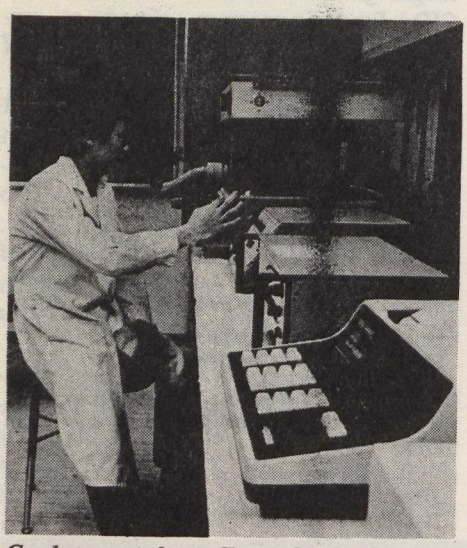
Simple test to detect intestinal cancer cut from hours to seconds

The occurrence of cancer of the intestine, one of North America's most common cancers, could probably be cut down if methods to measure bile acid concentrations clinically could be made less expensive and more accessible.

The recent discovery of a rapid method of separating and quantitating bile acids by Dr. Karl Blass and his associates at the University of Regina provides a piece in the jigsaw puzzle which will eventually lead to an inexpensive method of analyzing blood samples for individual bile acid concentrations.



Graduate student Chung-Shun Ho operates a spectrofluorometer. A new process which he helped develop cuts bile acid testing down from several hours to as little as five seconds.

Individual bile acids are so similar in molecular structure that up to now purification and separation of them has meant a complex process that takes up to several days to accomplish.

Bile acids are essential for the digestion and absorption of fat in the intestine, but certain ones, notably Deoxycholic Acid (DOC) and Lithocholic Acid (LC) have been shown to be pyrogenic (fever-producing) and carcinogenic (cancer-causing). Normal concentrations of these bile acids are probably not harmful, but in intestinal disorders and liver dysfunctions an increase of these bile acids may be responsible for the growth of cancers.

If an increase in harmful bile acids could be detected early enough, certain measures could be taken to reduce the risk of cancer; measures which could be as simple as a change in diet or the addition of charcoal to the diet (charcoal has been shown to absorb harmful bile acids). Other medications with similar, but more specific effects are available.

Meat in moderation

Scientists are relatively certain that a high-cholesterol diet promotes the production of harmful bile acids. The occurrence of intestinal cancer among vegetarians is almost non-existent, where North Americans are highly prone to the disease simply because of their high-meat diet.

Methods to measure bile acid concentrations in the body do now exist (they begin with a blood sampling), but laboratory sample testing is extremely difficult. A laboratory in California charges over $50 to quantitate individual bile acids. The test is simply too expensive to conduct on every patient at every check-up.

The new process, perfected by graduate student Chung-Shun Ho, can separate Lithocholic Acid in as little time as five seconds. The relative concentration of the substance is measured accurately with a spectrofluorometer. The method is sensitive enough to measure ten nanograms of LC, or the quantity of material in one-tenth of a fingerprint.

The CANDU safeguards system

The nuclear non-proliferation treaty ratified in March 1970 had been signed by 104 states including Canada, by the end of last year.

As part of its program to support international safeguards, Canada has worked in close co-operation with the International Atomic Energy Agency to design a system to detect the diversion of nuclear material from a CANDU power station. Scientists at the Chalk River Nuclear Laboratories of Canada's Atomic Energy agency are testing the spent fuel bundle counter they designed as an integral part of the safeguards system for a 600-megawatt CANDU.

Unique safety factor

An increasing number of countries are using the CANDU reactor to supply their electricity. Other reactor systems can be refuelled only when the reactor is shut down and an IAEA inspector can arrange to be present. The CANDU's operating advantage of on-power refuelling means that a unique approach is necessary to keep a running tally of the fuel that is discharged daily from the reactor. The "spent-fuel bundle counter" can monitor all bundles entering the storage area between IAEA inspections.

The principal function of the bundle counter is to detect, and hence deter, illicit actions, specifically by counting bundles transferred in and out of the storage area. A bundle is removed from the reactor by the fuelling machine, then pushed into a fuel transfer ladle which directs it to the storage area. Movement of the bundles is detected by four Geiger counters positioned on the ladle so that at least one counter will "see" a bundle, no matter what its position. A microprocessor determines how many bundles have been transferred each time the ladle is used by sorting out the signals from the Geiger counters. A printer registers a code for the number of bundles and the direction of movement. If, for example, a bundle were moved back towards the reactor vault, the microprocessor would "decide" this was an abnormal movement, the corresponding code would be printed and the inspector would see this on his visit.

Own power supply

The instrument has its own power supply in case of a station power failure, as well as electrical cables buried under concrete, a one-piece seamless box-like enclosure and all doors closed under an IAEA seal. When no bundles are in the ladle, a small radioactive source acts as a watchdog – if the signal stops a Geiger counter has failed or been disconnected and the date and time are recorded for follow-up by the inspector.

The bundle counter is now being tested in the reactor fuel storage area where an assembly has been built to simulate the motion of spent fuel bundles as they are removed from the reactor. If tests are successful, counters will be built for the CANDU 600 MW reactors now under construction at Point Lepreau and Gentilly in Canada, Cordoba in Argentina and Wolsung in Korea.

The CANDU safeguards system also includes surveillance cameras, IAEA seals, and special bundle storage baskets. A spent fuel bundle verifier has been designed to verify that the bundles in the storage baskets are not dummies that have been substituted for the spent fuel.

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