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Evaluation of a Microchip Implant System Used for Animal Identification in Rats

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A 1-year study was undertaken in rats to evaluate a new microchip-based animal identification system (BioMedic Data Systems, Inc., Maywood, N.J.). Each animal was implanted with a miniature radio transponder that was capable of transmitting a unique identification number. The system provided proper identification of each animal and permitted data to be added automatically to a computer data base file. The implanted transponders produced no adverse clinical or histopathological side effects in the rats.

Currently, laboratory animals are identified by ear punching, ear tagging, toe clipping, or tail tattooing (1–4). These techniques have served relatively well; however, recent attention by animal welfare groups, as well as scientific and economic issues, have pointed out inadequacies in these conventional procedures (5). Furthermore, some commonly used animal marking techniques occasionally lead to infection, which can then affect results or the long-term health of a colony (6). In addition, tumor induction at the site of ear tag placement has been reported in rats (7).

For these reasons, a 1-year study was undertaken to evaluate a new animal identification system. This system involved implantation of a miniature radio transponder which was capable of transmitting a unique number. The basic system included the transponder, a low-power frequency reader, and a digital display unit. For our purposes, the display unit was interfaced to a computer for data collection.

Our goals in this study were threefold: (1) to evaluate the implant-tissue interface as well as the surface of the microchip over a 1-year period; (2) to assess the potential effects of this implantable device on animal health; and (3) to evaluate mechanical, electronic and data processing.

A miniature transponder that was preprogrammed with its own permanent, unalterable number was hermetically sealed in an inert glass capsule. The implant was sterilized by the manufacturer according to the Guideline for Industrial Ethylene Oxide Sterilization of Medical Devices (8). When the subcutaneously implanted transponder was interrogated by a very low power radio-frequency signal, it transmitted the encoded identifying number to a "reader" that interpreted the number and transferred it to a computer.

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Twenty male and twenty female Sprague-Dawley rats (CD, VAF+) (Charles River Laboratories, Inc., Kingston, N.Y.) were used in this study. They were approximately 6 to 7 weeks of age at the start of the study. On study day 1 each animal had an implantable microidentification (IMI) transponder implanted subcutaneously in its mid-dorsal region, under aseptic conditions. The animals were prepared for implantation by swabbing the implant area with 70% ethanol. The animals were restrained physically while a second technician injected the implant via the 12-gauge needle implantation device which was supplied by the manufacturer. A new presterilized needle was used for each injection. In study weeks 2, 12, 26, and at termination of the test periods, in study week 52, five animals of each sex were sacrificed by CO_2 asphyxiation for postmortem evaluation of the implant site. A macroscopic evaluation of the tissue surrounding the implant was performed on each animal. Tissue sections of the implant site (skin and subcutis) and underlying muscle tissue were prepared for histopathologic examination. At each necropsy, a transponder from one male and one female was dissected carefully from the tissue site and evaluated by scanning electron microscopy (SEM) for possible structural changes.

The electronic animal identification system was evaluated functionally on a weekly basis as follows. The animal was removed from its cage then placed proximal to the low-power, radio-frequency reader. The transponder responded to the signal, and a 10-digit alpha-numeric code was displayed by the digital display unit. In addition, we interfaced the display unit to a computer. The code number was cross-referenced by a computer-driven protocol that provided the operator with a five-digit animal number which was assigned by our laboratory.

Comparisons of body weight and food consumption were based on historical control data from previous 1-year rat toxicity studies conducted in our laboratories. No effects on normal body weight gain or food consumption (data not presented) were seen in this study when compared to the historical control data. No palpable masses were detected at the implant site during this period, and the general health of these animals was considered normal.

Grossly, the microchips were found easily, in all cases, in the subcutaneous tissue, with no visible tissue reaction surrounding the implant sites. Tissue sections of the implant sites were characterized by thin rims of immature fibrous connective tissue with occasional subacute inflammatory cells

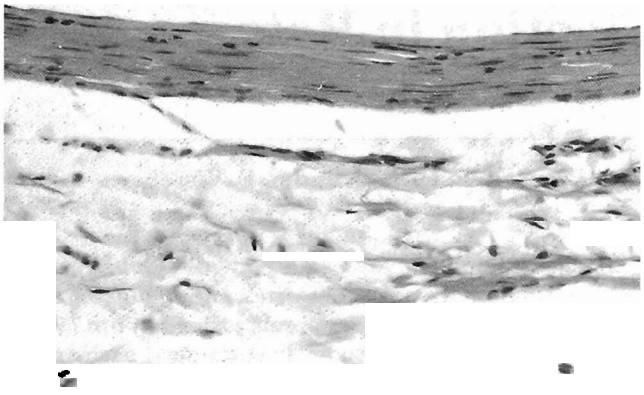

Figure 1. A photomicrograph of the IMI implant site after 52 weeks. Only a very thin rim of fibrous connective tissue surrounds the implant site. No hemorrhage, necrosis, or inflammatory reaction is seen. Hematoxylin and eosin stain. Scale bar = 1000 micrometers.

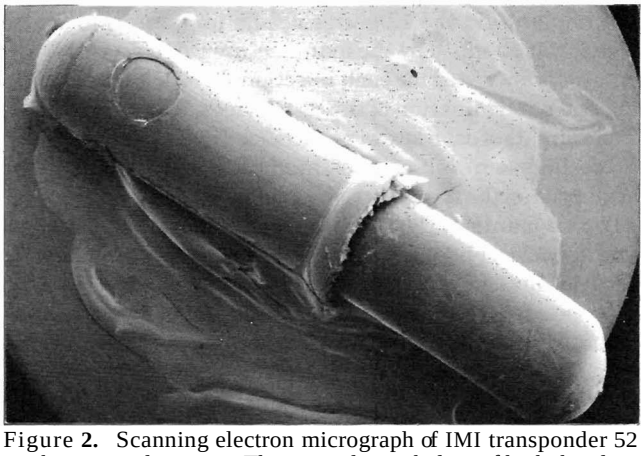

Figure 2. Scanning electron micrograph of IMI transponder 52 weeks postimplantation. The general morphology of both the glass capsule and polypropylene sheath were comparable to transponders before implantation. Higher magnifications revealed comparable results.

present in the subcutis 2 weeks after implantation. At later times (weeks 12, 26, and 52), very thin rims of mature fibrous connective tissue were seen surrounding the implant sites, with no evidence of persistent inflammatory reaction (Figure 1). Occasional hair shafts (introduced at the time of implantation), associated with a slight granulomatous response, were found admixed in the connective tissue. The tissue response to the implanted transponders was inconsequential.

Examination of the transponders by SEM at weeks 2, 12, 26, and 52 postinjection revealed no morphological alterations as a result of implantation (Figure 2). The glass capsule had a smooth, homogenous surface. The polypropylene sheath that covered one end of the transponder had a manufactured hole at its closed end. Its surface was characterized by scratches, ridges, and other irregularities.

The system presented here is a reliable, easy-to-use, nonadverse, identification system. The IMI transponder is implanted easily. Presently, in our laboratory, two teams (two technicians each) routinely implant approximately 250 rats an hour under aseptic conditions. The use of the transponder necessitates use of the electronic reader connected to a digital display. The complete package can be interfaced directly with an online computer system, as it is in our laboratory, or it can be used as a stand-alone identification system. The use of the IMI transponder results in improved quality control of animal identification and data collection. In this study, we observed no electronic microchip failures in 4,733 individual interrogations that utilized the complete IMI system interfaced to a computer-driven protocol.

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