1960s and 1970s. In the late 1960s, serious work with microwave heating in the treatment of human melanoma (black-pigmented tumors) began, and soon other groups were making use of a wide variety of radio-frequency and microwave applicators, at first in treatment of surface tumors, including those in cattle as well as humans. Later attempts have been focusing on deeper tumors.

The ability to focus radio and microwave fields repeatably in internal structures while determining the distribution of local temperatures simultaneously has proved quite a technological challenge. Most radio or microwave applicators generate considerable heat at the skin or other dielectric interfaces which can be diminished by interposing bags of water between the source and the skin, but poses problems in deeper structures. Simultaneous temperature measurement requires indwelling probes (either fiberoptic or high impedance probes), so that knowledge of internal temperature excursions is spotty at best.

Applicators in experimental use for deep tumors include annular phased-array antennae, magnetic induction rings, a variety of capacitors, and indwelling probes acting as the tip of antennae. Ultrasound generators are used for superficial tumors and breast carcinoma. Work is just beginning using nuclear-magnetic-imaging apparatus to drive internal probes and detect alterations in local temperature, but it will be some time before this can be used in experimental animals or humans.

To date, with most cases restricted to surface tumors of the breast, skin, or other superficial structures, human tumors whose temperatures are increased to about 40° centigrade regress quite nicely, which is encouraging since many of those tumors have already failed to respond to the full spectrum of chemotherapy and radiotherapy. In many cases, radiation necrosis of the skin was significantly improved. These tumors do, however, tend to recur when heat alone is the treatment modality. When given in combination with anti-tumor drugs, a much greater response is elicited, though time only will tell how many of these are complete remissions. Therapy is limited by pain which can occur when bony structures are heated, by uncertainty of temperature in deeper structures, and by relationship of thermal distribution to major blood vessels and nerves. In experimental animals, it is not uncommon to have permanent regression of local tumors with heat alone. At the same time, there are occasional regressions of distant metastasis. The latter is still an interesting observation deserving further attention.

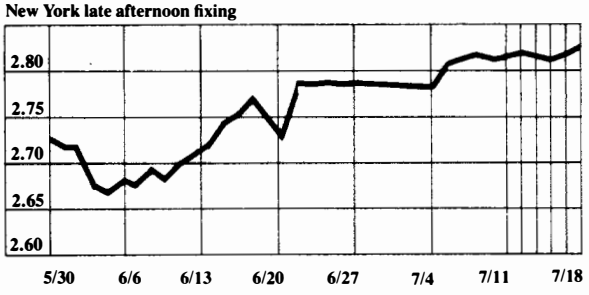
On an experimental level, uses of changes in tissue refractive index or dielectric for temperature measurement are being studied quite intensively. Perhaps the most hopeful studies are those using the radio-frequency of nuclear-magnetic-resonance-imaging equipment in conjunction with indwelling probes while performing imaging analysis for temperature changes.

Hyperthermia, adequately used and controlled, is a valuable therapeutic adjunct to other forms of cancer therapy.

Currency Rates

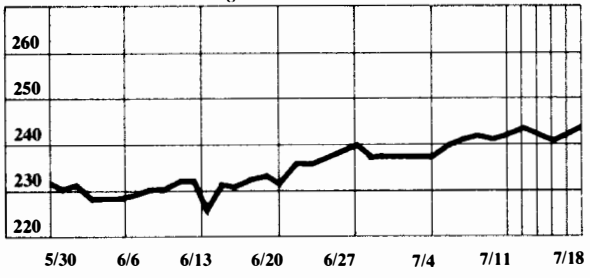
The dollar in deutschemarks

New York late afternoon fixing



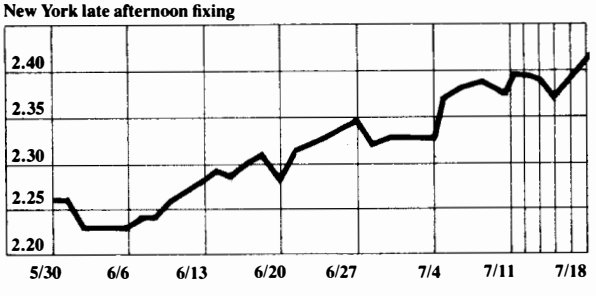
The dollar in yen

New York late afternoon fixing



The dollar in Swiss francs

New York late afternoon fixing



The British pound in dollars

New York late afternoon fixing