

# JDRF GLOSSARY OF TERMS & DEFINITIONS

Included below are definitions for many commonly used terms relating to type 1 (juvenile) diabetes and some of the research initiatives funded by JDRF. While the list is presented alphabetically, many of the definitions or explanations are cross-referenced to enhance understanding of each term.

Sources include: [www.jdrf.ca](http://www.jdrf.ca), [www.jdrf.org](http://www.jdrf.org), [www.medical-dictionary.com](http://www.medical-dictionary.com), and [www.medicaldictionaryweb.com](http://www.medicaldictionaryweb.com).

## A.

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

**Advocate:** A person who acts on behalf of another, usually for a cause or plea.

**Alpha Cell:** A type of cell found in the Islets of Langerhans within the pancreas. Alpha cells make and release a hormone called glucagon, which raises the blood sugar level.

**Antibodies:** Proteins that the body makes to protect itself from foreign substances such as bacteria, viruses, and transplanted organs.

**ARRCC:** Acronym for JDRF's five cure therapeutics – Autoimmunity, Regeneration, Replacement, Complications and Control. See Autoimmunity, Regeneration, Replacement, Complications and Control.

**Artificial Pancreas:** An artificial pancreas is a “closed-loop” device that would regulate glucose levels in the body of someone with diabetes by continuously measuring the level of glucose and dispensing doses of insulin based on those measurements. An artificial pancreas would enable a person with diabetes to maintain “normal” glucose levels by providing the right amount of insulin at the right time, just as a pancreas does in people without the disease. See Edmonton Protocol.



**Autoimmunity:** One of JDRF's key five cure therapeutics, JDRF's research is aimed at stopping or reversing the immune system response that causes diabetes: the attack on insulin-secreting cells in the pancreas. The process by which the immune system turns on the body, killing the insulin-producing beta cells and causing the onset of type 1 diabetes. This attack must

be stopped so therapies involving regenerating or replacing insulin-producing cells can work long-term.

**Autoimmune Disease:** A disorder in which the immune system mistakenly attacks and destroys body tissue it believes to be foreign. Type 1 (juvenile) diabetes is a chronic autoimmune disease in which the immune system attacks and destroys the insulin-producing beta cells.

## B.

**Beta Cell(s):** A type of cell in the pancreas in areas called the Islets of Langerhans. They make up 65-80 per cent of the cells in the islets. Beta cells make and release insulin, a hormone that controls the level of glucose in the blood. There is a baseline level of insulin maintained by the pancreas, but it can respond quickly in blood glucose by releasing stored insulin while simultaneously producing more. Beta cells make and release insulin. Apart from insulin, beta cells release C-peptide, a byproduct of insulin production, into the bloodstream in equimolar quantities. Measuring the levels of C-peptide can give a practitioner an idea of the viable beta cell mass.

**Biomarkers:** Biological clues to gauge whether a treatment is working.

**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.

**Blood Glucose Metre:** A hand-held machine designed to test blood glucose (sugar) levels. A drop of blood from the finger or other approved site is placed on a specially coated strip, which is then inserted into the metre for analysis, and the result is displayed. A blood glucose metre allows a person with diabetes to play an active role in monitoring his or her own blood glucose levels.

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**Blood Glucose Monitoring:** A way of testing how much glucose (sugar) is in the blood. It can be done by visually comparing a blood sample on a strip of material to a colour chart, or by using a metre. Blood testing is more accurate than urine testing to monitor the levels of blood glucose. The wearing of continuous monitors allows physicians to examine additional readings, including blood glucose levels while sleeping.

**Brittle Diabetes:** Though not a distinct form of diabetes, and now considered an outmoded term, it refers to diabetes that is very difficult to control, but that nevertheless will usually respond to a more intensive team approach to care.

## C.

**C-Peptide:** A substance formed in the beta cells of the pancreas; therefore, a test of C-peptide levels indicates the amount of beta cell function occurring in the pancreas.

**Carbohydrate:** One of the three main classes of foods and a source of energy. Carbohydrates are mainly sugars and starches the body breaks down into glucose, the main sugar made by the body (See Blood Glucose). The body also uses carbohydrates to make a substance called glycogen that is stored in the liver and muscles for future use. Without insulin, the body cannot use carbohydrates for energy the way it is supposed to.

**Cardiovascular Disease:** Cardiovascular disease, a range of blood vessel system diseases that includes both stroke and heart attack, is the major cause of death in people with type 1 and type 2 diabetes. The two most common types of cardiovascular disease are coronary heart disease, caused by fatty deposits in the arteries that feed the heart, and hypertension, or high blood pressure.

**Cell Lines:** A permanently established cell culture that will proliferate indefinitely given appropriate fresh medium and space.

**Cells:** Minute protoplasmic masses that make up organized tissue, consisting of a nucleus which is surrounded by protoplasm which contains the various organelles and is enclosed in the cell or plasma membrane. Cells are the fundamental, structural, and functional units of living organisms.

**Clinical Trials:** A biomedical or health-related research study in human beings that follow a pre-defined protocol with three phases of clinical trials:

- small, controlled human populations of 20-80 patients (testing safety);
- large human population of 100-300 patients with the disease (test efficacy); and
- pre-commercialization, large, global human trials with 1,000 to 3,000 patients (multi-centered)

In 2000, JDRF funded six human clinical trials; JDRF is currently funding more than 40 human clinical trials.

**Complications:** One of JDRF's key five cure therapeutics. Harmful effects caused by diabetes. Diabetes is the leading cause of kidney failure, adult blindness, and non-traumatic amputations and a leading cause of nerve damage, stroke, and heart attacks. Studies have shown strict control of blood glucose levels may help reduce, delay, or prevent these problems. (See Nephropathy, Neuropathy, Retinopathy, and Vascular Disease.)

**Continuous Glucose Monitors:** Continuous glucose monitors (CGMs) are devices that provide continuous "real-time" readings and data about trends in glucose levels.

This can allow people with diabetes to understand the level of their glucose and whether it is rising or falling and to intervene by eating food or taking insulin to prevent it from going too high or too low. To date, three continuous glucose monitors (CGMs) have been approved by the FDA.

**Control (Metabolic):** One of JDRF's key five cure therapeutics. Treatments that continually monitor the body's blood sugar levels and automatically respond with the correct dose of insulin would significantly enhance metabolic control. JDRF research is focused on demonstrating that advanced monitoring tools improves the health of people with diabetes, and on developing technologies that link insulin pumps and continuous glucose monitors. Such as a "closed loop" system would, in effect, be an artificial pancreas.

**Cure Therapeutics:** JDRF has identified a set of five cure therapeutic goal areas in which to focus its research funding efforts. These cure therapeutics are the interventions, procedures, drugs or treatments that would effectively halt or reverse diabetes and its complications, and prevent it from occurring or recurring. JDRF actively pursues research within the framework of the following goals, while adapting to new opportunities as they arise:

- Stopping the immune system response that causes type 1 diabetes and restoring autoimmunity in new-onset patients

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- Regenerating the body's own beta cells without transplantation
- Perfecting islet replacement strategies without chronic immunosuppression, including the creation of a renewable islet cell source
- Creating novel therapeutics for predicting, preventing, and reversing complications
- Achieving (metabolic) control through mechanical intervention, including the development of a closed-loop artificial pancreas

## D.

**Diabetes Mellitus:** A term no longer used to describe a condition in which the body either cannot produce insulin or cannot effectively use the insulin it produces. (See type 1 diabetes, type 2 diabetes, and Gestational Diabetes.)

**Diabetic Coma:** A severe emergency in which a person is not conscious because their blood glucose is too low or too high.

**Diabetic Ketoacidosis (DKA):** Severe, out-of-control diabetes (high blood sugar) that requires emergency treatment. DKA occurs when the blood does not have enough insulin. The body starts using stored fat for energy, and ketone bodies (acids) build up in the blood.

## E.

**Edmonton Protocol:** A method of islet cell transplantation that uses more islet cells and a less-toxic combination of drugs that suppress the immune system. First used on adult patients with severe type 1 diabetes at the University of Alberta, Edmonton, Canada, in June 2000, the protocol provides “proof of principle” that islet transplantation can cure type 1 diabetes. Though not for everyone with diabetes, the protocol is proof of principle that islet transplantation can potentially work.

**Embryonic stem cells:** Relatively undifferentiated cells that retain the ability to divide and proliferate throughout postnatal life to provide progenitor cells that can differentiate into specialized cells.

**Endocrinologist:** A medical doctor who treats people who have problems with their endocrine system. The pancreas is an endocrine gland; diabetes is an endocrine disorder.

**Euglycemia:** A normal level of glucose (sugar) in the blood.

## G.

**Gastrin:** A family of gastrointestinal peptide hormones that excite the secretion of gastric juice. They may also occur in the central nervous system where they are presumed to be neurotransmitters.

**Gene Therapy:** A method of treating or preventing disease by replacing, altering or supplementing a patient's genetic material. This is done by delivering genetic material to target cells, often through the use of a harmless virus, which has the ability to enter cells and introduce DNA into them.

**Genetics:** The branch of science concerned with the means and consequences of transmission and generation of the components of biological inheritance. (Stedman, 26th ed)

**Gestational Diabetes:** A temporary condition that develops during pregnancy due to a deficiency of insulin. Although it disappears following delivery, women who have had gestational diabetes may be at a higher risk of developing type 2 diabetes later in life.

**Glucagon:** A hormone produced by the pancreas that stimulates the liver to produce large amounts of glucose. Glucagon is given by injection to treat hypoglycemia (also known as insulin shock) and generally restores blood sugar to “normal” level within 10-30 minutes. People with type 1 diabetes should have an emergency glucagon kit close at hand at all times, including when traveling. Family members and caregivers should be trained on how to administer glucagons.

**Glucose:** The main sugar 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.

**Glycogen:** The main carbohydrate storage material, which is saved in the liver and muscles for use when energy is required.

## H.

**Hemoglobin A1c test:** Also called the HbA1c or A1c test.

This test measures the amount of glucose attached to hemoglobin in the red blood cells, which shows the average blood glucose levels for a two to three month period.

**Honeymoon Period:** The period of time after diagnosis of type 1 diabetes when beta cells still produce a small

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amount of insulin. This period may last weeks, months, or years.

**Hormone:** A naturally occurring substance secreted by specialized cells that affect the metabolism or behaviour of other cells possessing functional receptors for the hormone. Hormones may be hydrophilic, like insulin, in which case the receptors are on the cell surface or lipophilic, like the steroids, where the receptor can be intracellular.

**Human Clinical Trials:** Human clinical trials are the final phase of research done before a new drug or treatment is approved for market. Many tests are conducted before the clinical trial stage to determine whether new treatments are both safe and effective for people. In 2008, JDRF funded six human clinical trials; currently, JDRF is funding more than 40 human clinical trials.

**Hyperglycemia:** High blood sugar. Signs of hyperglycemia are extreme thirst, dry mouth, and frequent urination. Left untreated, it can lead to diabetic ketoacidosis.

**Hypoglycemia:** Low blood sugar. Symptoms may include nervousness, weakness, headache, blurred vision, and increased appetite. Taking small amounts of sugar, juice, or food with sugar usually helps the person feel better within 10-15 minutes.

I.

**Immune System:** The body's defense mechanism against foreign organisms or substances and deviant native cells. It includes the humoral immune response and the cell-mediated response and consists of a complex of interrelated cellular, molecular, and genetic components.

**Immune Tolerance Network (ITN):** An international consortium of 40 institutions co-funded by JDRF and the National Institutes of Health (NIH) that are investigating ways to induce, maintain and monitor immune tolerance in humans for kidney and islet transplantation, autoimmune diseases and allergy and asthma. The ITN is currently conducting trials of the Edmonton Protocol.

**Immunosuppressive Drug:** A drug that blocks the body's ability to fight infection. A person receiving a kidney, pancreas, or islet cell transplant is given such drugs to keep the body from rejecting the new organ or tissue.

**Impaired Glucose Tolerance (IGT):** Blood sugar levels that are higher than normal but below the level of someone with diabetes. People with this condition may never develop true diabetes. Formerly called "borderline," "subclinical," "chemical" or "latent" diabetes.

**Insulin:** A hormone produced by the beta cells of the pancreas in response to increased levels of glucose in the blood. When the body cannot make enough insulin on its own, a person with diabetes must inject insulin from other sources.

**Insulin Dependent Diabetes Mellitus (IDDM):** An older term for type 1 diabetes, which occurs when the pancreas stops producing or produces very little insulin. (See type 1 diabetes).

**Insulin Pump:** A pager-sized computer device that can be clipped to the belt or a pocket, the pump delivers insulin continuously to its user through a small tube, or cannula, which is inserted easily into the abdomen, buttocks, thigh or arm and held in place by an adhesive dressing.

**Insulin Reaction:** Low blood sugar (hypoglycemia). This occurs when a person with diabetes injects too much insulin, has eaten too little food, or has exercised without extra food. Also called insulin shock.

**Islet Cell Transplantation:** A procedure still in the research stage and currently employed in human clinical trials that involves taking beta (islet) cells from a donor pancreas and putting them into a person whose pancreas has stopped producing insulin. See Edmonton Protocol

**Islet Cells (of Langerhans):** In a healthy pancreas, there are two different kinds of cells: one kind secretes digestive juices into the bowel to digest different good ingredients, and the other kind secretes hormones like insulin and glucagon into the blood. The latter cells are grouped in small islands in the pancreas; they are called the Islet Cells or Islets of Langerhans. Each of these islets contains a few thousand cells, and a total of one to two million insulin-secreting cells. In a person with type 1 diabetes, the insulin producing cells are attacked by immune system and are destroyed, leading to a deficiency of insulin and high blood sugar. For the person with diabetes to survive, insulin has to either be provided by injections or, as this research shows, the islet cells can be transplanted to provide insulin. There are five types of cells in an islet: beta cells, alpha cells, delta cells, PP (polypeptide) cells, and D1 cells.

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## J.

**JDRF:** Juvenile Diabetes Research Foundation was founded in 1970 by the parents of children with type 1 (juvenile) diabetes. JDRF Canada was founded in 1974 and is part of an international presence with JDRF affiliates in cities around the globe. There are 15 Chapters in major markets across Canada with a National Support Office in Markham, Ontario. JDRF is the leading charitable funder and advocate of type 1 research in the world. JDRF's mission is to find a cure for type 1 diabetes and its complications through the support of research.

**JDRF Centre for Beta Cell Replacement at McGill and University of Montreal:** To find out exactly when the toxic molecules known as free radicals start to develop inside living islet cells that have been extracted from a human pancreas. These radicals threaten the viability of the islet cells and thus their usefulness for clinical transplantation. These free radicals are identified in the "isolated" islet cells by imaging techniques which themselves do not harm the cells, but allow the team to visualize and follow the development of the radicals as they appear. They can also monitor how well drugs can prevent their development, so prolonging the survival of the cells until they can be successfully transplanted into a diabetic patient. Centre Director: Lawrence Rosenberg, M.D., Ph.D, Montreal General Hospital, Montreal, QC.

**JDRF Centre for Clinical Islet Transplantation at the University of Alberta:** To advance outcomes and minimize risk of clinical islet transplantation, to study impact of successful islet transplant in control of secondary diabetic complications, quality of life and cost-utility benefit, and to optimize recovery of islets to enhance success with single donor islet transplants. Centre Director: James Shapiro, M.D., Ph.D., University of Alberta, Edmonton, Alberta.

**JDRF Centers for Islet Transplantation:** JDRF-funded initiatives at four institutions in the United States are investigating the transplantation of islet cells to cure diabetes.

**JDRF Human Islet Distribution Programs:** JDRF-funded initiatives at nine institutions to coordinate and standardize the distribution of islets for research and transplants.

**JDRF Coordinating Center for the Study of Genetics in Type 1 Diabetes and its Complications:** A program

based at the Joslin Diabetes Center in Boston and the George Washington University Biostatistics Center in Washington, D.C. that will assemble, maintain and distribute DNA and other genetic samples and data from populations needed to study the genetics of type 1 diabetes and the genetics of susceptibility to complications.

## K.

**Ketones:** Chemicals produced by the body when it cannot use glucose and must break down fat for energy. Ketones can poison or kill body cells. When the body does not have the help of insulin, ketones build up in the blood and then "spill" over into the urine so the body can get rid of them. Ketones remaining in the body for a long time may lead to serious illness and coma. People with diabetes should test for ketones whenever blood sugar levels are high for an extended period of time, and they should also test during periods of illness even if blood glucose levels are not high.

**Ketoacidosis:** Ketoacidosis is a diabetic emergency. In most, but not all cases, very high blood sugar levels are also present with ketoacidosis. Signs of ketoacidosis may include:

- dehydration
- labored breathing
- vomiting
- abdominal pain
- fruity-smelling breath
- weakness or fatigue

Diabetic ketoacidosis requires prompt attention; untreated, a child with ketoacidosis can lapse into a coma. If there are signs of ketoacidosis, the child should be taken to the emergency room immediately.

## L.

**Lancet:** A fine, sharp-pointed blade or needle for poking the skin.

## M.

**Mg/dl:** Milligrams of glucose per decilitre of blood.

## N.

**Needle Pokes:** A child living with type 1 diabetes requires approximately 1,463 needle pokes a year (based on four per day) and 2,190 finger pokes per year in order to test their blood sugar level.

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**Nephropathy:** Diabetic kidney disease, also known as diabetic nephropathy, is one of the most common and most devastating complications of diabetes. It is, essentially, a slow deterioration of the kidneys and kidney function which, in more severe cases, can eventually result in kidney failure, also known as end-stage renal disease, or ESRD. About 25 per cent of people with type 1 diabetes suffer from nephropathy. Those with type 2 diabetes are also at risk.

**Neuropathy:** Diabetic neuropathy is one of the most debilitating complications of type 1 diabetes, and one of the most common. It is the medical name given to progressive damage to the nervous system caused by diabetes. Diabetic neuropathy leads to a loss of feeling in the hands and feet, and is the most common cause of “nontraumatic” (not due to an accident) amputations. More than 60 per cent of people with diabetes have some form of neuropathy, but only about half experience symptoms. It is most common among those who have had diabetes for at least 25 years.

Peripheral neuropathy is an inflammation or degeneration of the peripheral nerves (arms, hands, feet, and legs). Autonomic neuropathy affects the internal organs of the body. Focal neuropathy affects a single, specific part of the body.

## P.

**Pancreas:** A gland behind the lower part of the stomach that is about the size of a hand. It produces insulin, glucagon, and enzymes that aid digestion.

**Prevention trials:** Clinical studies involving people at high risk for diabetes, as well as their families. Researchers provide information about treatment options to those at risk for diabetes, and the participants in the trial provide data that could help researchers identify the cause of the disease.

## R.

**Regeneration:** One of JDRF’s key five cure therapeutics. Among the fastest-growing scientific areas, JDRF supports research aimed at regenerating insulin producing cells in people who have diabetes (as opposed to transplanting cells from organ donors or other sources). This involves triggering the body to grow its own new insulin producing cells, either by copying existing ones - some are usually still active, even in people who have had diabetes for decades - or causing the pancreas to create new ones.

**Replacement:** One of JDRF’s key five cure therapeutics. An alternative to sparking the body into growing new insulin-producing cells is replacing cells killed off by diabetes with functioning ones from a donor - similar to a heart or kidney transplant. Beyond improving transplantation techniques, our research is focused on increasing the supply of cells that can be transplanted - from animals, like pigs, or by finding ways to change different types of cells, such as liver cells, or coaxing adult or embryonic stem cells into becoming insulin-producing cells.

**Retinopathy:** Diabetic retinopathy is the most common and most serious eye-related complication of diabetes. It is a progressive disease that destroys small blood vessels in the retina, eventually causing vision problems. In its most advanced form (known as “proliferative retinopathy”) it can cause blindness. Nearly all people with type 1 diabetes show some symptoms of diabetic retinopathy, usually after about 20 years of living with diabetes; approximately 20 to 30 per cent of them develop the advanced form. Those with type 2 diabetes are also at risk.

## S.

**Stem Cells:** The basic cell in the body from which all other cells arise. Scientists believe stem cells could be critical to curing type 1 diabetes and many other devastating diseases. There are three primary types of stem cells: Embryonic Stem Cells, Embryonic Germ Cells and Adult Stem Cells.

Embryonic Stem Cells are isolated from fertilized eggs that are in excess after a couple has used in vitro fertilization (IVF) as a means to reproduce. These cells replicate easily and have the ability to grow into any tissue or organ in the body (yet cannot develop into a full human being).

Embryonic Germ Cells (so-called because they are taken from germline or gamete tissue) are isolated from fetal tissue obtained from terminated pregnancies before the end of the first trimester.

Adult Stem Cells are isolated from a fully developed human after birth. Adult stem cells are found in many tissues of the body, including skin, bone marrow, muscle, brain, and other tissues.

Embryonic germ cells and adult stem cells appear limited in their ability to be replicated in the laboratory, and they have not been shown that they can form every

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tissue and organ in the body. Of the three primary types of stem cells, embryonic stem cells have so far shown the most potential for medical applications, but research is proceeding on all three types.

## T.

**Transplantation:** Transference of a tissue or organ, alive or dead, within an individual, between individuals of the same species, or between individuals of different species.

**Type 1 Diabetes:** (Juvenile or insulin-dependent diabetes.) A disease that occurs when the pancreas stops producing or produces very little insulin. It usually develops before age 30 and is known as an autoimmune disease, because the body's immune system mistakenly attacks and destroys its own beta cells. The warning signs and symptoms of type 1 diabetes are:

- extreme thirst
- frequent urination
- sudden vision change
- fruity, sweet or wine-like odour on breath
- Increased appetite
- sudden weight loss
- drowsiness, lethargy
- heavy, labored breathing
- stupor, unconsciousness

Although the causes of type 1 diabetes are not entirely known, scientists believe the body's own immune system attacks and destroys insulin-producing cells in the pancreas. It is not caused by obesity or by eating excessive sugar, which are two common myths about type 1 diabetes. Both genetics

and environmental "triggers" are being studied as potential causes of type 1 diabetes.

According to William Winter, M.D., a professor at the University of Florida College of Medicine in Gainesville, "At most, only 15 per cent of people with type 1 diabetes have an affected first-degree relative—a sibling, parent, or offspring. Research suggests that genes account for less than half the risk of developing type 1 diabetes. These findings suggest that there are other factors besides genes that influence the development of diabetes."

**Type 2 Diabetes:** (Non-insulin-dependent or adult-onset diabetes.) Usually develops after age 40 but is becoming more prevalent in teens and children. Insulin is present but in reduced amounts, and it is ineffective because the body's cells resist its effects—a condition known as insulin resistance. Signs and symptoms of diabetes include the following:

- unusual thirst
- frequent urination
- weight change (gain or loss)
- extreme fatigue or lack of energy
- blurred vision
- frequent or recurring infections
- cuts and bruises that are slow to heal
- tingling or numbness in the hands or feet
- trouble getting or maintaining an erection

It is important to recognize, however, that many people who have type 2 diabetes may display no symptoms.

**Vascular Disease:** A disease of the blood vessels.