

- Acute vs. Chronic vs. Delayed
 - Acute infections generally develop quickly after an event, typically within days (e.g., soon after a surgery or injury). Delayed infections develop months or even years later but are assumed by their nature to be associated with the original event. Chronic infections are those that recur repeatedly and/or are resistant to standard treatments.
- Alkline Phosphatase (ALP)
 - Alkaline phosphatase is an enzyme that is used by osteoblasts (bone forming cells) to capture calcium and incorporate it into new bone.
- Antibiotic / antimicrobial / antifungal
 - Certain molecules have been found to have the ability to inhibit or even kill microbes. If they kill bacteria, they are generally called antibiotics; if they kill fungi, they are called antifungals; as a general class, they are collectively referred to as antimicrobials.
 - Antibiotics often try to interfere with molecules used by the bacteria during replication. When an error in replication occurs, the cell will then die.
 - Fungi are more like animals in many biological ways, meaning drugs that kill fungi are often quite toxic to animals. Thus, we have fewer options for fungal infections and what we have can often be quite dangerous for the animal if not carefully administered.
 - Bacteria and fungi reproduce very rapidly; some species can go through hundreds of generations in just a few days. This means that evolution occurs very rapidly, and they can quickly develop new genes to resist antimicrobial drugs. This 'antimicrobial resistance' (AMR) is a key factor in today's fight against microbial diseases.
- Bacteria
 - One of three classes of single celled microscopic organisms*. Certain species, given the right situation, can cause disease in humans such as strep throat, bacterial pneumonia, bacterial meningitis, necrotizing fasciitis (aka 'flesh eating bacteria'), implant-associated infections, etc.
 - *The third group, archaea, hasn't been found to include any species able to cause disease in humans, so won't be addressed further here.
- Biofilm
 - A slime-like structure that groups of bacteria and fungi can produce to encapsulate and protect themselves from the environment. Much like a wall around a town, the biofilm can be permeable to certain things and impermeable to others. Again like humans, bacteria and fungi inside the 'walls' generally change their behavior, altering how they interact with their surroundings.
 - Biofilms are generally very resistant to antibiotic treatment, as the EPS provides a protective layer, and the cells inside are often insensitive to the antibiotics.
- Bone Cement
 - A synthetic material used to fill up a cavity or provide mechanical fixation. Artificial joints are sometimes anchored with bone cement, which fills the free

space between the prosthesis and the bone and provides a strong bond between the implant and the patient.

- Bone Mineralization
 - The process by which new bone matrix becomes filled with calcium phosphate nanocrystals, which is necessary for bone to carry mechanical stress and loads.
- Chelation
 - Chelation is a type of bonding of ions and molecules to metal ions, which can be used to remove the metal from the system. It involves the formation of two or more separate bonds between the ion or molecule with the metal ion. This type of bonding can override lower bond energies of metal ions, thus capturing the metal ion.
- Collagen
 - A family of proteins that makes up the main structural protein found in the body's various connective tissues, with roughly 28 unique types of collagen identified to date. Each type serves a unique function in the body. It is the most abundant protein in mammals.
- Diabetic Foot Ulcer (DFU)
 - Diabetic foot ulcers are wounds in the skin associated with complications from diabetes. They can be partial* to full** thickness wounds; advanced cases can penetrate all the way to the bone. Their root cause is diabetes, but important factors include changes in blood flow and nerve function that occur as a result of diabetes. Because the underlying vascular damage can reduce blood access, the wounds don't heal rapidly and are readily colonized by bacteria, creating a very challenging situation to treat.
 - *Involving just some of the surface layers of skin.
 - **Involving all layers of skin down to the muscle and fat beneath.
- Dressing
 - No, this doesn't go on your salad. Wounds—either intentional surgical wounds or accidental traumatic ones—need to be covered to protect them from contamination and further injury. Dressings can achieve this in various ways, including mechanical (a soft fabric dressing such as gauze), hydrologic (a moisture-balancing dressing such as creams and gels), chemical (an antimicrobial-containing dressing) or a combination of a mechanical or hydrologic with a chemical (such as BlastX), or others.
- Extracellular Polymeric Substance (EPS)
 - A mixture of polysaccharides (sugar-like molecules), lipids (fat molecules), proteins, and nucleic acids (DNA and RNA) that makes up the 'slime' component of a biofilm.
 - Every species of microbe uses a slightly different recipe to build its EPS, but all of them rely upon one core principle: long polysaccharide molecules bound together with metal atoms. These metal atoms act like the nails holding a house together, forming a strong and robust structure that is difficult to remove.
- Fungi

- One of three classes of single celled microscopic organisms. Depending upon the species and environment, some fungi are capable of existing in planktonic, biofilm, or multicellular forms (e.g. slime molds, mushrooms, etc.). A few species can cause disease in humans such as vaginal yeast infections, coccidiosis, histoplasmosis, thrush, toenail fungus, ringworm, etc.
- Infection
 - Prions, viruses, bacteria, and fungi can produce transmissible disease in animals, meaning the pathogen ('disease causing') agent or organism can move from one organism to another, replicate in that new host, and then pass to a new host. If the presence of the agent or organism causes the host to develop health complications, then they are considered infected.
- Interdigitation
 - To become interlocked like the fingers of folded hands. In the context of bone cement interlocking with the bone, this is the extent to which the bone cement moves into the porous surface of the bone. Greater interdigitation indicates greater strength of the bond.
- Jet Lavage
 - Orthopedic surgery tends to produce a substantial amount, of debris as the bones are cut, which can interfere with both visibility and fit of the implants. Surgeons often use an electrically powered spray washer to clean the site and remove debris. These devices often provide alternating spray and suction so that they rapidly cycle between spraying out liquid and sucking up the free material. Not all orthopedic surgeons use jet lavage, and for various reasons they are rarely used in other specialties.
- Log Scale
 - Microbial population sizes can vary immensely from tens to billions. In order to manage this vast range of numbers, it is generally easier to present the data in the form of a 'logarithm', meaning a power of ten. Thus, a shift from 1-log to 2-log means a shift from 10 to 100; every jump in a single log represents an entire 10-fold change. When discussing removal or killing of microbes, one can alternatively count the '9s': a 4-log reduction is a 99.99% removal.
- Microbe
 - A collective term for the three branches of microbial life: archaea, bacteria, and fungi. Each group is very different in key biological ways, but each can cause disease and produce biofilms in the right (or wrong) situation.
- Microbial colonization vs infection
 - All animals, including humans, are colonized by microbes. By most measures, every human body contains more microbial cells than human cells; we are giant walking colonies of microbes. In normal circumstances, these microbes are either neutral or helpful. Helpful microbe functions include digesting food, producing essential vitamins, and occupying a biological niche that could otherwise be taken by a harmful microbe. Even potentially harmful microbes can be kept in a 'colonizing' state as long as the immune system, antibiotics, and/or microbial competition keep them from taking over a space.

- When the wrong species gets in the wrong place at the wrong time, their population can start to grow and take over a region. Our immune system then mounts a counterattack which in turn causes inflammation, redness, heat, tenderness, and all the other signs and symptoms of infection.
 - Even potentially harmful microbes can be held in a 'colonizing' state if they stay inside a biofilm and don't emerge back into a planktonic state. Thus, a person can cycle from infected to colonized and back as the microbes, cycle from planktonic to biofilm and back.
- Osmolarity
 - When the concentration of dissolved molecules is different on either side of a barrier such as the membrane of a cell, it generates a pressure gradient across that barrier. Most cell membranes are impermeable to salts and large molecules (such as those used in XBIO™ products), but permeable to water. Just as Nature abhors a vacuum, it also abhors a difference in concentration; thus, if the dissolved molecules can't move, the water will. XBIO™ products contain a higher concentration of materials (acids, buffers, surfactants, etc.) than the inside of a cell, so water tends to flow out of the cell and into the surrounding space. Like a slug and salt, the microbe will shrivel up and die.
- Osteoblasts
 - Cells that synthesize new bone during growth and healing.
- Persister cell
 - Even the best therapy can fail to kill 100% of a microbial colony. If the colony includes millions of cells, then even a 99.9% kill rate could leave thousands of cells behind. These survivors are called persister cells and can lead to recurrence of the infection by rebuilding the population days, weeks, months, or years after treatment.
- pH
 - Various described as 'potential hydrogen', 'power of hydrogen', and other phrases (the original scientist who developed the pH scale was famously vague about the meaning of the abbreviation), pH is a measure of the acidity or alkalinity of a solution. Pure water is considered 'neutral' pH at 7.0, while the body's pH varies quite a bit, from urine (up to pH 8.0) to blood (roughly pH 7.3) to skin (pH 5.5) to stomach acid (pH 1.5).
 - The pH of a solution can alter how other molecules behave, thus changing how well they dissolve into solution and how proteins fold to do their job. By manipulating pH, XBIO™ products optimize the environment to disrupt and dissolve microbes and biofilms.
- Periprosthetic Joint Infection (PJI)
 - Approximately 1% of total joint arthroplasty cases develop a bacterial infection within roughly two years of the procedure. These rare events can have a dramatic impact upon the patient, their family, their insurers, the care team, and the hospital. Five-year mortality rates for PJI are around 20% (worse than several common cancers), and costs to treat the infection can be in excess of \$100,000 per case.

- Planktonic
 - When individual cells float free in their environment and behave as individuals, we refer to them as being in a 'planktonic' mode of life. Most microbes use the planktonic mode to spread themselves through the air, water, blood, etc., seeking out new locations to build a new biofilm colony.
- PMMA
 - Polymethylmethacrylate is the most common bone cement material. It is a self-curing, two component system consisting of liquid and powder components that cure into a solid.
- Surfactant
 - Surfactants are detergent-like molecules that can reduce the surface tension of water and/or allow for non-water soluble molecules to go into solution by binding to them. This can have several useful effects, including dissolving materials in the EPS, disrupting the membrane that encapsulates a microbe, and breaking specialized molecules that microbes use to stick to a surface. In combination, these effects disrupt biofilms, kill microbes, and remove microbes from a host to collectively reduce the microbial colony.
- Surgical Site Infection (SSI)
 - Any breach of the skin risks invasion by outside harmful microbes. Surgeons take extensive pains to reduce the risk of infection, but the environment, the patient's health status, and random luck sometimes lead to an infection at the site of the procedure. Many insurers consider these to be 'never events', i.e. they should never be allowed to happen, and so they place the financial burden for treatment on the hospital that did the original surgery.
- Total Joint Arthroplasty
 - A surgical procedure whereby an orthopedic joint (such as the knee, hip, or shoulder) is replaced by a prosthetic implant. The implants are variously made from metals, plastics, and ceramics to provide a long-lasting joint which restores most motion and relieves joint-related pain (arthritis).
- Venous Leg Ulcer (VLU)
 - Venous leg ulcers are wounds in the skin associated with complications from vascular insufficiency. They can be partial* to full** thickness wounds. Their root cause is damage to the valves inside veins, leading to pooling of blood in the lower leg and a reduction in local circulation. The wounds don't heal rapidly and are readily colonized by bacteria, creating a very challenging situation to treat.
 - *Involving just some of the surface layers of skin.
 - **Involving all layers of skin down to the muscle and fat beneath.
- XBIO™
 - XBIO™ refers to a family of technologies and products that aim to prevent, mitigate, or treat bacterial and fungal infections without conventional drugs. The products utilize chemical and physical means to break up biofilms, kill microbes, and remove microbes from surfaces (human or otherwise).