The Chemical Company
19 Narragansett Avenue
Jamestown, RI 02835
Phone: (401) 423- 3100

About Urea

History
French chemist Hillaire Rouelle discovered **Urea** in 1773. In 1828, just 55 years after its discovery, **Urea** became the first organic compound to be synthetically formulated, this time by a German chemist named Friedrich Wöhler, one of the pioneers of organic chemistry. Wöhler obtained **Urea** by treating silver isocyanate with ammonium chloride in a failed attempt to prepare ammonium cyanate.

Synthetic **Urea** is created from synthetic ammonia and carbon dioxide and can be produced as a liquid or a solid. The process of dehydrating ammonium carbamate under conditions of high heat and pressure to produce **Urea** was first implemented in 1870 and is still in use today. Uses of synthetic **Urea** are numerous and therefore production is high. Approximately one million pounds of **Urea** is manufactured in the United States alone each year, most of it used in fertilizers. Nitrogen in **Urea** makes it water soluble, a highly desired property in this application.

Urea was found to be useful for commercial and industrial applications in the production of some types of plastics, animal feed, glues, toilet bowl cleaners, dish washing machine detergents, hair coloring products, pesticides, and fungicides. Medicinally, it is incorporated in the manufacture of barbiturates, dermatological products that re-hydrate the skin, and diuretics.

Urea is naturally produced when the liver breaks down protein or amino acids, and ammonia. The kidneys then transfer the **Urea** from the blood to the urine. Extra nitrogen is expelled from the body through **Urea**, and because it is extremely soluble, it is a very efficient process. The average person excretes about 30 grams of **Urea** a day, mostly through urine, but a small amount is also secreted in perspiration.

Physicians found that **Urea** levels can be used to detect diseases and disorders that affect the kidneys, such as acute kidney failure or end-stage renal disease (ESRD). The blood **Urea** nitrogen (BUN) and the urine **Urea** nitrogen (UUN) tests, which measure **Urea** nitrogen levels in the blood and urine, are often used to assess how well a patient's kidneys are functioning. Increased or decreased **Urea** levels, however, do not always indicate kidney problems, but instead may reflect dehydration or increased protein intake.

Physiology
Urea is synthesized in the body of many organisms as part of the **Urea** cycle, either from the oxidation of amino acids or from ammonia. In this cycle, amino groups donated by ammonia and L-aspartate are converted to **Urea**, while L-ornithine, citrulline, L-argininosuccinate, and L-arginine act as intermediates. **Urea** production occurs in the liver and is regulated by N-acetylglutamate. **Urea** is found dissolved in blood (in the reference range of 2.5 to 7.5 mmol/liter) and is excreted by the kidney as a component of urine. In addition, a small amount of **Urea** is excreted (along with sodium chloride and water) in sweat.

Aminoacids from ingested food which are not used for the synthesis of proteins and other biological substances are oxidized by the body as an alternative source of energy and yielding **Urea** and carbon dioxide. The oxidation pathway starts with the removal of the amino group by a transaminase, the amino group is then fed into the **Urea** cycle.

Ammonia (NH_3) is another common byproduct of the metabolism of nitrogenous compounds. Ammonia molecules are smaller, more volatile and more mobile than **Urea**'s. If allowed to accumulate, ammonia would raise the pH in cells to toxic levels. Therefore many organisms convert ammonia to **Urea**, even though this synthesis has a net energy cost. Being practically neutral and highly soluble in water, **Urea** is a safe vehicle for the body to transport and excrete excess nitrogen.