1. Fifty-percent reduction in data transfer speeds;
2. Lower equipment costs (CAMAC users indicated that equipment cost for a CAMAC system can be 20 to 40 percent lower than the alternative); and
3. Reduced inventories (interviews with National Laboratory personnel indicate that for every NIM or CAMAC model in inventory, at least four of an alternative instrument would have to be in inventory).

Treatment

Nuclear medicine has promoted new medical treatments directly and indirectly. Direct results have come through the use of radioisotopes that are specially produced and economically available. Treatment procedures have been modified by the involvement of a broadened range of scientific disciplines such as physics, radiation health physics, and electronic engineering. These disciplines brought a new dimension to medicine.

The direct use of radioisotopes includes cobalt-60 for the treatment of tumors, cesium to power implanted heart pacemakers, and the use of special radiation beams, as well as complementary instrumentation. Economic availability also greatly enhanced the use of radioiodine in thyroid treatment. Among the most recent experimental results is the treatment of tumors with radioactive monoclonal antibodies. Iodine-131 to treat hyperthyroidism and thyroid adenomas (benign or low malignancy tumors) typifies the use of radionuclides for medical treatment.

The use of radioisotopes in diagnosis allowed the tracing and understanding of body functions (especially the immune and blood systems) not previously possible. These new understandings promoted the indirect benefits of new nonnuclear treatments. For example, studies to develop specific inhibitors of protease enzymes resulted in the discovery of a compound that acts against thrombin, an enzyme that induces blood clotting. The compound has been patented and is used as an anticoagulant. Another example is the development of L-dopa (levodopa) for the treatment of Parkinson's disease.

Iodine-131 Therapy for Hyperthyroidism Iodine-131 is a radioactive isotope that concentrates in the thyroid gland and, thus, can be used in the diagnosis and treatment of thyroid disorder. This isotope has an 8-day half-life and emits high-energy beta particles and gamma rays in the region of 360 kiloelectron volts and higher.

Hyperthyroidism is a hypermetabolic state, caused by excessive levels of circulating thyroid hormones, which contributes to a variety of clinical symptoms. The dose of iodine-131 that concentrates in the thyroid gland destroys abnormal, hyperactive thyroid tissue that is producing excess hormone. This treatment, therefore, allows the gland to return to normal activity without surgery, hospitalization, or adverse effects on other tissues.

History In late 1939, J. G. Hamilton and M. H. Soley (University of California-Berkeley) published a paper on the first use of iodine-131 in patients with benign thyroid disease. In early 1941 the first patient was administered a therapeutic dose of iodine-130 and iodine-131 at MIT, and in late 1941 iodine-131 was used therapeutically against toxic goiter disease at Berkeley. In mid-1946 iodine-131 from nuclear reactor fission products was being shipped from ORNL, and in late 1946 iodine-131 was used by Seidlin for successful treatment of metastasized thyroid cancer. Until the mid-1960's, iodine-131 was the main nuclide used for the diagnosis of many diseases. After the mid-1960's, many diagnostic uses of iodine-131 were supplanted by technetium-99m labeled compounds. Iodine-131 is still extremely important, however, in evaluating thyroid condition and thyroid cancer therapy, for studying thyroid uptakes, and for thyroid imaging.

Benefits Radioactive iodine-131 is used in about 12 percent of all nuclear medicine procedures and is a good exmple of the use of radioactive therapy. Over the past 10 years at the Johns Hopkins University Hospital, surgery for hyperthyroidism has decreased drastically from 3000 to 4000 cases/year to a current level of 50/year. This reduction can be attributed to the use of nuclear medicine therapy with iodine-131.

In the United States, radioactive iodine is the preferred treatment for adults suffering from hyperthyroidism. Because peak occurrence of hyperthyroidism occurs between the ages of 30 to 50, approximately 85 percent of hyperthyroid patients are now treated with radioactive iodine. The alternative medical treatments for hyperthyroidism are surgical removal of the thyroid gland and drug therapy. Surgery is invasive, painful, and expensive and carries a significant risk of complications and, possibly, death. Drug treatment can be long term, can have serious side effects, and, in many cases, may still require subsequent surgery. The comparative costs (in 1982) of surgery and iodine-131 treatment reported for a medical teaching center were $7400 and $600, respectively. The reported overall incidence of hyperthyroidism in females and males is, respectively, 4.7/10,000 and 1.06/10,000. Thus, the total estimated savings in treatment cost because of the use of iodine 131 could be as high as $280 million/year (based on the United States incidence of hyperthyroidism in 1980).

L-Dopa Treatment for Parkinson's Disease L-dopa [(-)-3(3,4-dihydroxyophenyl)-L-adamine or levodopa] is an amino acid used in the treatment of Parkinson's disease. Oral administration of L dopa substantially slows the rate of progression of the disease, reduces symptoms, and decreases the mortality rate.

Parkinson's disease is a progressive neurological disease that produces tremors, inability to plan or initiate a movement, inability to control movements, rigidity, and disturbance of postural reflexes. The disease is characterized by a