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SHORT COMMUNICATION

Helium Leak Measurements as a Predictor of Hermetic Package Life in Surgically-implanted Microelectronic Devices

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Commercially-available hermetic packages are not ideal for use in surgically implanted mircoelectronic neuroprostheses. In the moist saline environment of the body, such packages are prone to corrosion; furthermore the range of available sizes and lead-out arrangements, though impressive, seems nevertheless insufficient for one to be able to choose exactly what one wants. In consequence, we have in our Unit been developing a procedure for making hermetic packages of the exact size, shape and pin configuration required, which do not corrode. In the course of this work we have compared helium leak rate measurements made shortly after packages were sealed, with actual lives obtained, from microcircuits in those packages during accelerated *in vitro* simulation of the implanted environment. We found little correlation between submerged life expected and submerged life actually obtained. The tests are still incomplete, but the picture which is emerging looks like this:

The 21 packages constituting the experiment are disposed as follows:

		Failed on test YES	NO
Expected to fail on helium leak criteria	YES	2	6
	NO	4	9

Evidently 11 packages have done the expected thing, and 10 have done the opposite. However, the prognosis for helium leak measurements as a predictor of package life is not quite so dismal as these results suggest. Considering first the 4 packages which were not expected to fail but did: all 21 specimens of the test batch were made by one of five alternative processes, originally supposed to differ from one another only in minor respects. The 4 unexpected failures were all made by either of two of these five processes, in which less-than-normal attention was paid to cleaning procedures. No unexpected failures have occurred in packages made by any of the remaining 3 processes tried.

That leaves the 6 packages which were expected to fail but didn't. All that can be said for this group at present is that lives are obtainable 2 or 3 orders of magnitude greater than one would suppose from considerations of rate of water vapour entry, possibly longer. One package, for example, had a time-constant for helium escape of 0.5 day. It is still working perfectly, submerged, after 320 days.

We are carrying out experiments, using humidity-sensing chips, to try to determine the mechanism by which these unexpectedly extended lifetimes are obtained. In particular, we want to test the idea that the interior of leaky packages can be maintained at below 100% R. H. osmotically.