A Look Inside

By Shawn Stevenson

In this modern age each of us is consumed with the multiple routines that make up our day. How much of a role does the microscopic world play in everyday life? When we are not feeling well it can affect our productivity and attitude. Does this change occur on a conscious level or is it a chemical reaction changing body processes just slightly? Our chemical make-up can determine the quality of life that we lead based on several factors including: sensitivity to certain foods, allergies, and the need for prescription drugs. In previous articles the discussions have been geared to the world around us and even different worlds in the vastness of space. This topic of discussion will differ since the places we will explore cannot be seen with the naked eye.

Each of has a unique signature within our body, it determines who we are and what we are to a certain extent. The level that chemistry determines who we are might be considered too personal and puzzling to classify scientifically. But in 1953 a piece of this puzzle was answered by scientists Watson and Crick. They determined the shape of (dioxyribose-nucleic-acid) DNA. The realization was also established that DNA is the pipeline by which people and animals carried genetic information to the next generation at a chemical level. Now over fifty–plus years later the acronym seems to be more of a catch phrase in primetime television than a huge genetic achievement. One underlying common factor in human chemical processes and DNA is water. Its necessary presence within the body can now be broken down to the smallest of building blocks.

Among all these hi-tech analogies and in-depth analyses there lies an aspect of our health that most of us do not consciously note but infrequently. This usually occurs when we are contemplating that huge plate of chili fries or a platter of jalapeño poppers and what effect it might have on our innards as well as our cholesterol level. The truth of the matter is that what we eat or drink causes a seemingly endless list of chemical reactions.

As water system purveyors you are privy to knowledge of several chemical reactions for the treatment of raw water sources. If you think about it, one perspective is that the water itself is inert despite treatment. In other words the water itself is not the concern; how it affects the consumer when ingested within their bodies is ultimately the issue. This may seem obvious but the reactions that happen within the body based upon chemicals or constituents within water can potentially cause drastic health issues with only the most subtle signs in your customers.

Your profession dictates through its many regulations which elements and constituents require treatment and subsequent periodic testing. This is based upon a general perception of public health. But aside from knowing that it is just plain bad, how much do we really know about these elements? Do we really consider how the human body reacts to some of these primary offenders? The purpose of this discussion is not to promote or refute regulations just offer an alternative perspective.

One such element of concern is Arsenic; it has been a topic of discussion at the federal level for some time and was put into regulation earlier this year. The EPA has set the arsenic standard for drinking water at .010 parts per million which equates to 10 parts per billion *(www.epa.gov, 2006).* Arsenic in ground water is largely the result of minerals dissolving from weathered rocks and soils thereby limiting foreseeable avoidance.

Until the 1940s, arsenicals were widely used in the treatment of various diseases such as syphilis and psoriasis. Arsenicals are still used as anti-parasitic agents in African countries *[Agency of Toxic Substances and Disease Registr (ATSDSR), 2006].* According to the ATSDSR most Americans ingest very limited amounts of Arsenic through food, primarily poultry and fish. After absorption through the lungs or gastrointestinal (GI) tract, arsenic initially accumulates in the liver, spleen, kidney, lungs, and GI tract *(ATSDSR, 2006).* When exposed to low levels the body processes the element within the liver to less toxic metabolites. This is done through oxidation and reduction reactions. Then the kidneys excrete low levels through the urine at a fairly rapid pace.

However, at higher levels of exposure in terms of potency or a longer timeframe the liver and kidneys can be overburdened and unable to rid the body of the toxin completely which can lead to adverse

health affects. Many of the initial symptoms can be flu-like (nausea, vomiting; diarrhea) with long term symptoms including non-cancer effects such as thickening and discoloration of the skin, stomach pain, numbness in hands and feet; partial paralysis; and blindness. Arsenic has also been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate *(EPA, 2006).*

To aid local planning and preparation for problem areas, the United States Geologic Survey (USGS) has developed maps that show where and to what extent arsenic occurs in ground water across the country. The current maps are based on samples from 31,350 wells. Widespread high concentrations were found in the West, the Midwest, and the Northeast areas of the country *(USGS, 2006).*

Another common contaminant that plagues many parts of Oregon and the United States, as a whole is Nitrate/Nitrite. What exactly is Nitrate? Nitrate N03 is an inorganic compound that can be found in several ways within the environment, both naturally and synthetically. Nitrite (NO2) can be formed from nitrate by a chemical process called reduction. Nitrate does not normally cause health problems unless it is reduced to nitrite *(M. McCasland, N. Trautmann, and K. Porter, Cornell University).*

The most common sources of nitrate are wastewaters, landfills, animal feed lots/dairies, and septic systems. Other sources are runoff or leaching from manure or fertilized agricultural land and urban drainage. Human exposure to nitrates occurs primarily through the diet because nitrate is a natural substance found in both water and plants. In the United States, the average dietary intake of nitrate is about 75 to 100 mg. per day. About 80 to 90 percent of this amount comes from vegetables. Some common vegetables with high nitrate content are beets, celery, lettuce, and spinach. People following a vegetarian diet may have nitrate intakes of up to 250 mg. per day *(MSU Extension, Ext Bulletin WQ-19, 1993).*

When nitrate is ingested, bacteria in the mouth convert the nitrate in saliva into nitrite, producing an average of about 10 mg/day. Nitrite, itself, can be ingested by consuming cured meats such as bacon and luncheon meats. Since ingested nitrate is the major source of nitrite in the body, high levels of nitrate in drinking water are generally responsible for high levels of nitrite in the body. Nitrate intake depends on a variety of factors, including diet, and amount and quality of water consumed. ***Genetic factors*** also lead to different rates of conversion of nitrate to nitrite. As a result, people show great variability in nitrate and nitrite levels in their bodies *(MSU Extension, Ext Bulletin WQ-19, 1993).*

The primary concerns for nitrate ingestion are for infants and pregnant mothers. Within the body with high amounts nitrite cause the oxygen carrying hemoglobin is converted to methoglobin. Thereby not providing vital body parts with the necessary oxygen levels, without a remedy, the end results can range from brain damage or death. This is commonly referred as Blue-Baby Syndrome. Adults with limited stomach acid or digestive problems are also more prone along with infants based upon their limited digestive development.

The majority of nitrate contamination comes from non-point source pollution. A non-point source makes putting your finger on the direct cause of contamination for a certain area nearly impossible. The sources need to be addressed as a whole, making plans for reduction cumbersome and usually large scale.

We have examined only two of the many elements that are associated with drinking water. As society grows, the variety of people and specific traits will increase, thereby making the scope of modern health concerns broader with time. With so many new issues on the horizon, the future will most assuredly hold some further inclusions for chemical testing.

The inner workings of the body are complex and many things will remain a mystery for future scientists to unlock. Our internal individual make-up determines how our bodies react to certain chemicals, viruses, and constituents we either ingest or are exposed to. The body's symptoms and reactions can vary across the board. So in this regard we each are our own person. An inward look at oneself can provide insight on several levels whether it is chemical or something else. There is more to each of us than meets the eye!