Conclusions and Discussion

Certain of the branch root cortical cells of the fern *Lygodium japonicum* Swartz contain fungal hyphae and are filled with a dense material other than starch. Starch is present, often abundant, in the cells not containing the dense material.

The presence of endophytic fungi in the gametophytes of members of the Schizaeaceae is documented (Clarke, 1936; Bierhorst, 1965-1968), and the presence of an endophyte in the roots of certain sporophytes has been mentioned by Britton and Taylor (1901) and Bierhorst (1966).

Identification of the material congesting the cells surrounding the stele and its mode of development will be the subject of a subsequent study.

Acknowledgements

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Literature Cited

Bierhorst, D. W. 1965. Older gametophytes and young sporophytes of *Schizaea melanesica*. Bull. Torr. Bot. Club 92 (6): 475-488.

Bierhorst, D. W. 1966. The fleshy cylindrical subterranean gametophyte of *Schizaea melanesica*. Amer. Jour. Bot. 53 (2): 123-133.

Bierhorst, D. W. 1967. The gametophyte of *Schizaea dichotoma*, Amer. Jour. Bot. 54 (5): 538-549.

Bierhorst, D. W. 1968. Observations on *Schizaea* and *Actinostachys* spp., including *A. oligostachys*, sp. nov. Amer. Jour. Bot. 55 (1): 87-108.

Britton, E. G. and A. A. Taylor. 1901. Life history of *Schizaea pusilla*. Bull. Torr. Bot. Club 28 (1): 1-19.

Clarke, H. M. 1936. The morphology and anatomy of *Lygodium japonicum* Sw. Amer. Jour. Bot. 23 (6): 405-413.

Johansen, D. A. 1940. Plant microtechnique. McGraw-Hill Book Co., New York. 523 p.

Sass, J. E. 1958. Botanical microtechnique. 3rd ed. Iowa State Univ. Press, Ames. 228 p.

Stoughton, R. H. 1930. Thionin and Orange G for the differential staining of bacteria and fungi in plant tissues. Ann. Appl. Biol. 17 (1): 162-164.

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A LOW-COST FREEZER FOR HOME CARE OF PATIENTS WITH HEMOPHILIA

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Abstract

A low cost home freezer was designed to maintain blood products at -40°C. The total cost of materials does not exceed $200, and construction is simple. This freezer is at present in use by patients with hemophilia A and has proven satisfactory in all respects in actual home care situations.

Hemophilia A patients have a far brighter outlook with the greater availability of blood products and factor VIII preparations in concentrated forms. The two next logical steps in care have been taken: 1) prophylactic therapy and 2) home care. Prophylaxis has been successful in the limited series where it has been tried. Home care is enthusiastically received by patients and physicians alike. Fewer published reports are available to date (Halden, 1970; Lazerson, 1971; Rabiner and Telfer, 1970; van Eys, 1971), but several additional hemophilia treatment centers are reporting unofficially great success. Prophylaxis is clearly optimal when infusions are performed at home. For routine therapy there is available a choice of cryoprecipitate (Pool and Shannon, 1965), commercial AHF concentrates (Abilgaard et al., 1966), or fresh frozen plasma obtained by plasmapheresis of high potency donors (Halden, 1970).

At present, cryoprecipitate is the most economical material in preparation and distribution but it has the disadvantage of requiring the lowest temperature for storage. This has prompted many programs to rely for home care on the more costly commercial concentrates or the use of enriched fresh frozen plasma which also can be stored at somewhat less cold temperatures.

To take full advantage of the local availability and relatively low cost of cryoprecipitate, the Cumberland Chapter of the National Hemophilia Foundation designed and built a home freezer which can be made at only a small cost, and which makes home storage of cryoprecipitate safe and practical.

Description of Freezer

We felt that the requirements of this unit should be that the freezer compartment be large enough to contain forty-eight (48) 5¼" x 4½" x ¾" cartons of blood products, that it maintain a temperature of -40° C, that the overall cabinet size be as small as possible, and have an alarm system in case the temperature rose above a safe level. We also felt that all components in the system should be readily available standard items.

The condensing unit finally chosen is a ¼ horsepower unit manufactured by Copeland (FSAH-0025-IAA), charged with Freon 502. This condensing unit which includes the compressor, condenser, fan, shut off valve and associated tubing, was selected because it is a standard item meeting all the requirements, and its component parts are readily available. Refrigerant 502 was chosen because of its stability, low temperature capability, and low toxicity.

The freezing compartment is constructed of 16 ounce cold rolled sheet copper because of the ease of handling, and its resistance to rust and corrosion. The freezing compartment size is approximately 12½" x 11¼" x 12". Approximately 80 feet of 3/8" soft copper tubing is used for the evaporator coils. The side coils are wound on the inside of the compartment for more efficiency, but for protection the bottom coil is wound on the outside. The side coils are fastened to the compartment with soft solder, and the bottom coil has a continuous bead of solder between it and the bottom of the compartment for better heat transfer.

It was decided to use capillary tubing to control the low side pressure of the system instead of a pressure valve for simplicity and dependability. It requires approximately 70 feet of 0.031 inch capillary tubing to make the system operate properly. After experimenting with the length of capillary and amount of freon 502, it was determined that less than one pound of refrigerant would be required.

A heat exchanger was constructed of a short section of 1 5/8" copper pipe. The capillary tubing was coiled inside and

TABLE I. Parts and Materials for Freezer

Quantity	*Description*	*Price as of January, 1971*
1	Condensing unit - Copeland FSAH-0025-IAA	64.60
1	Strainer and Dryer - Sporlan C-032	2.90
1	Thermostat - White-Rodgers 1609-100	14.55
100 ft.	Capillary Tubing - Robinaire CT 031	14.40
85 ft.	Copper Tubing, 3/8"	15.81
4 ft.	Copper Tubing, ¼"	.52
2 ft.	Wiremold #500	.38
5 lb.	Foam Resin - 34-742	4.60
5 lb.	Foam Resin - 34-843	5.15
2 lb.	Refrigerant - DuPont Freon 502	3.05
1	10" piece 1 5/8" Copper Pipe	1.32
10 ft.	Door Gasket - Jarrow #1210-10	2.47
	Misc. Brass Fittings	1.91
3 ft.	16 oz. Cold Rolled Copper	6.25
1¼ sheet	Plywood ¾", 4' x 8'	6.25
2 sheets	Laminated Plastic - 2' x 2' - Consoweld #K39	3.92
	Misc. Hardware and Paint for Cabinet	5.45
1 roll	Insulation Tape - Virginia Presstite Pt. 1	3.05
2 lb.	Solder, 40/60 Rosin Core	3.20
1	Sonalert Alarm - Mallory SC628	5.50
1	Battery - Burgess TW-1	2.30
	Misc. Wiring	1.40
1	Thermostat - Ranco 010-1419	11.20
	Total	$181.18

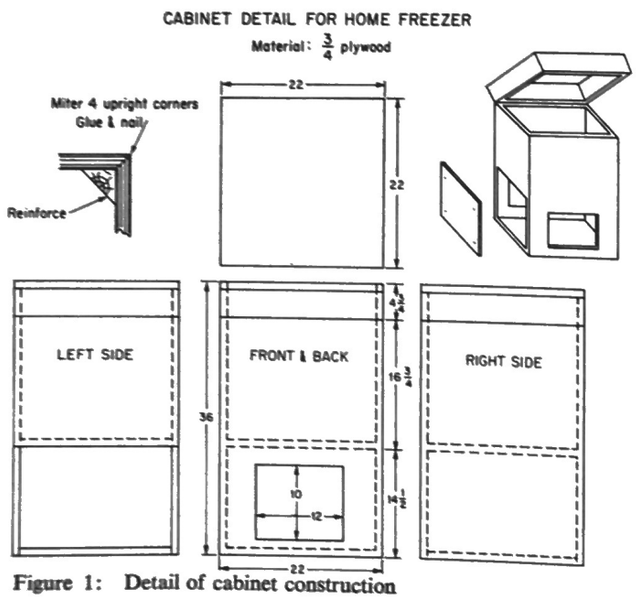

Figure 1: Detail of cabinet construction

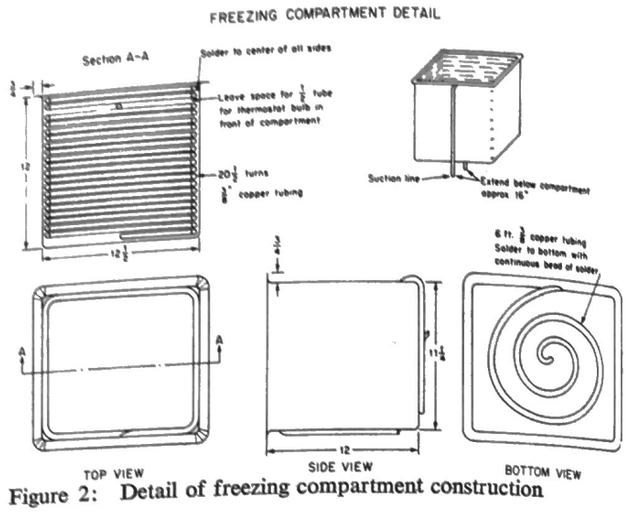

Figure 2: Detail of freezing compartment construction

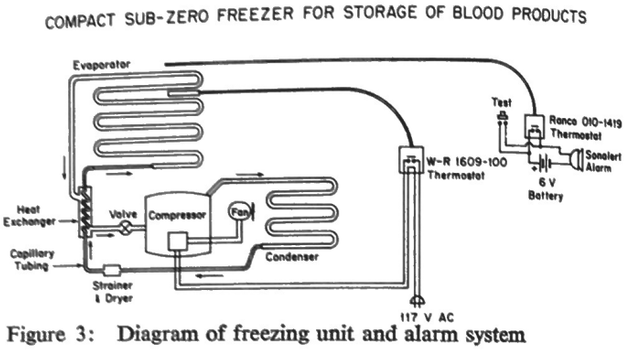

Figure 3: Diagram of freezing unit and alarm system

the refrigerant was returned through this pipe to further improve the efficiency of the system.

The cabinet is constructed of ¾" plywood of such dimensions to allow approximately 4 inches of polyurethane foam resin insulation on all sides of the freezing compartment and to have sufficient room below the compartments to mount the condensing unit, heat exchanger, and the associated tubing, thermostats, etc. The overall size of the cabinet is 22" wide, 22" deep, and 36" high. The door is located on top of the cabinet for efficiency. Ten inch x 12" openings were cut in the front and rear of the lower part of the cabinet to allow sufficient air circulation through the condensing unit, and grilles of expanded metal were used to cover these openings. One side of the lower part of the cabinet can be removed to service the condensing unit.

The freezing compartment is suspended in the upper part of the cabinet and foam resin is poured in the space between the freezing compartment and the cabinet, and also in the lid. A sheet of consoweld is used to cover the insulation in the lid and in the top of the cabinet. Two strips of Jarrow ½" x 1" gasket (#1210-10) are cemented to the consoweld on the lid to provide an air seal.

The thermostat used is a White-Rodgers 1609-100 set to operate at -46° with a five degree differential. The sensing bulb is inserted in a ½" copper tube four inches long which is soldered between two of the coils of the evaporator near the top of the compartment. The thermostat capillary tube is brought out through holes in the rear of the freezing compartment and cabinet, through a short piece of #500 wiremold mounted on the back of the cabinet, and into the condensing unit compartment through another hole.

Several approaches to the alarm system were investigated, and it was finally decided to use another thermostat to close the circuit of a Sonalert alarm which is powered by battery so that if there is a loss of power the alarm will still operate. This thermostat (Ranco 010-1419) is set so that the alarm will sound if the temperature in the compartment reaches −30°C. The capillary for this thermostat follows the same path as the operating thermostat, the sensing bulb is fastened near the