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**DO METALWORKING FLUID MICROBES
CAUSE INFECTIOUS DISEASE?**

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It is a sad fact that unproved rumors concerning the possibility that infectious or communicable disease spread via the vehicle of contaminated metalworking fluids has been perpetrated primarily by people who either do not know the facts or who choose to ignore them. Let us examine the facts as they do exist in the literature.

How do we determine the causative agent of an infectious disease? The time-honored procedure is to try to satisfy what are known as Koch's Postulates, a series of statements by a pioneer microbiologist of the 19th century who, in attempting to prove the germ theory of disease, laid out certain guidelines that now bear his name. Essentially, these state:

1. The organism reputed to cause the disease must be found on the individuals having the disease.
2. They must not be found on individuals not having the disease.
3. They must be grown independently by themselves in the laboratory, i.e. isolated from their environment in pure cultures.
4. They must prove infectious for some laboratory animal.

We have long since recognized that the germ theory of disease is a reality and more frequently than not we ignore most of the above postulates. However, in order to prove that a particular organism(s) or environments are responsible for infectious disease, there must be a proven case of infectious disease. To my knowledge, i.e. from a very good appreciation of the published literature, I know of no documented case of infection caused by organisms from metalworking fluid. In fact, from an article by Key, et al.(1) (Dr. Key is past director of NIOSH), I give you the following quotation:

"The belief that bacteria present in cutting fluids is an important cause of skin disease has no basis in fact."
This was also emphasized in a review article by Gellin(2).

Unfortunately, unsubstantiated statements in some references(3) suggest that some bacteria known as pathogens can cause infection. Let us examine what the probabilities are by differentiating between what is possible and what is fact.

Can infection or contagious disease be spread via metalworking fluid vehicles? On an **experimental** basis, the answer must be "yes".

In an earlier publication, Bennett and Wheeler(4) studied the **survival** of a number of species of bacteria, including some species that are associated with infectious disease (e.g. the microbe of typhoid fever, **Salmonella typhi**). Let me emphasize, however, that these organisms were grown in the laboratory and were added to the metalworking fluid in the laboratory. Some of the disease-producing organisms survived in the metalworking fluids; others did not. These organisms were originally isolated from field samples of metalworking fluid using heroic measures, e.g. centrifuging large volumes of metalworking fluid and using highly selective media to pick up small numbers of these organisms. Let me emphasize that there were no reported cases of infectious disease in the sources from which these organisms came. In the laboratory handling of large numbers of **Salmonella typhi** organisms in the experimentally infected fluid, however, Dr. Bennett's student and co-author contracted typhoid fever.

Thus, the possibility exists. What is the probability?

When asked by my students if it is possible to get gonorrhea from a toilet seat, my answer is "Yes, if someone is sitting on your lap." This may sound facetious, but considering the data — 99% of venereal disease is from sexual intercourse; 1% are liars — we can be facetious. We can also be facetious about infectious disease from metalworking fluids.

Again, what are the possibilities?

In several articles (5), (6), (7) the improbability of pathogen survival in the presence of large numbers of non-pathogens has been established. The fact that non-pathogens can coexist with pathogens does not tell the whole story. Numerically the non-pathogens overwhelm the pathogenic or disease-producing bacteria. In addition, it was also found that **Staphylococci**, which are normally associated with skin and the respiratory tract of human beings and also with very common skin infections, survive very poorly in metalworking fluids and their survival rate is directly proportional to their ability to produce disease, i.e. the more infectious the poorer the survival. Again, heroic measures were used to isolate these organisms from metalworking fluids.

What about coliforms, which in some cases are used as a measure of fecal pollution and as an indication of potential danger?

The coliform group of organisms is widespread and only reflects the ability of a certain group of organisms to use milk sugar as a medium for growth. Some of these are normal inhabitants of the large intestine of man and other animals. Some are found in soil and some on plants. They grow under a variety of conditions and their presence in metalworking fluids has no bearing whatsoever on their relationship to use in public health practices.

It is obvious that if attempts were made to establish the origin of some of these coliform organisms some indeed would be of fecal origin. The use of metalworking fluid sumps as a latrine of last resort is a well known fact. However, in spite of their presence and in spite of their survival in aerosols (8), again, there is no indication in occupational health records on reported illness of any respiratory infection traceable to these fluids.

Coliforms as agents of deterioration have been emphasized (9) and de-emphasized (10). Their detection as a group without verification of their specific type only leaves an impression that is too frequently misunderstood, i.e. coliforms mean fecal contamination, and fecal contamination means disease.

What about the other aspect of disease and microorganisms, that is, the **bugaboo** of dermatitis?

Again, there is no published evidence that microorganisms can or do cause "dermatitis," which literally means inflammation of the skin. Only one study to my knowledge has been published to challenge this assumption(11). These researchers actually used patches saturated with microbe-containing metalworking fluid and placed them on members of both the white - and blue-collar work force. This was done in New Process Gear in Syracuse, New York. It was rather an extensive study, but it proved to be negative in terms of bacterial effects resulting in dermatitis.

What can cause dermatitis indirectly from microbes is the injudicious use of antimicrobial agents(12). Either they are used at too high a concentration, obviating instructions from the manufacturers of the antimicrobial agents, or they are used with some members of the work force with known hypersensitivity. Such a report is in the literature(13). in which a well known biocide was proven to be a sensitizer for a small number of individuals. This is a unique report since it is documented with scientific evidence. However, there are a number of other antimicrobial agents that have also been labeled as sensitizers for selected members of the work force.

In closing, to state categorically that metalworking fluids containing microorganisms are not capable of causing infectious disease would be unscientific; however, to state categorically that in spite of the presence of some well known infectious disease organisms in metalworking fluids, no infectious disease has been reported, is good scientific behavior.

Do not be among that large group that can be categorized by the following quotation: "My mind is made up. Don't confuse me with the facts."

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