus: A disease of the pituitary gland or kidney, not diabetes mellitus. Diabetes insipidus is often called "water diabetes" to set it apart from "sugar diabetes."

Diabetes Mellitus: A disease that occurs when the body is not able to use sugar as it should. The body needs sugar for growth and energy for daily activities. It gets sugar when it changes food into glucose (a form of sugar). A hormone called insulin is needed for the glucose to be taken up and used by the body. Diabetes occurs when the body cannot make use of the glucose in the blood for energy because either the pancreas is not able to make enough insulin or the insulin that is available is not effective. The beta cells in areas of the pancreas called the islets of Langerhans usually make insulin.

There are two main types of diabetes mellitus: insulin-dependent (Type 1) and noninsulin-dependent (Type 2). In insulin-dependent diabetes (IDDM), the pancreas makes little or no insulin because the insulin-producing beta cells have been destroyed. This type usually appears suddenly and most commonly in younger people under age 30. Treatment consists of daily insulin injections or use of an insulin pump, a planned diet and regular exercise, and daily self-monitoring of blood glucose.

In noninsulin-dependent diabetes (NIDDM), the pancreas makes some insulin. The insulin, however, is less effective (see Insulin Resistance) and not enough is produced. NIDDM can be controlled by diet and exercise and daily monitoring of glucose levels. Often oral drugs that lower blood glucose levels or insulin injections are needed. This type of diabetes usually develops gradually, most often in people over 40 years of age. NIDDM accounts for 90 to 95 percent of diabetes. The signs of diabetes include having to urinate often, losing weight, getting very thirsty, and being hungry all the time. Other signs are blurred vision, itching, and slow healing of sores. People with untreated or undiagnosed diabetes are thirsty and have to urinate often because glucose builds to a high level in the bloodstream and the kidneys are working hard to flush out the extra amount. People with untreated diabetes often get hungry and tired because the body is not able to use food the way it should.

Diabetic Amyotrophy: A disease of the nerves leading to the muscles. This condition affects only one side of the body and occurs most often in older men with mild diabetes. See also: Neuropathy.

Diabetic Coma: A severe emergency in which a person is not conscious because the blood glucose (sugar) is too low or too high. If the glucose level is too low, the person has

hypoglycemia; if the level is too high, the person has hyperglycemia and may develop ketoacidosis. See also: Hyperglycemia; hypoglycemia; diabetic ketoacidosis.

Diabetic Ketoacidosis (DKA): Severe, out-of-control diabetes (high blood sugar) that needs emergency treatment. DKA happens when blood sugar levels get too high. This may happen because of illness, taking too little insulin, or getting too little exercise. The body starts using stored fat for energy, and ketone bodies (acids) build up in the blood. Ketoacidosis starts slowly and builds up. The signs include nausea and vomiting, which can lead to loss of water from the body, stomach pain, and deep and rapid breathing. Other signs are a flushed face, dry skin and mouth, a fruity breath odor, a rapid and weak pulse, and low blood pressure. If the person is not given fluids and insulin right away, ketoacidosis can lead to coma and even death.

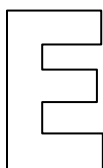
Diabetic Myelopathy: Spinal cord damage found in some people with diabetes.

Diabetic Osteopathy: Loss of foot bone as viewed by x-ray; usually temporary. Also called "disappearing bone disease."

Diabetic Retinopathy: A disease of the small blood vessels of the retina of the eye. When retinopathy first starts, the tiny blood vessels in the retina become swollen, and they leak a little fluid into the center of the retina. The person's sight may be blurred. This condition is called background retinopathy. About 80 percent of people with background retinopathy never have serious vision problems, and the disease never goes beyond this first stage. However, if retinopathy progresses, the harm to sight can be more serious. Many new, tiny blood vessels grow out and across the eye. This is called neovascularization. The vessels may break and bleed into the clear gel that fills the center of the eye, blocking vision. Scar tissue may also form near the retina, pulling it away from the back of the eye. This stage is called proliferative retinopathy, and it can lead to impaired vision and even blindness. See also: Photocoagulation or vitrectomy for treatments.

Diabetogenic: Causing diabetes; some drugs cause blood glucose (sugar) to rise, resulting in diabetes.

Dialysis—A method for removing waste from the blood when the kidneys can no longer do the job.



Electromyography (EMG): Test used to diagnose neuropathy and check for nerve damage.

Endocrine Glands: Glands that release hormones into the bloodstream. They affect how the body uses food (metabolism). They also influence other body functions. One endocrine gland is the pancreas. It releases insulin so the body can use sugar for energy. See also: Gland.

Endocrinologist: A doctor who treats people who have problems with their endocrine glands. Diabetes is an endocrine disorder. See also: Endocrine glands.

Endogenous: Grown or made inside the body. Insulin made by a person's own pancreas is endogenous insulin. Insulin that is made from beef or pork pancreas or derived from bacteria is exogenous because it comes from outside the body and must be injected.

Enzymes: A special type of protein. Enzymes help the body's chemistry work better and more quickly. Each enzyme usually has its own chemical job to do such as helping to change starch into glucose (sugar).

Epinephrine: One of the secretions of the adrenal glands. It helps the liver release glucose (sugar) and limit the release of insulin. It also makes the heart beat faster and can raise blood pressure; also called adrenalin.

Exogenous: Grown or made outside the body; for instance, insulin made from pork or beef pancreas is exogenous insulin for people.

F

Fasting Blood Glucose Test: A method for finding out how much glucose (sugar) is in the blood. The test can show if a person has diabetes. A blood sample is taken in a lab or doctor's office. The test is usually done in the morning before the person has eaten. The normal, nondiabetic range for blood glucose is from 70 to 110 mg/dl, depending on the type of blood being tested. If the level is over 140 mg/dl, it usually means the person has diabetes (except for newborns and some pregnant women).

Fats: One of the three main classes of foods and a source of energy in the body. Fats help the body use some vitamins and keep the skin healthy. They also serve as energy stores for the body. In food, there are two types of fats: saturated and unsaturated.

Saturated fats are solid at room temperature and come chiefly from animal food products. Some examples are butter, lard, meat fat, solid shortening, palm oil, and coconut oil. These fats tend to raise the level of cholesterol, a fat-like substance in the blood. Unsaturated fats, which include monounsaturated fats and polyunsaturated fats, are liquid at room temperature and come from plant oils such as olive, peanut, corn, cottonseed, sunflower, safflower, and soybean. These fats tend to lower the level of cholesterol in the blood. See also: Carbohydrate; protein.

Fatty Acids: A basic unit of fats. When insulin levels are too low or there is not enough glucose (sugar) to use for energy, the body burns fatty acids for energy. The body then makes ketone bodies, waste products that cause the acid level in the blood to become too high. This in turn may lead to ketoacidosis, a serious problem. See also: Diabetic ketoacidosis.

Fibre: A substance found in foods that come from plants. Fibre helps in the digestive process and is thought to lower cholesterol and help control blood glucose (sugar). The two types of fibre in food are soluble and insoluble. Soluble fibre, found in beans, fruits, and oat products, dissolves in water and is thought to help lower blood fats and blood glucose (sugar). Insoluble fibre, found in whole-grain products and vegetables, passes directly through the digestive system, helping to rid the body of waste products.

Fructose: A type of sugar found in many fruits and vegetables and in honey. Fructose is used to sweeten some diet foods. It is considered a nutritive sweetener because it has calories.

G

Galactose: A type of sugar found in milk products and sugar beets. It is also made by the body. It is considered a nutritive sweetener because it has calories.

Gastroparesis: A form of nerve damage that affects the stomach. Food is not digested properly and does not move through the stomach in a normal way, resulting in vomiting, nausea, or bloating and interfering with diabetes management. See also:

Autonomic neuropathy.

Gestational Diabetes Mellitus (GDM): A type of diabetes mellitus that can occur when a woman is pregnant. In the second half of the pregnancy, the woman may have glucose (sugar) in the blood at a higher than normal level. When the pregnancy ends, the blood glucose levels return to normal in about 95 percent of all cases; however, women with GDM are at increased risk for developing type 2 diabetes later in life.

Gland: A group of special cells that make substances so that other parts of the body can work. For example, the pancreas is a gland that releases insulin so that other body cells can use glucose (sugar) for energy. See also: Endocrine glands.

Glomerular Filtration Rate: Measure of the kidneys' ability to filter and remove waste products.

Glomeruli: Network of tiny blood vessels in the kidneys where the blood is filtered and waste products are removed.

Glucagon: A hormone that raises the level of glucose (sugar) in the blood. The alpha cells of the pancreas (in areas called the islets of Langerhans) make glucagon when the body needs to put more sugar into the blood.

An injectable form of glucagon, which can be bought in a drug store, is sometimes used to treat insulin shock. The glucagon is injected and quickly raises blood glucose levels. See also: Alpha cell.

Glucose: A simple sugar found in the blood. It is the body's main source of energy; also known as dextrose. See also: Blood glucose.

Glucose Tolerance Test: A test to see if a person has diabetes. The test is given in a lab or doctor's office in the morning before the person has eaten. A first sample of blood is taken from the person. Then the person drinks a liquid that has glucose (sugar) in it. After one hour, a second blood sample is drawn, and, after another hour, a third sample is taken. The object is to see how well the body deals with the glucose in the blood over time.

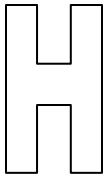
Glycemic Response: The effect of different foods on blood glucose (sugar) levels over a period of time. Researchers have discovered that some kinds of foods may raise blood glucose levels more quickly than other foods containing the same amount of carbohydrates.

Glycogen: A substance made up of sugars. It is stored in the liver and muscles and releases glucose (sugar) into the blood when needed by cells. Glycogen is the chief source of stored fuel in the body.

Glycogenesis (or glucogenesis): The process by which glycogen is formed from glucose. See also: Glycogen.

Glycosuria: Having glucose (sugar) in the urine.

Glycosylated Hemoglobin Test: A blood test that measures a person's average blood glucose (sugar) level for the 2- to 3-month period before the test. See: Hemoglobin A1C.



HCF Diet: A high-carbohydrate, high-fibre diet.

HDL (or high-density lipoprotein)—A combined protein and fatlike substance. Low in cholesterol, it usually passes freely through the arteries. Sometimes called “good cholesterol.”

Hemoglobin A1C (HbA1C): The substance of red blood cells that carries oxygen to the cells and sometimes joins with glucose (sugar). Because the glucose stays attached for the life of the cell (about 4 months), a test to measure hemoglobin A1C shows what the person's average blood glucose level was for that period of time.

High Blood Pressure: When the blood flows through the vessels at a greater than normal force. High blood pressure strains the heart; harms the arteries; and increases the risk of heart attack, stroke, and kidney problems. Also called hypertension.

HLA Antigens: Proteins on the outer part of the cell that help the body fight illness. These proteins vary from person to person. Scientists think that people with certain types of HLA antigens are more likely to develop insulin-dependent diabetes.

Hormone: A chemical released by special cells to tell other cells what to do. For instance, insulin is a hormone made by the beta cells in the pancreas. When released, insulin tells other cells to use glucose (sugar) for energy.

Human Insulin: synthetic insulins that are similar to insulin produced by your own body. Human insulin has been available since October 1982.

Hyperglycemia: Too high a level of glucose (sugar) in the blood; a sign that diabetes is out of control. Many things can cause hyperglycemia. It occurs when the body does not have enough insulin or cannot use the insulin it does have to turn glucose into energy. Signs of hyperglycemia are a great thirst, a dry mouth, and a need to urinate often. For people with insulin-dependent diabetes, hyperglycemia may lead to diabetic ketoacidosis.

Hyperinsulinism: Too high a level of insulin in the blood. This term most often refers to a condition in which the body produces too much insulin. Some researchers believe that this condition may play a role in the development of noninsulin-dependent diabetes and in hypertension. See also: Syndrome X. Inappropriately high insulin can cause hypoglycemia.

Hyperlipidemia: Too high a level of fats (lipids) in the blood. See also: Syndrome X.

Hyperosmolar Coma: A coma (loss of consciousness) related to high levels of glucose (sugar) in the blood and requiring emergency treatment. A person with this condition is usually older and weak from loss of body fluids and weight. The person may or may not have a previous history of diabetes. Ketones (acids) are not present in the urine.

Hypoglycemia: Too low a level of glucose (sugar) in the blood. This occurs when a person with diabetes has injected too much insulin, eaten too little food, or has exercised without extra food. A person with hypoglycemia may feel nervous, shaky, weak, or sweaty, and have a headache, blurred vision, and hunger. Taking small amounts of sugar, sweet juice, or food with sugar will usually help the person feel better within 10-15 minutes. See also: Insulin shock.

Impaired Glucose Tolerance (IGT): Blood glucose (sugar) levels higher than normal but not high enough to be called diabetes. People with IGT may or may not develop diabetes. Other names (no longer used) for IGT are "borderline," "subclinical," "chemical," or "latent" diabetes.

Implantable Insulin Pump: A small pump placed inside of the body that delivers insulin in response to commands from a hand-held device called a programmer.

Incidence: How often a disease occurs; the number of new cases of a disease among a certain group of people for a certain period of time.

Injection Site Rotation: Changing the places on the body where a person injects insulin. Changing the injection site keeps lumps or small dents from forming in the skin. These lumps or dents are called lipodystrophies. However, people should try to use the same body area for injections that are given at the same time each day—for example, always using the stomach for the morning injection or an arm for the evening injection. Using the same body area for these routine injections lessens the possibility of changes in the timing and action of insulin.

Insulin: A hormone that helps the body use glucose (sugar) for energy. The beta cells of the pancreas (in areas called the islets of Langerhans) make the insulin. When the body cannot make enough insulin on its own, a person with diabetes must inject insulin made from other sources, i.e., beef, pork, human insulin (recombinant DNA origin), or human insulin (pork-derived, semisynthetic).

Insulin Antagonist: Something that opposes or fights the action of insulin. Insulin lowers the level of glucose (sugar) in the blood, whereas glucagon raises it; therefore, glucagon is an antagonist of insulin.

Insulin-Dependent Diabetes Mellitus (IDDM): See type 1 diabetes mellitus.

Insulin Pen: An insulin injection device the size of a pen that includes a needle and holds a vial of insulin. It can be used instead of syringes for giving insulin injections.

Insulin Pump: A device that delivers a continuous supply of insulin into the body. The insulin flows from the pump through a plastic tube that is connected to a needle inserted into the body and taped in place. Insulin is delivered at two rates: a low, steady rate (called the basal rate) for continuous day-long coverage, and extra boosts of insulin (called bolus doses) to cover meals or when extra insulin is needed. The pump runs on batteries and can be worn clipped to a belt or carried in a pocket. It is used by people with insulin-dependent diabetes.

Insulin Reaction: Too low a level of glucose (sugar) in the blood; also called hypoglycemia. This occurs when a person with diabetes has injected too much insulin, eaten too little food, or exercised without extra food. The person may feel hungry, nauseated, weak, nervous, shaky, confused, and sweaty. Taking small amounts of sugar, sweet juice, or food with sugar will usually help the person feel better within 10-15 minutes. See also: Hypoglycemia; insulin shock.

Insulin Receptors: Areas on the outer part of a cell that allow the cell to join or bind with insulin that is in the blood. When the cell and insulin bind together, the cell can take glucose (sugar) from the blood and use it for energy.

Insulin Resistance: Many people with noninsulin-dependent diabetes produce enough insulin, but their bodies do not respond to the action of insulin. This may happen because the person is overweight and has too many fat cells, which do not respond well to insulin. Also, as people age,

their body cells lose some of the ability to respond to insulin. Insulin resistance is also linked to high blood pressure and high levels of fat in the blood. Another kind of insulin resistance may happen in some people who take insulin injections. They may have to take very high doses of insulin every day (200 units or more) to bring their blood glucose (sugar) down to the normal range. This is also called "insulin insensitivity.

Insulin Shock: A severe condition that occurs when the level of blood glucose (sugar) drops quickly. The signs are shaking, sweating, dizziness, double vision, convulsions, and collapse. Insulin shock may occur when an insulin reaction is not treated quickly enough. See also: Hypoglycemia; insulin reaction.

Insulinoma: A tumor of the beta cells in areas of the pancreas called the islets of Langerhans. Although not usually cancerous, such tumors may cause the body to make extra insulin and may lead to a blood glucose (sugar) level that is too low.

Islet Cell Transplantation: Moving the beta (islet) cells from a donor pancreas and putting them into a person whose pancreas has stopped producing insulin. The beta cells make the insulin that the body needs to use glucose (sugar) for energy. Although transplanting islet cells may one day help people with diabetes, the procedure is still in the research stage.

Islets of Langerhans: Special groups of cells in the pancreas. They make and secrete hormones that help the body break down and use food. Named after Paul Langerhans, the German scientist who discovered them in 1869, these cells sit in clusters in the pancreas. There are four types of cells in an islet: beta cells, which make insulin; alpha cells, which make glucagon; delta cells, which make somatostatin; and PP cells, which make pancreatic polypeptide.

J Juvenile Onset Diabetes: Former term for insulin-dependent or type 1 diabetes. See: Insulin-dependent diabetes mellitus.

K Ketone Bodies: Chemicals that the body makes when there is not enough insulin in the blood and it must break down fat for its energy. Ketone bodies can poison and even kill body cells. When the body does not have the help of insulin, the ketones build up in the blood and then "spill" over into the urine so that the body can get rid of them. The body can also rid itself of one type of ketone, called acetone, through the lungs. This gives the breath a fruity odor. Ketones that build up in the body for a long time lead to serious illness and coma. See also: Diabetic ketoacidosis.

Ketonuria: Having ketone bodies in the urine; a warning sign of diabetic ketoacidosis (DKA).

Ketosis: A condition of having ketone bodies build up in body tissues and fluids. The signs of ketosis are nausea, vomiting, and stomach pain. Ketosis can lead to ketoacidosis.

Kidney Disease: Any one of several chronic conditions that are caused by damage to the cells of the kidney. People who have had diabetes for a long time may have kidney damage. Also called nephropathy.

Kidneys: Two organs in the lower back that clean waste and poisons from the blood. The kidneys are shaped like two large beans, and they act as the body's filter. They also control the level of some chemicals in the blood such as hydrogen, sodium, potassium, and phosphate.

Kidney Threshold: The point at which the blood is holding too much of a substance such as glucose (sugar) and the kidneys "spill" the excess sugar into the urine. See also: Renal threshold.

Kussmaul Breathing: The rapid, deep, and labored breathing of people who have ketoacidosis or who are in a diabetic coma. Kussmaul breathing is named for Adolph Kussmaul, the 19th century German doctor who first noted it. Also called "air hunger."

L **Labile Diabetes:** A term used to indicate when a person's blood glucose (sugar) level often swings quickly from high to low and from low to high. Also called brittle diabetes.

L **Lactose:** A type of sugar found in milk and milk products (cheese, butter, etc.). It is considered a nutritive sweetener because it has calories.

LADA: Latent autoimmune diabetes of adulthood (LADA or type 1.5 diabetes) is due to autoimmune- destruction of the insulin-producing beta cells as in type 1 (juvenile onset) diabetes, except that LADA occurs later in life, typically at age thirty or older.

Latent Diabetes: Former term for impaired glucose tolerance. See also: Impaired glucose tolerance.

Lipid: A term for fat. The body stores fat as energy for future use just like a car that has a reserve fuel tank. When the body needs energy, it can break down the lipids into fatty acids and burn them like glucose (sugar).

M **Macrosomia:** Abnormally large; in diabetes, refers to abnormally large babies that may be born to women with diabetes.

M **Macrovascular Disease:** A disease of the large blood vessels that sometimes occurs when a person has had diabetes for a long time. Fat and blood clots build up in the large blood vessels and stick to the vessel walls. Three kinds of macrovascular disease are coronary disease, cerebrovascular disease, and peripheral vascular disease.

Macular Edema: A swelling (edema) in the macula, an area near the center of the retina of the eye that is responsible for fine or reading vision. Macular edema is a common complication associated with diabetic retinopathy. See also: Diabetic retinopathy; retina.

Maturity-Onset Diabetes: Former term for noninsulin-dependent or type 2 diabetes. See: Noninsulin-dependent diabetes mellitus.

Maturity-Onset Diabetes of the Young (MODY): a form of noninsulin-dependent or type 2 diabetes that strikes youths and young adults and has a strong genetic component. Patients are typically not obese, and have a genetic defect in insulin production

Metabolism: The term for the way cells chemically change food so that it can be used to keep the body alive. It is a two-part process. One part is called catabolism-when the body uses food for energy. The other is called anabolism-when the body uses food to build or mend cells. Insulin is necessary for the metabolism of food.

Metformin: A drug currently being tested as a treatment for noninsulin-dependent diabetes; belongs to a class of drugs called biguanides.

mg/dL: Milligrams per deciliter. Term used to describe how much glucose (sugar) is in a specific amount of blood. In self-monitoring of blood glucose, test results are given as the amount of glucose in milligrams per deciliter of blood. A fasting reading of 70 to 110 mg/dL is considered in the normal (nondiabetic) range.

Microvascular Disease: Disease of the smallest blood vessels that sometimes occurs when a person has had diabetes for a long time. The walls of the vessels become abnormally thick but weak, and therefore they bleed, leak protein, and slow the flow of blood through the body. Then some cells, for example, the ones in the center of the eye, may not get enough blood and may be damaged.

Mononeuropathy: A form of diabetic neuropathy affecting a single nerve. The eye is a common site for this form of nerve damage. See also: Neuropathy.

Myo-inositol: A substance in the cell that is thought to play a role in helping the nerves to work. Low levels of myo-inositol may be involved in diabetic neuropathy.

N

Necrobiosis Lipoidica Diabeticorum: A skin condition usually on the lower part of the legs. The lesions can be small or extend over a large area. They are usually raised, yellow, and waxy in appearance and often have a purple border. Young women are most often affected. This condition occurs in people with diabetes, or it may be a sign of diabetes. It also occurs in people who do not have diabetes.

Neovascularization: The term used when new, tiny blood vessels grow in a new place, for example, out from the retina. See also: Diabetic retinopathy.

Nephrologist: A doctor who sees and treats people with kidney diseases.

Nephropathy: Disease of the kidneys caused by damage to the small blood vessels or to the units in the kidneys that clean the blood. People who have had diabetes for a long time may have kidney damage.

Neurologist: A doctor who sees and treats people with problems of the nervous system.

Neuropathy: Disease of the nervous system. Many people who have had diabetes for a while have nerve damage. The three major forms of nerve damage are: peripheral neuropathy, autonomic neuropathy, and mononeuropathy. The most common form is peripheral neuropathy, which mainly affects the feet and legs. See also: Peripheral neuropathy; autonomic neuropathy; mononeuropathy.

Noninsulin-Dependent Diabetes Mellitus (NIDDM): See type 2 diabetes mellitus.

Nonketotic Coma: A type of coma caused by a lack of insulin. A nonketotic crisis means: (1) very high levels of glucose (sugar) in the blood; (2) absence of ketoacidosis; (3) great loss of body fluid; and (4) a sleepy, confused, or comatose state. Nonketotic coma often results from some other problem such as a severe infection or kidney failure.

O

Obesity: When people have 20 percent (or more) extra body fat for their age, height, sex, and bone structure. Fat works against the action of insulin. Extra body fat is thought to be a risk factor for diabetes.

Ophthalmologist: A doctor who sees and treats people with eye problems or diseases.

Optometrist: A person professionally trained to test the eyes and to detect and treat eye problems and some diseases by prescribing and adapting corrective lenses and other optical aids and by suggesting eye exercise programs.

P

Pancreas: An organ behind the lower part of the stomach that is about the size of a hand. It makes insulin so that the body can use glucose (sugar) for energy. It also makes enzymes that help the body digest food. Spread all over the pancreas are areas called the islets of Langerhans. The cells in these areas each have a special purpose. The alpha cells make glucagon, which raises the level of glucose in the blood; the beta cells make insulin; the delta cells make somatostatin; and the PP cells make somatostatin.

Pancreas Transplant: A surgical procedure that involves replacing the pancreas of a person who has diabetes with a healthy pancreas that can make insulin. The healthy pancreas comes from a donor who has just died or from a living relative. A person can donate half a pancreas and still live normally. At present, pancreas transplants are usually performed in persons with insulin-dependent diabetes who have severe complications. This is because after the transplant the patient must take immunosuppressive drugs that are highly toxic and may cause damage to the body.

Pancreatectomy: A procedure in which a surgeon takes out the pancreas.

Pancreatitis: Inflammation (pain, tenderness) of the pancreas; it can make the pancreas stop working. It is caused by drinking too much alcohol, by disease in the gallbladder, or by a virus.

Pediatric Endocrinologist: A doctor who sees and treats children with problems of the endocrine glands; diabetes is an endocrine disorder. See also: Endocrine glands.

Peripheral Neuropathy: Nerve damage, usually affecting the feet and legs; causing pain, numbness, or a tingling feeling. Also called "somatic neuropathy" or "distal sensory polyneuropathy."

Peripheral Vascular Disease (PVD): Disease in the large blood vessels of the arms, legs, and feet. People who have had diabetes for a long time may get this because major blood vessels in their arms, legs, and feet are blocked and these limbs do not receive enough blood. The signs of PVD are aching pains in the arms, legs, and feet (especially when walking) and foot sores that heal slowly. Although people with diabetes cannot always avoid PVD, doctors say they have a better chance of avoiding it if they take good care of their feet, do not smoke, and keep both their blood pressure and diabetes under good control. See also: Macrovascular disease.

Pituitary Gland: An endocrine gland in the small, bony cavity at the base of the brain. Often called "the master gland," the pituitary serves the body in many ways-in growth, in food use, and in reproduction.

Placenta - special tissue that joins the mother and fetus to provide hormones necessary for a successful pregnancy, and supplies the fetus with water and nutrients (food) from the mother's blood.

Polydipsia: A great thirst that lasts for long periods of time; a sign of diabetes.

Polyphagia: Great hunger; a sign of diabetes. People with this great hunger often lose weight.

Polyunsaturated Fats: A type of fat that comes from vegetables. See also: Fats.

Polyuria: Having to urinate often; a common sign of diabetes.

Postprandial Blood Glucose: Blood taken 1-2 hours after eating to see the amount of glucose (sugar) in the blood.

Preeclampsia: A condition that some women with diabetes have during the late stages of pregnancy. Two signs of this condition are high blood pressure and swelling because the body cells are holding extra water.

Prevalence: The number of people in a given group or population who are reported to have a disease.

Previous Abnormality of Glucose Tolerance (PrevAGT): A term for people who have had above-normal levels of blood glucose (sugar) when tested for diabetes in the past but who show as normal on a current test. PrevAGT used to be called either "latent diabetes" or "prediabetes."

Proinsulin: The substance made first in the pancreas that is then made into insulin. When insulin is purified from the pancreas of pork or beef, all the proinsulin is not fully removed. When some people use these insulins, the proinsulin can cause the body to react with a rash, to resist the insulin, or even to make dents or lumps in the skin at the place where the insulin is injected. The purified insulins have less proinsulin and other impurities than the other types of insulins. The beta cells of persons with type 2 diabetes tend to secrete more proinsulin than non-diabetic persons.

Proliferative Retinopathy: A disease of the small blood vessels of the retina of the eye. See also: Diabetic retinopathy.

Protein: One of the three main classes of food. Proteins are made of amino acids, which are called the building blocks of the cells. The cells need proteins to grow and to mend themselves. Protein is found in many foods such as meat, fish, poultry, and eggs. See also: Carbohydrate; fats.

Proteinuria: Too much protein in the urine. This may be a sign of kidney damage.

Purified Insulins: Insulins with much less of the impure proinsulin. It is thought that the use of purified insulins may help avoid or reduce some of the problems of people with diabetes such as allergic reactions.

R

Reagents: Strips or tablets that people use to test the level of glucose (sugar) in their blood and urine or the level of acetone in their urine. These reagents are treated with chemicals that change color during the test. Each type of reagent has its own color code to show how much glucose or acetone there is at the time of the test..

Receptors: Areas on the outer part of a cell that allow the cell to join or bind with insulin that is in the blood. See also: Insulin receptors.

Renal Threshold: When the blood is holding so much of a substance such as glucose (sugar) that the kidneys allow the excess to spill into the urine. This is also called "kidney threshold," "spilling point," and "leak point."

Retina: The center part of the back lining of the eye that senses light. It has many small blood vessels that are sometimes harmed when a person has had diabetes for a long time.

Retinopathy: A disease of the small blood vessels in the retina of the eye. See also: Diabetic retinopathy.

S

Saturated Fat: A type of fat that comes from animals.

Secondary Diabetes: When a person gets diabetes because of another disease or because of taking certain drugs or chemicals.

Segmental Transplantation: A surgical procedure in which a part of a pancreas that contains insulin-producing cells is placed in a person whose pancreas has stopped making insulin.

Somatostatin: A hormone made by the delta cells of the pancreas (in areas called the islets of Langerhans). Scientists think it may control how the body secretes two other hormones, insulin and glucagon.

Somogyi Effect: A swing to a high level of glucose (sugar) in the blood from an extremely low level, usually occurring after an untreated insulin reaction during the night. The swing is caused by the release of stress hormones to counter low glucose levels. People who experience high levels of blood glucose in the morning may need to test their blood glucose levels in the middle of the night. If blood glucose levels are falling or low, adjustments in evening snacks or insulin doses may be recommended. This condition is named after Dr. Michael Somogyi, the man who first wrote about it. Also called "rebound."

Sorbitol: A sugar alcohol the body uses slowly. It is a sweetener used in diet foods. It is called a nutritive sweetener because it has four calories in every gram, just like table sugar and starch. Sorbitol is also produced by the body. Too much sorbitol in cells can cause damage. Diabetic retinopathy and neuropathy may be related to too much sorbitol in the cells of the eyes and nerves.

Sucrose: Table sugar; a form of sugar that the body must break down into a more simple form before the blood can absorb it and take it to the cells.

Sugar: A class of carbohydrates that taste sweet. Sugar is a quick and easy fuel for the body to use. Types of sugar are lactose, glucose, fructose, and sucrose.

Sulfonylureas: Pills or capsules that people take to lower the level of glucose (sugar) in the blood. See also: Oral hypoglycemic agents.

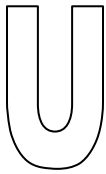
T

Toxemia of Pregnancy: A condition in pregnant women in which poisons such as the body's own waste products build up and may cause harm to both the mother and baby. The first signs of toxemia are swelling near the eyes and ankles (edema), headache, high blood pressure, and weight gain that the mother might confuse with the normal weight gain of being pregnant. The mother may have both glucose (sugar) and acetone in her urine. The mother should tell the doctor about these signs at once.

Triglyceride: A type of blood fat. The body needs insulin to remove this type of fat from the blood. When diabetes is under control and a person's weight is what it should be, the level of triglycerides in the blood is usually about what it should be.

Type 1 diabetes - a condition in which the body's immune system destroys the cells in the pancreas that produce insulin. Insulin allows glucose to enter the cells of the body to provide energy. Persons with type 1 diabetes must take daily insulin injections. This type of diabetes used to be known as "juvenile diabetes," "juvenile-onset diabetes," and "ketosis-prone diabetes." It is also called insulin-dependent diabetes mellitus (IDDM).

Type 2 diabetes - a condition in which the body either makes too little insulin and/or cannot properly use the insulin it makes to convert blood glucose to energy. Type 2 diabetes may be controlled with diet, exercise, and weight loss, or may require oral medications and/or insulin injections. It is the most common form of diabetes mellitus; about 90 to 95 percent of people who have diabetes have type 2 diabetes. People with type 2 diabetes can often control their condition by losing weight through diet and exercise. If not, they may need to combine insulin or a pill with diet and exercise. Generally, type 2 diabetes occurs in people who are over age 40. Most of the people who have this type of diabetes are overweight. Type 2 diabetes is also sometimes called "Noninsulin-dependent diabetes mellitus (NIDDM)", "adult-onset diabetes," "maturity-onset diabetes," "ketosis-resistant diabetes," and "stable diabetes."



Unit of Insulin: The basic measure of insulin. U-100 insulin means 100 units of insulin per milliliter (mL) or cubic centimeter (cc) of solution. Most insulin made today in the United States is U-100.

Unstable Diabetes: A type of diabetes when a person's blood glucose (sugar) level often swings quickly from high to low and vice versa. Also called "brittle diabetes" or "labile diabetes."

Urea: One of the chief waste products of the body. When the body breaks down food, it uses what it needs and throws the rest away as waste. The kidneys flush the waste from the body in the form of urea, which is in the urine.

Urine Testing: Checking urine to see if it contains glucose (sugar) and ketones. Special strips of paper or tablets (called reagents) are put into a small amount of urine or urine plus water. Changes in the color of the strip show the amount of glucose or ketones in the urine. Urine testing is the only way to check for the presence of ketones, a sign of serious illness. However, urine testing is less desirable than blood testing for monitoring the level of glucose in the body. See also: Blood glucose monitoring; reagents.

3. For the Truly Curious...

The BC Children's Hospital Diabetes Clinic website has a remarkable list of resources and links:

www.cw.bc.ca/endodiab/diablink

Other useful sites include:

www.diabetes.ca

Canadian Diabetes Association

www.diabetes.org

American Diabetes Association

www.jdrf.org

Juvenile Diabetes Research Foundation

www.jdrf.ca

Juvenile Diabetes Research Foundation – Canada

www.idf.org/home

International Diabetes Federation

www.diabete.qc.ca

Diabete Quebec

www.cihr.ca

Canadian Institutes of Health Research – CIHR.

www.cihr-irsc.gc.ca/e/13521.html

CIHR Institute of Nutrition Metabolism and Diabetes

www.hc-sc.gc.ca/pphb-dgspsp/publicat/dic-dac99/index.html

(Health Canada)

www.cw.bc.ca/endodiab/index.asp

BCCH Endocrinology and Diabetes Unit

www-hsl.mcmaster.ca/tomflem/diab.html

McMaster Health Care information resources

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