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How to reduce health costs

Diagnostic instruments recently developed show the vast potential of non-military uses of advanced laser technology.

In yet another demonstration of the spin-offs which can be expected from the development of directed energy technologies, Los Alamos National Laboratory recently announced the development of two new laboratory instruments to rapidly detect many dangerous diseases. One instrument will identify viruses in a few minutes, rather than the two to 14 days currently required; the other will identify bacteria in less than an hour, rather than the one or more days using conventional methods.

The potential of this technology is enormous. Clinical microbiology laboratories in the United States generate some $30 million per week in the process of isolating and identifying micro-organisms—viruses, bacteria, fungi, and protozoa—from patients suspected or known to be suffering from an infectious disease. Infectious diseases are still a leading cause of death and disability in this country, as well as in the developing sector.

In this context, current microbiology laboratories do not provide information on which initial treatment decisions are based, but rather, retrospectively, confirm or deny an initial clinical impression. Ideally, microbiology should provide at least a tentative identification of an infecting organism before treatment is started. These new instruments provide the possibility of attaining that ideal.

A clinical microbiologist, quoted in a paper published by the Los Alamos scientists, stated the problem succinctly: "It is quite proper to question the relevance of clinical microbiology when the clinician must rely on an educated guess—to intercede effectively during the crucial early hours of disease manifestations."

Present methods of identifying micro-organisms rely either on growing the organisms in culture, which may take days to weeks, inspecting stained specimens microscopically, or using various immunological techniques which require an hour or so to perform. These tests are primarily useful for bacteria, protozoa, and fungi. Very few laboratories, about 4% of approximately 12,000 in the United States, are equipped to do virus isolation, even though viruses account for a large volume of maladies, from the common cold and various diarrheas to such devastating and lethal diseases as AIDS and *Herpes encepalitis*.

Herpes encephalitis can kill up to 70% of infected individuals and leave survivors with serious brain damage. Prompt treatment with drugs effective against herpes can reduce mortality by 50%, but the disease is difficult to diagnose without rapid identification of the virus.

Unlike the standard laboratory methods listed above, the Los Alamos instruments measure the scattering of left- and right-polarized laser light by the micro-organisms. This technique, called circular intensity differential scattering (CIDS), requires about 4 minutes to obtain a spectral signature which is specific for each organism.

About 7% of bacterial infections are polymicrobic, i.e., caused by more than one organism, and these infections have a worse prognosis (probable outcome) than infections with a single organism. To apply the CIDS technique to specimens containing more than one organism, the Los Alamos scientists plan to couple the CIDS spectrometer to another device called a flow cytometer.

The flow cytometer is another instrument developed at Los Alamos for rapid analysis and sorting of cells. In the instrument, cells, or micro-organisms, are passed rapidly through a light source and their spectra are read individually. The spectra are then stored in a computer during the run, and at the completion of the test, a report of the type and percentage of each organism is available to the physician. One area in which this technique has great potential is the detection of the virus responsible for AIDS (Acquired Immune Deficiency Syndrome) in donated blood. The present tests being developed for this actually detect antibodies to the virus, but the significance of this result is unclear since, in some cases, it indicates an active infection and, in others, immunity to the virus. In the latter case, transfusion of such blood might actually enhance resistance to AIDS. But in the former case, presence of the virus itself in a unit of blood is an absolute reason not to use the blood and provides the basis for possible early treatment for the donor, which could lead to a cure.

The major significance of these instruments, however, is that they give but an inkling of the non-military technological spin-offs that will be generated from a mobilization to develop directed energy weapons, such as lasers, for strategic defense.