That an inorganic ion might control growth and differentiation is not a totally new idea. But the magnesium theory is sufficiently different from other models of cellular control that Rubin foresees the need for a vigorous scientific defense. He is continuing his studies with a more detailed look at cell response to Mg^{++}, quantitative measurements of Mg^{++} and other ions (calcium, sodium and potassium) and the possible relationship of Mg^{++} to malignant transformations. □

Stimulating the brain to prevent pain

As James S. awakens, his arthritis is acting up again. He reaches for a battery-charged box on his bedside table, switches it on and places it near his chest. An electrical charge generated by the battery pack stimulates receivers implanted in his upper chest, and then runs along wires implanted under the skin of his neck and up into tiny electrodes implanted in his medial brain stem. Several minutes later his joints stop hurting, and he remains pain-free for the rest of the day. . . .

Sound like science fiction? Absolutely. Yet this method of pain relief is already a reality at several American medical centers. It has become so because of recent, dramatic neuroscience advances, notably the discoveries that the medial brain stem is a major area of the brain for pain processing and that electrical stimulation of this area can turn pain off.

It all started back in 1969 when David Reynolds of the Stanford Research Institute discovered, in experimental animals, that electrical stimulation of the medial brain stem can inhibit pain. (The medial brain stem is deep in the middle of the brain, a continuation of the spinal cord that includes the hindmost portions of the brain—the medulla, pons, midbrain, thalamus and hypothalamus.) Then the following year John C. Liebeskind, a psychologist at the University of California at Los Angeles, and co-workers David Mayer and Huda Akil, took up where Reynolds left off.

During the past five years, Liebeskind reported at the recent annual meeting of the Society for Neuroscience, he and his colleagues have learned that the technique is indeed potent and that it is more effective if selected areas of the medial brain stem are stimulated. Examples are the periaqueductal gray matter of the midbrain or the nucleus *raphe magnus* of the medulla. They have obtained dramatic evidence that when they electrically tickle the medial brain stem, they are activating a descending nervous path which reaches down into the spinal cord and pinches off incoming pain information right there at the level of the spinal cord. And, most provocative, they have found that pain inhibition produced by stimulating the medial brain stem can be reversed by naloxone, a morphine antagonist.

"This was a terribly crucial observation," Liebeskind says, "because it suggested that the brain has some natural pain inhibitor similar to morphine and that we were simply stimulating the inhibitor into action." Indeed, this suggestion has subsequently been confirmed by John Hughes of the University of Aberdeen, Scotland, and by several other biochemists. They have found that the brain does contain such a pain inhibitor. They are now feverishly attempting to figure out the chemical structure of this inhibitor.

Meanwhile, Akil, who is now with Stanford University, Donald Richardson of Louisiana State University, and John Adams of the University of California at San Francisco, have been attempting to abolish chronic pain in patients by electrically stimulating their medial brain stems. So far they have tried the technique on some 17 patients; the patients are experiencing pain relief. Like James S., they carry battery packs to stimulate their medial brain stems whenever they feel pain. In fact, one of these patients has been successfully relieving his pain with a pack for two years now.

Does such a technique have any advantages over conventional pain relievers such as narcotics? Yes and no, Liebeskind replies. Obviously it's a lot easier to pop a pain pill every day than to stimulate your brain with a battery pack. But long-term use of narcotics, he notes, can lead to tolerance, the need for increased dosages and physical dependence. So, he foresees the continuing use of narcotics as pain relievers for patients who are in severe pain over the short term and electrical stimulation of the brain emerging as a means of pain relief for patients who suffer from pain for months or years on end.

But is there any danger that patients using this technique might stimulate the wrong neurons in their brains and thereby inadvertently alter their thoughts, emotions or behavior? Liebeskind says not. Electrodes are placed in a patient's brain on a temporary basis while he is awake and then are stimulated right away. Only if the electrodes produce the desired effect will the neurosurgeon implant them permanently in that position.

Liebeskind admits that certain questions still have to be answered about this highly experimental technique. One is what the long-term effects of brain stimulation to prevent pain will be. Still another is how much of pain relief is really due to this technique and how much is due to a placebo effect. □

Lasker awardees: Medical research honors

Last week, America's most prestigious medical research awards, the Albert Lasker awards, were presented, this year for a variety of medical accomplishments—medical technology development, hormonal research, immunological research, the pioneering of new drugs and efforts to improve vision.

Godfrey N. Hounsfield of the EMI Central Research Laboratories in Hayes, Middlesex, England, and William Oldendorf of the University of California at Los Angeles School of Medicine share a Lasker Clinical Research Award for their conception and development of the EMI scanner. The scanner, which makes possible for the first time an imaging of the brain and other soft tissues in the body, is revolutionizing diagnostic radiology (SN: 1/11/75, p. 27; 5/10/75, p. 303).

Roger C. Guillemin of the Salk Institute and Andrew V. Schally of the Veterans' Administration Hospital in New Orleans share a Lasker Basic Research Award for their hypothalamic hormone discoveries. Specifically, Guillemin has discovered several hormones released by the hypothalamus, notably somatostatin. Somatostatin inhibits the secretion of growth hormone from the pituitary gland (SN: 5/4/75, p. 286). Schally has also discovered several hypothalamic hormones, notably luteinizing hormone-releasing hormone. This hormone in turn stimulates the pituitary gland to release hormones which regulate male and female reproduction. Schally's discoveries are also opening the door to new kinds of birth control (SN: 7/17/71, p. 37; 11/6/71, p. 310; 1/8/72, p. 28).

Frank Dixon of the Scripps Clinic and Research Foundation in LaJolla, Calif., and Henry G. Kunkel of Rockefeller University have also received Lasker Basic Research Awards for their immunological research. Dixon has shown that immunological responses, which usually protect people, can malfunction and cause kidney, cardiovascular, joint and other diseases, and that many chronic viral infections can also trigger immunological diseases. Kunkel has shown how wayward immunological mechanisms underlie kidney disease and arthritis.

Four scientists at Merck, Sharp and Dohme Research Laboratories in Rahway, N.J., and West Point, Pa., have won a Lasker Special Award for pioneering new kinds of drugs. They are Karl H. Beyer Jr., James M. Sprague, John E. Bayer and Frederick C. Novello. A Lasker Public Service Award has also been given to Jules Stein, ophthalmologist and chairman of Research to Prevent Blindness, for his efforts to prevent blindness and restore sight.

During the 30 years that Lasker awards have been given, 25 awardees have gone on to win a Nobel Prize, including this year's physiology and medicine award winners (SN: 12/2/72, p. 365; 10/25/75, p. 261). □