## **Introduction**

Humans are thought to be able to accomplish anything as long as they work together. They put a man on the moon, cloned animals, mapped the human genome, and even sent a rocket to Mars. However, there are still many mysterious things that humans cannot comprehend or figure out. The Ebola virus, Mad cow disease, Foot and hands disease, and HIV are a few diseases and viral infections that scientists cannot solve. Ebola is known to have a 88% fatality rate in Zaire and 55% fatality rate in Sudan. Those are very frightening statistics. Even though we are in the midst of scientific advancement, there are still some things that we cannot figure out. No matter how hard we humans try, we cannot rid the world of viruses or bacterium that cause illnesses in humans. But, as long as we are here on this planet, we will always try to find a cure in order to save an individual’s life.

## **OUR BACTERIA: Bacillus cereus**

## Bacillus Cereus is known to cause two distinct types of illnesses: one, a diarrheal illness with an incubation time of approximately 4 to 16 hours, and two, a vomiting illness with an incubation time of approximately 1 to 5 hours. Incubation is the time it takes for the bacteria to take effect. The vomiting illness strains are often associated with rice and other starchy food. The diarrhea illness is commonly associated with meats, fish, and vegetable. Symptoms can last up to 24 hours. It’s widely distributed in nature and in foods, and commonly found in soil, milk, cereal, starch, meat, and vegetable produces. Foods most often implicated in outbreaks include meats, pie, and fried rice (Bacillus Cereus, #19). All people are believed to be susceptible, or vulnerable, to Bacillus Cereus (so watch out!). Bacillus Cereus hasn’t been thought to be life-threatening until recently; there have been a strain of Bacillus Cereus able to produce enough toxin to cause liver failure. This prokaryote is so widespread, that it’s very difficult to keep it from contaminating food. Bacillus Cereus is able to produce spores that can survive dryness and mild heat treatments, such as cooking. Freshly cooked food eaten hot, and immediately after cooking is safe. Steaming under pressure, roasting, frying, and grilling are most likely to destroy the bacillus cell and it’s spores. However, temperatures under 212 F will allow the survival of some spores (Bacillus Cereus, #19).

## **SULFUR: History**

In 2000 B.C., sulfur was used to bleach cotton and linen. Egyptian paintings as early as 1600 B.C. contained sulfur derived colors. We can conclude from this that sulfur has been used by people in their daily lives. Sulfur is referred to brimstone in the Bible and is the fuel in the fires of Hades. Sulfur was also used as a disinfectant in the time of Homer. It wasn’t recognized as an element until the 1800’s (Watt #1).

**SULFUR: Scientific Information**

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| --- | --- | --- | --- |
| **NAME** | Sulfur | **GROUP #** | 16 |
| **SYMBOL** | S | **GROUP NAME** | Chalcogen |
| **ATOMIC WT** | 32.066 | **PERIOD #** | 3 |
| **ATOMIC #** | 16 | **BLOCK** | p-block |

Sulfur is essential in all life forms including microorganisms, plants, and animals. It is a minor constitute of fats, body fluids, and skeletal minerals. Pure sulfur is tasteless, odorless, brittle-solid, that is pale yellow. It is a poor conductor of electricity and is insoluble in water. Sulfur exists in several different forms. The two most important are orthorhombic and moncilice crystalline modifications. Sulfur burns easily and gives a blue flame and pungent fumes. It is known as an allotropic element and is a solid non-metal. Sulfur makes up 0.06% of the Lithosphere and 0.09% of water in the sea (Britannica, #5). Organic sulfur is a component of many living things; cabbages, turnips, mustard greens, onions and garlic are all high on sulfur (Lam, #11). Large amounts of the element associated with volcanic vents that are found in Japan and Chile. Smaller deposits are found in hot springs such as the Mammoth Hot Springs in Yellowstone Park. It is not normally necessary to make sulfur in a laboratory because it’s so readily available. It is found as a native element in nature and is extracted by the Frach process. This means that sulfur can be extracted from underground without mining for it. In the Frach process, the underground deposits are forced to the surface using super heated water and steam and compressed air. Purity of sulfur can reach up to 99.5% and the process is energy exhaustive (Watt, #1). Sulfur Dioxide is a dangerous component in atmospheric pollution and is one of the factors that cause acid rain (Encarta, #8).

## **WHAT IS AN ANTIBACTERIAL?**

The ideal antibacterial compound displays a selective toxicity. This means that it is harmful to the microbe (bacteria or virus) without being harmful to the host (you). In reality, many antibacterials have a relative toxicity. Antimicrobial is a broader category that includes anti-fungal, anti-viral, anti-protozoal, or anti-bacterial compounds.

Antibacterial specifically act against bacterial cells (What is an Antibiotic?, #15). The actual mechanism of anti-bacterial components is not always known. In general term, most of these drugs act by altering or inhibiting one of the following structures or processes:

* cell wall synthesis
* permeability of the cell membrane
* protein synthesis
* nucleic acid synthesis

## **BENTGRASS**

Bentgrass (Agrostis) is a large genus with over 100 species. It flourishes throughout the New England states and the Pacific Northwest, where climate conditions are ideal for bentgrass. This species of grasses are primarily used for lawns, athletic fields and golf courses. This grass is common in Europe and Asia as it is commonly found in lawns, pastures, and sports fields (Agrostis #20).

## **BENTGRASS: Creeping Bentgrass Description**

Creeping Bentgrass (*Agrostis palustris*) is a cold season grass that forms a dense mat. The grass spreads to profuse creeping stems and possesses rather vigorous shadow roots. Stems (stolons) are creeping and slender, and produce long, narrow leafs. Leaf blades are smooth on the upper surface and rigid on the underside, 1 – 3 mm wide and bluish green in appearance. The ligule is long, membranous, finely toothed, or entire and rounded, auricles are absent. The species are characterized by single, flowered, spikelets in a compact panicle. The panicle in flower is purple to bronze in appearance. Seeds of creeping bentgrass are too small to be identified without a magnifying glass. Seeds are oval in shape and less than 1 mm long. They are usually silver in appearance (Bentgrass, #18).

## **BENTGRASS: Spiked Bentgrass Description**

Spiked Bentgrass (*Agrostis exarata*) has many forms. Some are tall, some are short, but ordinarily, they are usually 30-60 cm tall. They have flat blades, which are always dense, but vary in length and thickness. They are native on rather moist soil, and in various habitats and plan associations. This grass is perhaps best developed in the mountains and along the north coast. The species, with it’s many forms, occurs throughout the western half of the U.S. as far north as Canada and Alaska, and as far south into Mexico. Spike bentgrass is particularly abundant along streams, in or about meadows, moist slopes, or moist clearings in the forest. The green foliage and soft seed head are used by grazing animals in the mountains during most of the summer. Though excessive or too close grazing may drastically reduce the density of the grass. On disturbed soils, the grass soon forms a good stand, but over many years, diminishes because of competition between other plants (Bentgrass, #18).

## **BENTGRASS: Pacific Bentgrass**

Pacific Bentgrass (*Agrostis avenacea*) can get to 30-60 cm tall. The blades can be 3 to 8 mm wide. It tends to behave as a tumble weed. Introduced from Australia, naturalized mostly in the central valley, but extending into the surrounding foothills, delta region, and around the San Francisco Bay. Pacific Bentgrass occurs abundantly in old rice fields or pastures or marshlands. By late spring, it has widely dispersed its airy wind transported panicles, while pile up in ditches and fences conspicuously (Agrostis, #20).

## **BENTGRASS: Adaptation and Use**

Bentgrass is adapted to cool, humid environments such as those found in the northeastern United States. Cold, nighttime temperatures are particularly advantageous to bentgrass. In the south, high daytime temperatures together with warm, nighttime temperatures create highly adverse conditions for bentgrass. During the summer months in the south, carbohydrate reserves are depleted in bentgrass and the turf becomes susceptible to additional stress: drought, shade, insects, or disease. As a result, the only use of bentgrass in the south is for golf greens, where small acreage allows for intense management. In the south, bentgrass is best adapted to the transition zone where cooler temperatures prevail (Agrostis, #20). But even in this area, special attention needs to be given for soil preparation, water management, air circulation, shade, exposure, and other factors.

## **BENTGRASS: Preparation**

In the case of bentgrass, particular attention needs to be given to seed bed preparation. Well drained soil mixtures are essential for growing bentgrass in the south. Highly permeable mixtures of sand and organic adjustments placed over a drainage system are commonly used for a bentgrass green. Frequent fertilization is helpful to establish a cover of bentgrass. Early fall is the best time to see bentgrass. Spring planting dates do not allow adequate growing time for plants to mature prior to summer stress.

## **BENTGRASS: Management**

Management and frequent observation are keys to the success of bentgrass. Watering, fertilization, mowing, cultivation, and pests must be closely managed to keep the bentgrass green. Water must be closely managed to meet the moisture needs of the grass. Water also serves to monitor the temperature during heat stressed periods. To control insect and disease level, frequent surveillance needs to take place. If worms and crickets are found, the grass needs to be treated immediately (Agrostis, #20).