ing whether to encode a bit of information as a specific linear or circular polarization. For each photon detected, the receiver chooses randomly which type of polarization to measure. About half the polarization measurements would match the values the sender transmitted. By ascertaining which photons were correctly measured, the sender and receiver could derive a code, known only to them, which would serve as a key for encrypting and deciphering messages.

Because any measurement attempted by a third party would unpredictably alter a photon's polarization, an eavesdropper couldn't intercept the transmission without irrevocably scrambling the message and alerting both the sender and receiver to the surreptitious surveillance. To check for eavesdropping, the receiver would simply compare notes with the sender, ascertaining what the results for a number of selected measurements should have been. Statistical deviations from the expected results would signal an eavesdropper's presence.

This so-called "quantum public key distribution" system is the first communications system ever built to depend on the uncertainty principle to ensure secrecy, say its inventors, Charles H. Bennett of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y., and Gilles Brassard of the University of Montreal. "The system relies on the uncertainty principle to enable its users to detect eavesdropping on the quantum channel, even by an opponent with superior technology, and reject the compromised transmissions."

After playing with the idea for several years, Bennett and a colleague constructed a working model of the system last summer. The device consists of tiny diode lasers for generating faint light flashes and detectors for picking up the signals. The entire apparatus sits within a light-tight box about 13 inches long. A computer program controls the apparatus, tallies the signals sent, received and intercepted, and displays the results.

Because it is relatively slow and can be used only for communicating random bits, the apparatus is best suited for transmitting cryptographic keys. Once the two users establish a key, they can exchange secret messages by way of a faster, conventional communications channel.

However, the device's present size severely limits its usefulness. Bennett, who described his demonstration model at last week's Eurocrypt conference in Aarhus, Denmark, now plans to build an improved device using an optical-fiber cable for transmitting light pulses over distances up to 500 meters. Going to greater lengths is tricky because the light pulses must necessarily be weak, which means they travel only a limited distance along optical fibers before fading away.

— I. Peterson

Organ transplant drug tied to cancer risk

A new study links an anti-rejection drug used in most organ transplants to the development of cancer in heart recipients. The cancer, called non-Hodgkin's lymphoma, appears especially prevalent in patients who received higher-than-average doses of the drug, known as OKT3. But even low doses may carry an added risk of the lymphoma, which can kill the patient within a month or two after an otherwise successful transplant, researchers reported last week.

The study is the first to look for a specific link between OKT3 and non-Hodgkin's lymphoma. Many transplant surgeons express surprise at the new findings, saying their own experience suggests the drug is not especially carcinogenic. But the surgical department at Loyola University Medical Center in Maywood, Ill., where the study was performed, has halted preoperative administration of OKT3, reserving it instead as a last resort for patients who show signs of acute organ rejection.

Surgeons generally administer a combination of immunosuppressive drugs, including OKT3, before transplantation and/or afterward if signs of rejection appear. OKT3 consists of monoclonal antibodies made by cultured mouse cells. It destroys white blood cells that play a crucial role in organ rejection.

When the drug won FDA approval four years ago for use in kidney transplants, it was the first monoclonal antibody licensed for therapeutic use in humans. Today, virtually every U.S. kidney recipient gets it. In addition, surgeons have used OKT3 for years in many heart and liver transplants, all the while gathering added data on its safety and efficacy.

Lode J. Swinnen and his colleagues became suspicious of the drug when several of their heart transplant patients developed non-Hodgkin's lymphoma, a cancer of the lymphoid tissues. Previous studies had shown that severe immunosuppression can trigger lymphoma in a small percentage of cases, but the Loyola team noted a higher incidence that seemed to warrant further analysis.

The researchers reviewed the records of all Loyola heart recipients since 1984. About half of them had received drug combinations that included OKT3 before and/or after surgery; others had received combinations in which a different drug replaced OKT3. Ten of the 154 transplant patients later came down with non-Hodgkin's lymphoma; nine of those were in the OKT3 group. All told, 12 percent of the OKT3 patients developed the lymphoma, compared with 1.5 percent of patients not receiving OKT3.

Moreover, among patients receiving a cumulative OKT3 dose of more than 75 milligrams (a standard course is 70 mg), the percentage getting lymphoma jumped to nearly 36 percent. All of the high-dose patients who got lymphoma died of the disease within one to two months, despite aggressive anticancer therapy. Those who developed lymphoma after lower doses had less severe cases that typically arose four to 18 months after their transplants.

Statistical analysis of all known lymphoma risk factors in the heart recipients — including use and dose of other immunosuppressive drugs — indicates that OKT3 was "the only one that significantly correlated" with cancer appearance, Swinnen said at the annual meeting of the American Society of Clinical Oncology in Washington, D.C.

The implications for people who receive the drug for kidney transplants are not immediately clear, Swinnen and others say. Most kidney recipients get 5 mg per day for 10 to 14 days, for a total dose of up to 70 mg, according to Richard Salem, a spokesman for Ortho Pharmaceutical Co. in Raritan, N.J., which manufactures the drug. The company "is aware of and is analyzing the [new] data," Salem told SCIENCE NEWS.

Swinnen says doses higher than 70 mg generally accumulate in people receiving both a prophylactic course of the drug and additional doses following signs of rejection. The value of preventive immunosuppression for organ recipients remains controversial, he says.

Mitchell L. Henry, a transplant surgeon at Ohio State University in Columbus who has studied OKT3, says prophylactic use of the drug is "fairly common" in kidney, heart and liver transplants, but that cumulative doses above 75 mg "are probably unusual." Nonetheless, Swinnen notes, four of the group's 10 lymphoma cases occurred in patients who received only a single course of the drug. While stressing that the statistical correlation does not by itself prove OKT3 causes lymphoma, he adds: "We're worried enough to stop using it [prophylactically]."

FDA spokeswoman Faye Peterson says OKT3's approval in 1986 included a special provision that Ortho continue to gather data on the drug's safety. In particular, she says, FDA wanted to watch for drug-associated lymphoma. Peterson says Ortho has forwarded some data to the agency for review.

Surgeons at several major transplant centers told SCIENCE NEWS they have noticed no particular link between lymphoma and OKT3. Swinnen responds that no other study has specifically looked for the link. "I'd be surprised if other centers do not report this later," he adds.

Swinnen calls for a reassessment of the drug as a preventive treatment, while recommending that physicians follow OKT3 recipients closely for early signs of lymphoma.

— R. Weiss