

## **Information on E coli**

### **What does E.coli mean?**

E. coli is the abbreviated name of the bacterium in the Family Enterobacteriaceae named Escherichia (Genus) coli (Species).

In fact, it is for this reason that the organisms which happily inhabit the intestinal tract as normal flora are named enteric bacteria. The Family to which E. coli belongs

(Enterobacteriaceae, is so named because of the Greek word enterikos - which pertains to the intestine. The name Escherichia comes from the name of the person Escherich, who in 1885 first isolated and characterised this bacterium.

### **Is E.coli bacteria OK.**

You are correct, for the most part. The presence of E. coli and other kinds of bacteria within our intestines is necessary for us to develop and operate properly, and for us to remain healthy - E. coli, along with other species of bacteria, provide us with many necessary vitamins for example. The bacteria make the vitamins, and we gladly absorb them. We pretty much depend upon E. coli in our intestines for our source of Vitamin K and B-complex vitamins.

The fetus of any animal is completely sterile. Immediately after birth however, the new-born acquires all kinds of different bacteria which live symbiotically (we help them to live, and they help us to live) with the new-born and throughout the individual's life. From the day we are born, we are never without bacteria. However, the helpful bacteria like these are located "only" in regions of our body directly exposed to the environment, e.g., our intestines, upper and lower respiratory tract, etc and never within our bloodstream or the tissues inside our body. Sounds weird, but, it's true - billions of these little critters chugging away, making things we need, helping to digest our food.

### **So, when are E.coli bacteria bad for us?**

Truly, you have billions of "friends" that you never knew you had. So, "What's the big deal about E. coli?" you ask with a puzzled expression on your face. Well, now I need to talk about the "bad guys." Bacteria are somewhat like humans in that certain individual humans are not very nice - and we know that some individual humans can be downright dangerous. Of course all humans belong to the Genus/Species Homo sapiens, and all E. coli belong to, well, Escherichia coli. So, as there exist individual humans, so too can different individuals exist among E. coli bacteria - we call such individuals a different "strain" of bacteria within a given species. Some of these different strains of bacteria (there may be several within a given species) can be harmful to us. Each of us - given the assumption that a human is reading this information - is sort of a strain of the human species, sapiens. We are different because we are genetically different, e.g., unless we are one member of an identical twin pair, the combination of genes each of us possess is different from every other human on the face of the earth - or arm of the earth for that matter. If

you think about it a little bit, there are only about 5-billion (is that about right?) humans who are alive on the earth - there are probably that many bacteria in your intestine alone - don't worry - they don't take up much room.... So, it is possible for us to acquire an individual strain of E. coli which mixes with the other E. coli in our intestines. Now, since an individual strain of E. coli may exist, this situation means that this particular strain of E. coli is genetically different than the vast majority of E. coli in our intestines; otherwise, it would not be a different strain of this organism. If this E. coli strain happens to have genetic information for producing something harmful to us, then, we may be in trouble.

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### **What is and who "is" the bad guy?**

The rare strain of E. coli that is E. coli O157:H7, a member of the EHEC - enterohemorrhagic E. coli group. Enterohemorrhagic means an intestinally-related (here we are at the Greek word enterikos again) organism which causes haemorrhaging - and therefore, loss of blood. The image shown below is a picture of an electron microscope visualisation (an electron micrograph) of O157:H7 (David Graham, University of Illinois at Urbana/Champaign).

### **How then do we "pick up" this organism?**

Basically, here is the problem: E.coli bacteria are everywhere in the environment. But, since they are such a common occupant of all animals, anytime we eat something, drink something, or touch our hands to something that has been either a part of or has been near where animals are, there is always the potential to ingest these bacteria - is a good reason for washing your hands.

### **How did this strain of E. coli come to be.**

Since bacterial cells are all over the place, it is possible for them to acquire genetic information from other sources (bacterial viruses, plasmids, or just naked pieces of DNA floating around and about) - bacteria are "pretty good" at this - this information has nothing to do with the original genetic information necessary for the survival of the bacterium - although in some cases, acquisition of this information may provide an advantage for survival. In the case of E.coli O157:H7, a long-ago cell appears to have been infected with a bacterial virus. This particular virus had the ability to insert its own DNA into the bacteria's chromosome without harming the bacterium - and to remain there. Now, every time this bacterial cell divided, the virus DNA, being now a part of the bacterial DNA, was passed on to every daughter cell - and now, we have the E.coli strain, O157:H7.... This virus's genetic information (genes) unfortunately (for us) contained information for the production of a toxin, called Shiga-like toxin (SLT), or is sometimes called, Vero toxin. Consequently, this strain of E.coli, and all of its progeny produce this toxin.

The toxin is a protein which causes severe damage to intestinal epithelial cells (the cells that line the wall of the intestine). The damage is so severe that if we acquire this bacterial strain, not only do we lose water and salts, blood vessels are damaged, and bleeding occurs - lots of bleeding - haemorrhaging. This condition is particularly dangerous to small children - may be lethal - children are too small to tolerate much blood and fluid loss. It is for this reason that small children should not be allowed to become dehydrated, even in mild cases of diarrhoea. Too, in some cases another syndrome is involved which is called hemolytic uremic syndrome (HUS), which is characterised by kidney failure and loss of red blood cells. Approximately 5% to 10% of little kids progress to this stage of disease - which is very dangerous for them. In severe cases, the disease can cause permanent kidney damage. The presence of this bacterium can also be very dangerous to the elderly or infirm. There can be a combination of HUS and some other things which involve the blood system, which can be lethal to the elderly in 50% of the cases.

### **How long does it take for any symptoms to appear?**

There are many things which may influence the onset of symptoms for this particular disease. Symptoms may appear within hours or may appear only after several days. It is for this reason that if diarrhoea occurs, one should examine the stool for blood, and pay attention to any other symptoms which may occur, particularly if the person affected is a young child, is elderly, or is infirm in any way. The following are some of the things which can influence the time it takes for symptoms to occur:

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1: The actual number of organisms ingested - the higher the number ingested, the sooner the possibility for symptoms (the relatively greater concentration of toxin made).

2: The health status of the individual - the weaker or less healthy, the sooner the possibility for symptoms.

3: The individual's natural resistance to either (a) the growth of the organism within the intestine, or (b) the effect of the toxin itself. Different people may respond differently.

4: Usually, the disease is self-resolving (means that the disease clears "on its own") within about 8 days or so. However, as stated above, if any blood appears in the stool, or if watery diarrhoea appears in an infant or a small child, one should immediately contact one's physician and describe the symptoms as accurately as possible. Whether or not E. coli O157:H7 is involved, diarrhoea for any reason in a small child can potentially be dangerous - so - discuss the symptoms with your doctor if you are the least bit concerned.

### **How can you reduce the risk of infection from E.coli O157:H7?**

1: Always clean any surface that has come in contact with raw meat, before any other item is placed on that surface.

2: Always thoroughly wash your hands after handling raw meat, and before you handle any other utensils or other food items.

3: Never use the same plate, tray or utensils for the cooked meat that you use for the raw meat - unless you thoroughly wash the plate, tray or utensils

4: Always cook meat, especially ground meat, until the juices run absolutely clear - pink is not good enough. In fact, it is necessary for the internal temperature of a hamburger pattie to reach 160 degrees F to kill all of any contaminating E. coli.

5: In day-care centres, schools, etc., any small children with diarrhoea should be carefully handled, and kept separate from all well children. All nappies, and any soiled clothing should be kept separate from all well children. The day-care worker, teacher, and health-care personnel should practice strict hygiene at all times, regardless of the health of the children.

The best advice is to of course sensible about all of this realise that there is always a risk and simply take common-sense actions to minimise the risk.

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**[NB: The above is a guide only and is for information purposes only. You should consult your own doctor for medical advice.]**