ON Bypass

A Look Back At Travenol

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It can be aptly stated that Travenol Laboratories was the *original* perfusion manufacturing company. First launched in 1949 as a subsidiary of Baxter International, the name Travenol was intended as a marketing label for the company's new artificial organs division. As a first effort, Travenol representatives met with Dr. Willem Kolff in 1954 to discuss building the world's first commercial dialysis machine. This apparatus, named the UA 10 Twin-Coil Artificial Kidney, featured the familiar Sigmamotor "finger" pump to propel the patient's blood. A couple years later, Travenol engineers were invited to Minnesota to discuss commercial production and design of Dr. Vincent Gott's revolutionary "pillowcase" bubble oxygenator (see Figure 1). This project fell perfectly in line with Travenol's mission as an artificial organs company. In turn-key fashion, Travenol arranged to manufacture, sterilize, package, and deliver Gott's sheet-type oxygenator to the perfusion community. Unfortunately, the Minnesota group proved reluctant to go forward with market release during the final stages of development. In response, Travenol shifted its focus to Houston. Partnering with Dr. Michael DeBakey and Dr. Denton Cooley, further refinements to Gott's original design led quickly to the commercial production of the Miniprime disposable bag oxygenator in 1962 (see Figure 2).

Figure 1. "Pillowcase" disposable bubble oxygenator developed by Dr. Richard DeWall (left) and Dr. Vincent Gott (right) in 1957.

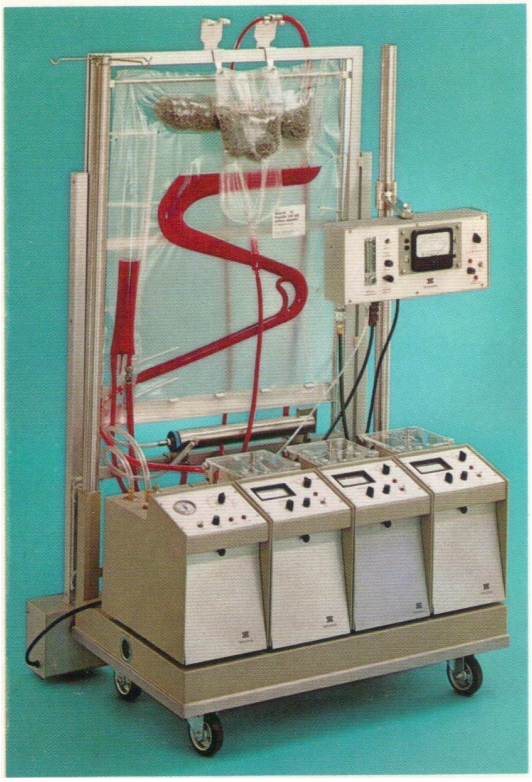

Figure 2. Miniprime disposable bubble oxygenator developed by Travenol in 1962.

In 1967, Travenol announced plans to build a $4.5 million facility in Hays, Kansas. At its core, Travenol was a thermoplastics company. The ability to extrude and heat-seal polyvinyl plastic led to numerous product advancements in the 1960's such as IV tubing (formerly silicone rubber), IV bags (formerly glass bottles), and of course disposable oxygenators (formerly metal screens and discs). At the outset, the Hays plant was intended to produce IV needle and tubing sets, small volume parenteral containers, and rubber products such as cystoscopy catheters and latex gloves. With open-heart surgery on the rise however, Travenol began using the Hays plant to ramp up production of its cardiopulmonary line. As the 1970's approached, emphasis on patient temperature control led to development of the disposable Miniprime heat exchanger (see Figure 3).

Figure 3. A worker at the Travenol plant in Hays, Kansas inspects a Miniprime disposable heat exchanger (circa 1972).

This device was popularized by Charlie Reed's favorable article which appeared in the very first issue of the CanSECT journal published in 1972. More Miniprime heat exchangers were assembled at the Hays plant than in any other Travenol facility. Early cardiotomy reservoirs were basically plastic collapsible bags that contained a stainless steel defoaming sponge. As perfusionists swung their preference in favor of hard-shell devices, Travenol began making a disposable rigid polycarbonate reservoir (see Figure 4).

Figure 4. Workers pictured at the Travenol plant in Hays, Kansas in 1976 (note the rigid disposable cardiotomy reservoirs atop the rack in the background).

Again, the Hays assembly line for this product was one of the largest in the country. Towards the end of the 1970's, a great debate was centered around membrane oxygenators. Considered by most perfusionists at the time to be complicated in design and operation, membranes were also more expensive than bubblers. Comparative data, however, suggested that membranes offered less postoperative bleeding than bubblers. Furthermore, Karlson's group reported that patients perfused with a membrane appeared to have a "clearer mental status" postoperatively. Beginning in 1971, Travenol used a variety of materials in their membrane oxygenators including silicone, Teflon, and polypropylene. In 1979, the Hays plant began producing the Travenol TMO membrane oxygenator (see Figure 5). Featuring a fan-folded sheet of polypropylene, the TMO also utilized an inflatable shim to control the blood film thickness.

Figure 5. A worker at the Travenol plant in Hays, Kansas inserts a shim tube into a TMO membrane oxygenator (circa 1979).

In 1980, Travenol agreed to market and distribute a novel bubble oxygenator originally developed by Delta Medical (see Figure 6). The Hays facility was chosen exclusively to assemble the device. Upon further evaluation however, Travenol discovered that the oxygenator contained nearly 32 feet of aluminum coil for heat exchange. The device was deemed too costly and was never brought to market. In 1983, Travenol released the LPM-50 membrane oxygenator (see Figure 7) utilizing the same fan-folded polypropylene sheet configuration used in the reliable TMO. The Hays plant assembled the LPM-50 for approximately one year. In 1984, Baxter International (Travenol's parent company) decided to close the Hays facility. The doors were officially shut in 1986.

In 1998, during a visit to the Travenol facility, this author recovered a brand new LPM-50 membrane oxygenator from a storage closet. The oxygenator's outer wrap was intact, as well as the original cardboard shipping container. For me, this clunky device is a daily reminder of a previous time – a time when real people (not machines) assembled perfusion devices with great care. And for a brief time, it happened right here in my small community.

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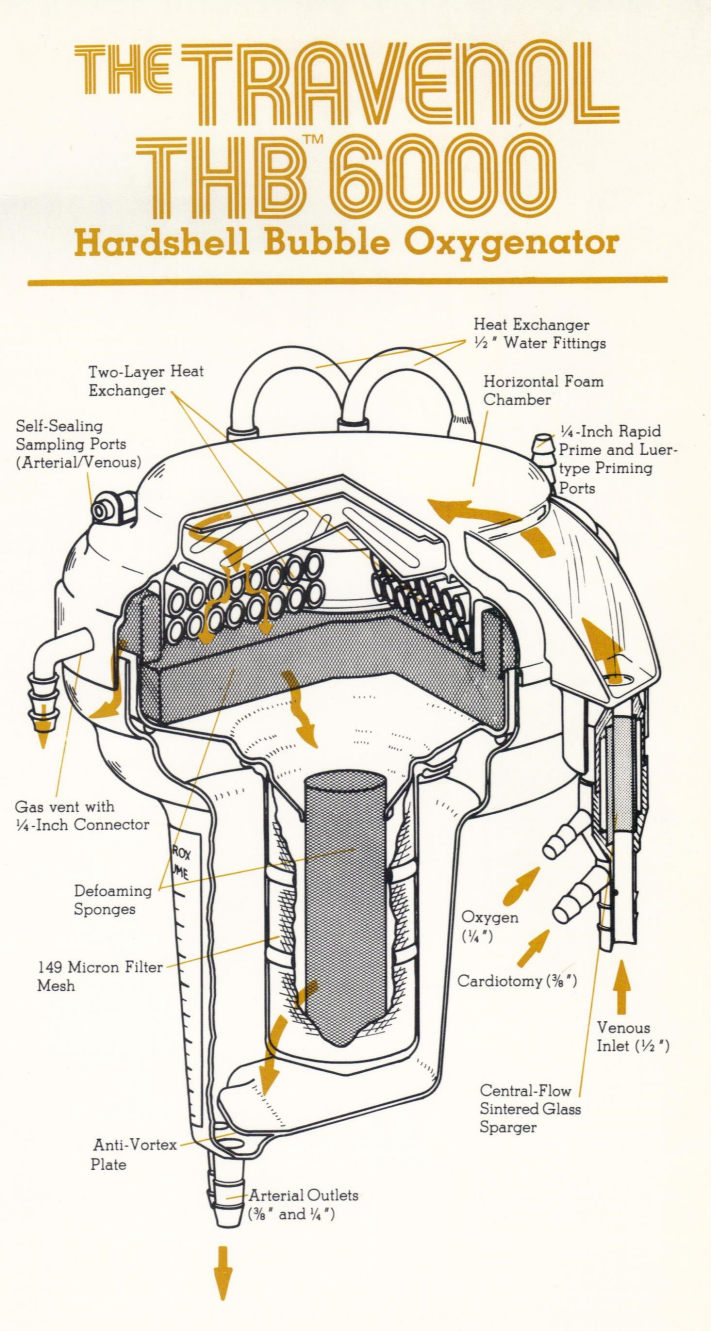

Figure 6. Schematic drawing of disposable hard-shell bubble oxygenator developed by Delta Medical in 1980 and marketed by Travenol. This device was never released for clinical use.

Figure 7. Travenol LPM-50 membrane oxygenator (circa 1983).

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