CRYONICS

ISSUE #12 JULY 1981

Selected Contents:

CRYONICS is the newsletter of the Institute for Advanced Biological Studies, Inc. and the Alcor Life Extension Foundation. Published monthly. Free to members of IABS and Alcor. Individual subscriptions $8.00 per year. Group rates available upon request. Please address all editorial correspondence to IABS, Inc., 1720 North Layman, Indianapolis, IN 46218, or phone (317) 359-7260. Alcor may be contacted at P.O. Box 312, Glendale, CA 91209, (213) 956-6042.

EDITORIAL MATTERS

If you have a red star at the top of this page, this is the last issue of your subscription. You may continue to receive CRYONICS by sending us money for a new subscription ($8/yr) or membership to IABS (Associate--$15/yr, or Supporting (voting)--$50/yr.).

This issue is a special double-sized one so that we can get caught up on some important submissions, especially the report of the Annual Meeting of the Society for Crybiology. You may rest assured that the August issue will be back to normal size, since IABS will be in the process of moving to California at that time. In addition, the September issue is being guest-edited by Dr. Thomas Donaldson.

Until further notice, please correspond with IABS c/o Stephen W. Bridge, 1720 N. Layman, Indianapolis IN 46218 (317-359-7260). We will announce the new IABS address as soon as possible. PLEASE NOTE: Checks for subscriptions, memberships, donations, etc. must be payable to The Institute for Advanced Biological Studies, Inc. --not to any individual. This is a tax-exempt organization and we must follow certain rules. Also, if you are making a contribution to Jerry Leaf for the electron microscope, please make your check payable to him and send it to Jerry Leaf, 13152 S. Blodgett Ave., Downey CA 90242. Do not send these contributions to IABS, which is merely acting to provide information in this case.

It is our intent to make CRYONICS a unique publication for persons who are already involved in cryonics. We do not plan to duplicate material from any other publications, except in very unusual circumstances. Please do not submit material to us which you are also submitting to other publications. With this in mind, it should be clear that any serious cryonicist should also be subscribing to The Immortalist, the monthly publication of the Cryonics Association. Subscription is available through membership in CA (minimum $15 Associate Membership) by writing Cryonics Association, c/o Mae Junod, Treasurer, 17534 Lamont, Fraser MI 48026. IABS members (CRYONICS subscribers are not automatically members) may receive The Immortalist for $5/yr. IABS members should send the $5 to us and we will send it to CA.

We can also recommend Anti-Aging News, published by Saul Kent, who is a long-time cryonics and immortalist writer. This monthly report is $27/yr. Write to 2835 Hollywood Blvd, Hollywood FL 33020.

CALIFORNIA LAWSUIT NEWS

The "multimillion dollar" lawsuit against former cryonics entrepeneur Robert Nelson and Buena Park mortician Joseph Klockgether closed in Los Angeles Superior Court on June 5th. The awards against the defendants totaled $928,594. The breakdown is as follows:

Judgements against Nelson:

Claire Halpert was awarded $2,300 for fraud and out of pocket expenses and $35,000 punitive damages as compensation for Nelson's failure to assume custody and care of Mrs. Halpert's mother Claire Dostal after reportedly being paid $2,000 to do so.

Marie Bowers was awarded $4,865 for a storage capsule, $10,000 emotional damages and $50,000 punitive damages, all arising from

ERRATA

p. 3. Correction: Dr. Lehr did not serve on the Advisory Board for the Cryonics Societies.

p. 5. Typographical error: A more realistic estimate of minimum cell volume should be 40%. A more precise way of stating this phenomenon would be that a cell cannot lose more than 60-65% of its water without suffering severe damage.

p. 6. Typo: In the discussion of Dr. Pegg's work, the use of the word "insulin" is incorrect. The correct word is "inulin," which is a vegetable starch used for evaluating renal function.

Nelson's failure to maintain her father, Louis Nisco, in cryonic suspension. Nisco was originally frozen in Michigan and transferred to Nelson's care.

Terry and Dennis Harris were each awarded $13,214.50 for fraud and out of pocket expenses, $100,000 emotional and $100,000 punitive damages in compensation for Nelson's failure to maintain their mother, Marie Harris, in cryonic suspension.

Judgements against Klockgether:

Terry and Dennis Harris were each awarded $100,000 emotional and $100,000 punitive damages for Klockgether's actions in assisting Nelson in the cryonic suspension of Mrs. Harris.

We understand that yet another lawsuit has been filed against Nelson and Klockgether by Laura Coronel, daughter of Pedro Ledesma, a Los Angeles man whom Nelson and Klockgether reportedly had placed into suspension following his exhumation. Michael Worthington, attorney for the plaintiffs in the previous suit, is reportedly the lawyer in the new case and is asking for damages of 10.5 million dollars.

Public relations problems for cryonics were further increased when sloppily written wire service stories made it seem that the judgement was due to the fact the subjects were frozen, rather than to the fact that they were allowed to thaw out. □

OBITUARIES

It is with the deepest regret that we inform you of the death of Audrey Smith, the Mother of Cryobiology. Dr. Smith died in England from cancer at the age of 66.

Dr. Smith was a gifted experimentalist whose work stands as the basis for all of modern cryobiology. It was Smith who, with Polge and Parkes, first reported the cryoprotective effects of glycerol (Nature 164: 666, 1949.) Following the initial discovery, Dr. Smith pioneered in the development of techniques for the freezing of sperm, blood and corneas. She is also to be remembered for authoring the classic book The Biological Effects of Freezing and Supercooling (Williams & Wilkins Co., Baltimore, 1961).

Perhaps just as important as her own contributions to cryobiology were her enthusiasm and ability to motivate and excite those workers who surrounded her. Her colleague David Pegg, in eulogizing her, cited this as a major reason for the existence of the cryobiology research group which grew up around Dr. Smith at Mill Hill.

In losing Dr. Smith we lose a truly great cryobiologist and a large chunk of the important history of that science. We are deeply saddened that Dr. Smith's enthusiasm, energy and huge store of personal and scientific information is forever gone.

****

Dr. Richard C. Lillehei also died recently of heart attack at the age of 53. Dr. Lillehei was a transplant surgeon and cryobiologist at the University of Minnesota and was well known for his flamboyant and innovative approach to both cryobiology and surgery. He was among the first to transplant the pancreas and kidney and was active in cryobiological research, pioneering in the application of microwave thawing and membrane stabilization using high concentrations of synthetic steroids. In 1967 Lillehei confidently pre-

dicted, "I expect to freeze and revive whole animals up to the size of dogs by 1970. The problems which remain are primarily technical."

Always at the center of controversy and a sometime friend of cryonicists, he served for several years on the scientific advisory board of the Cryonics Societies of America. We acknowledge Dr. Lillehei's support and contributions to both cryonics and cryobiology and mourn his passing.

****

Dr. Herndon B. Lehr, transplant surgeon and cryobiologist at the University of Pennsylvania Medical School, died at the age of 57. Dr. Lehr demonstrated successful cryopreservation of the canine intestine. Dr. Lehr also served as an advisor to Cryonics Societies. His contributions to cryobiology will be greatly missed. □

A REPORT ON THE 18th ANNUAL MEETING OF THE SOCIETY FOR CRYOBIOLOGY JUNE 14-18, 1981 ST. LOUIS, MISSOURI

By Michael Darwin

Introduction:

The Society for Cryobiology presented its meeting in conjunction with the annual meeting of the American Association for Tissue Banks. Both meetings were very poorly attended, with only 139 total registered (61 Cryo members, 74 AATB members and 23 "walk-ins.") This represents an all-time low for the Society and reflects a continuing trend of dwindling meeting attendance and membership. The Organ Preservation Symposium, which was by far the most exciting program, drew a peak crowd of 35 for the morning session, but only about 22 in the afternoon.

These numbers are extremely disturbing. They indicate that the Society for Cryobiology is not in robust condition by any means; and we can only speculate about what a continuation of this trend implies. With these facts in mind, we are urging that memberships in the Society be secured by as many interested cryonicists as possible. Certainly, as a minimum, a subscription to the journal Cryobiology should be purchased. There are many fine, technically oriented and professional people involved in cryonics. Any of these people would be a credit to the Society for Cryobiology. Our records indicate that approximately half a dozen cryonicists are ALREADY members of the Society, and we believe that doubling or tripling that number should be possible.

The question of institutional and corporate memberships has been raised again with the Society's secretary, Mary Douglas. In the past, such requests for information have simply remained unanswered. We are intent that this should not continue to be the case. We want an answer on this matter and we will pursue it until we receive one. We will be happy to provide some financial support to the Society, providing they are willing to take our money. Certainly, as far as IABS is concerned, we can guarantee no exploitation based on purchase of an institutional membership. The overriding question here is the continued existence and health of the Society for Cryobiology. That goal alone is sufficient for cryonicists to be content with.

Some Impressions of the Meeting:

It was with more than a little trepidation that I arrived in St. Louis. Traditionally, cryobiologists have had no love affair with cryonics; and this was certainly not the best time to be a cryonicist among cryobiologists. However, I must say that by and large any fears I had of shouting denunciation or rude rebuffs were quickly dispelled by the reality of a group of scientists who were first and foremost interested in the truth, in exchanging useful scientific information, and in answering questions about their own work, regardless of their prejudices about the questioner. During the four days I spent in St. Louis, I met with just about every important cryobiologist in the world. I was afforded the opportunity to talk in considerable detail about cryonics and the cryobiological research we cryonicists are doing. I think that most of the cryobiologists with whom I spoke came away from the meeting more thoughtful and certainly much more aware of the kinds of people, procedures and approaches currently being used in perfusing and freezing human beings. I feel very strongly that this exchange of information should continue. Certainly we have much to learn from cryobiologists. As you will see on the following pages, there was a fine selection of papers presented at the meeting which will bear quite strongly on the way we approach cryopreservation in humans.

I also believe that cryobiologists may have things of interest to learn from us. We are conduction research, and I believe it is work of genuine importance which will bear publication in the open literature. We are encountering problems in glycerolizing whole animals and in working with the central nervous system which will be of interest to cryobiologists. Of course, the only way to learn if what we are doing is worthwhile is to present our findings in an organized fashion to that most rigorous of courts: the community of working scientists. Only then will we be accorded the right to stand as equals in what IS our common endeavor--to advance the state of knowledge in cryobiology.

Finally, it must be pointed out that we share not only the most basic goal of acquiring knowledge, but also a much more important one: the prolongation of human life and the amelioration of human suffering. BOTH cryobiologists and cryonicists look toward low temperature biology as one means to improve the length and quality of life. As one cryobiologist gently pointed out, "even if there were no cryonics, there would still be a burning need for cryobiology in order to solve the problems of long-term banking of organs." Indeed, cryobiology as a science has already contributed an incredible amount of good with techniques such as subzero blood banking, sperm freezing and skin cryopreservation. There can be no question but that most of our goals are the same. We must now find the means to work together, using discretion, patience and a good understanding of where our goals and sensibilities differ. I have come away from St. Louis convinced that there is a caliber of people in both groups that can allow this to happen.

A Review of Critical Papers:

Harold Meryman of the Red Cross Blood Research Laboratory in Bethesda, Maryland opened the joint plenary session with a paper entitled *Current Concepts of the Nature of Freezing Injury and Mechanisms of Cryopreservation.* Meryman presented a lucid and fascinating

overview of theories of cryoinjury. Most of the really interesting new information was based on the work of researchers Williams and Fahy, who are working in Meryman's lab. Williams has demonstrated that certain varieties of cold hardened wheat, such as Karkoff, can reversibly lose lipid from their cell membranes during osmotic dehydration and volume reduction secondary to freezing. This mechanism allows the cells to shrink below the normally lethal 20% of normal cell volume. Meryman and his coworkers have demonstrated that this "minimum cell volume" beyond which further reduction is not tolerated is demonstrable in a wide variety of cell types and is constant at around 20%.

Meryman also reviewed the work of Fahy, which indicates that cryoprotective agent (CPA) toxicity is a principal cause of injury in the cryoprotected system. Cryoprotective agents act primarily by preventing a significant fraction of the water in the system from freezing out as ice. This process also acts to prevent lethal volume reduction of the cell. However, some ice still does freeze out of the cell and, of course, it does so as pure water, leaving less water inside the cell to dilute the CPA. Apparently this leads to very high concentrations of CPA, at levels which are damaging to the cell.

****

Joseph Davie of Washington University School of Medicine in St. Louis presented a fascinating paper on *Transplantation of Pancreatic Beta Islet Cells.* Mice were treated with Streptozoticin, which causes diabetes by destroying the islets which secrete insulin. Transplanted islets suffered the usual tissue rejection; but Davie and his coworkers found great improvement if the islet cells were cultured for a week at 25°C. By the combined use of culturing and the immunosupression of the subject animals on a one-shot basis with Anti-Lymphocyte serum, good long-term survival of the islets was possible. Davie's conclusion was that there is at least one class of cell in the islet population which initiates immunological action by the host to reject the graft. A number of pieces of evidence led them to believe that macrophages (white blood cells) present in the islets were responsible for triggering rejection. When islets were pretreated with a serum designed to eliminate macrophages, good long-term survival of the islets was also seen, even with no pretreatment of the recipient.

In order to determine if the islets which had been transplanted and survived long-term were still antigenic, Davie administered a fresh bolus of uncultured and untreated islets to the animals. In every case the animals rejected ALL of the islets, both the old and new, and the animals reverted to their former diabetic states. This work holds great promise for the treatment of diabetes in humans. One of the major obstacles to islet transplantation in humans has been the islets' high immunological sensitivity. Perhaps Dr. Davie's work has pointed the way to a solution to this problem, as well as giving a valuable clue about the nature of the rejection mechanism, which may find broad application in the transplantation of other organs such as the kidney and heart.

****

One of the most thoughtful papers presented on Organ Preservation was David Pegg's discussion of *Mechanisms of Cryoinjury in Organs.*

1) Mixed cell types. Cells differ in their requirements for maximal recovery. As Pegg pointed out, optimal freezing rates at the same concentration of cryoprotective agent may vary greatly from cell type to cell type. Organs represent a mixture of cell types and, therefore, a mixture of proper freezing techniques. Pegg noted that as you increase the CPA concentration, the sensitivity of various cell types to different rates of cooling and warming diminishes. Of course, there are still some cell types, such as liver parenchymal cells which have not yielded to any method of cryopreservation yet applied. His conclusion was that, if high enough concentration of CPA was present, varying requirements for freezing and rewarming rates could be reduced or eliminated.

2) Geometry. Even if you have control of cooling and warming rates, the geometry of an organ may make it impossible to apply the desired protocol for heat transfer. The good news here is that at higher cryoprtective concentrations, the requirements for rapid rates of cooling and rewarming are lessened. Pegg then mentioned work by Michael Taylor (presented later in the session) indicating that slower rates of cooling are highly desirable because they tend to restrict ice formation to less sensitive areas, at least in Taylor's research with muscle tissue.

3) Packing density. Under some circumstances, a high cell packing density considerably reduces the recovery of cryopreserved cells, even when conditions are otherwise optimal. This phenomenon has been observed mostly with red blood cells, and the mechanism whereby cells are injured by increased packing density is not clear. One proposal is that the density creates an inability for the cells to readily lose water to the extracellular space during freezing. It is not even clear to what extent modifications in cooling or rewarming protocol may alter this effect.

4) Extracellular architecture. The interrelationships of cells and extracellular structures such as basement membranes are crucial for organ function. Extracellular damage by ice formation may destroy an organ even though the individual cells recover. Pegg presented some fascinating, almost unequivocal, evidence for this type of injury in the rabbit kidney. He first glycerolized kidneys to 3M at 10°C, cooled them to -7°C (just above the freezing point of a 3M glycerol solution), perfused them for six hours and then deglycerolized, rewarmed and evaluated them on a perfusion column for insulin transport, albumin leakage and several other critical parameters. Pegg found that this treatment was damaging, but not grossly so. In fact, Pegg has been able to glycerolize and deglycerolize kidneys to 3M and have them recover sufficiently to support an animal as the sole kidney.

Pegg then took kidneys cooled to -7°C with 3M glycerol and froze them to -25°C for one hour. These kidneys were also evaluated on a perfusion column and were found to be grossly injured and failed to transport insulin. In order to determine if the source of injury was osmotic or mechanical, Pegg next took kidneys cooled to -7°C with 3M glycerol and, over a three hour period perfusing them down to -25°C, he increased the glycerol and salt concentration to 2 times normal in order to simulate glycerol and electrolyte concentration increases seen as a consequence of ice separating out during freezing. Pegg found that kidneys subjected to perfusion with 6M glycerol and

2x elctrolytes were not significantly more injured than kidneys which were were simply cooled to -7°C in the presence of 3M glycerol with no ice formation. Pegg concluded that the formation of ice was the single most damaging factor.

Additional corroboration for this point of view came in the form of an informal conversation with Dr. Collins of the Veterans' Administration Hospital in San Diego and Dr. Fahy of the Red Cross in Bethesda. While waiting in line for luncheon seating, a conversation was struck up about Pegg's findings and Dr. Fahy mentioned that he has papers soon to appear in Cryobiology which document mechanical injury from ice formation on an ultrastructural level. Dr. Fahy stated that electron microscopy of the rabbit kidney tubule and glomerulus demonstrated gross disruption of the tubules and glomeruli by ice. In some cases the formation of ice appears to have stripped away the vascular endothelium from the basement membrane. Dr. Fahy reported that the glomeruli appeared totally disrupted by ice formation and, indeed, were hard to recognize as such. It was not clear from our conversation if these experiments were conducted with high or low concentrations of cryoprotective agents.

Additional direct evidence for the significance of mechanical disruption from ice was presented by Michael Taylor of Pegg's group. Taylor's paper, *Patterns of Ice Fromation in Smooth Muscle, Determined by Freeze Substitution and Isothermal Freeze Fixation at -21°C*, nicely demonstrated a good correlation between the location of extracellular ice and subsequent contractive function of smooth muscle.

The previously mentioned Dr. Gregory Fahy of The Red Cross Laboratory also presented another paper which, while only the first intriguing step down a new road, raises such interesting possibilities that we have made a special effort to review it in depth. The possibility raised by Dr. Fahy is that organs might be preserved in liquid nitrogen without being frozen. Instead, these organs would be *vitrified* or solidified without crystallization. If the principles involved are ever translated into workable techniques, it might be possible to completely circumvent all freezing damage, with obvious benefits to cryonics. The review (beginning on the following page) is written by Dr. Corey Noble who, with the aid of tape recordings and discussions with Mike Darwin, has reconstructed Dr. Fahy's remarks and has gone to the scientific literature to round up appropriate references. SB

A POSSIBLE ALTERNATIVE TO FREEZING

By Corey Noble, Ph.D.

The last thing any cryonicist wants is to be frozen. Freezing can severely damage or destroy cells, and the skepticism of cryobiologists concerning the ability of future science to reverse freezing injury is hardly reassuring. So formidable is the freezing process that some cryobiologists dealing with organ preservation appear to be on the verge of giving up[1]. It is known that freezing to -80°C kills mammalian brains[2] and, in fact, that frozen brains actually crack, even when cooled slowly[2,3]. It is because of such destructive potential that many immortalists are not cryonicists. The probable injury seems so great and the probable difficulty of reversing the injury seems so overwhelming that they simply cannot believe that the possibility of success exists. Even cryonicists frequently wish that there were an alternative more attractive than freezing.

Such an alternative may have just come into view. At the 18th Annual Meeting of the Society for Cryobiology, held June 15-18 this year in St. Louis, Dr. Gregory Fahy presented a paper dealing with the vitrification of organs which could have profound implications for cryonics. According to Dr. Fahy, vitrification may be thought of as solidification without freezing. Rather than freezing, very concentrated solutions of cryoprotective agents become progressively more viscous or "thick" as they are cooled to very low temperatures, and at a certain temperature, called the glass transition temperature (T_G), they become vitreous or glassy. A glass is a solid with no crystalline structure[4]. It is essentially a liquid whose molecules have simply stopped moving. Without molecular motion, almost no change is possible, and preservation can last indefinitely.

The great advantage of vitrification is that it would totally avoid freezing injury. In addition to avoiding all freezing injury, vitrification would allow much greater lattitude in the cooling rates employed, since the existence of an optimal cooling rate is primarily a consequence of ice formation[5]. A biological system equilibrated with enough cryoprotectant to allow it to vitrify rather than freezing would be damaged only by exposure to the high concentration of cryoprotectant required for vitrification. But, as Fahy pointed out, the concentrations of cryoprotectant needed for vitrification are actually less than the concentrations produced during the course of normal freezing! Furthermore, Fahy also reported methods to reduce the concentration of cryoprotectant required for vitrification and to neutralize the toxicity of high concentrations of dimethylsulfoxide (DMSO), as will be discussed below.

A better understanding of vitrification can be obtained with the aid of the supplemented phase diagram accompanying this article. The curve labeled T_M is the temperature at which the solution melts. This would also be the temperature at which the solution freezes if there were no energetic barriers to the initiation of freezing, or nucleation[6]. But there are such barriers, and consequently nucleation usually takes place at a temperature lower than T_M[6]. Cooling below T_M without freezing is a situation known as supercooling. Supercooling is impossible below the curve labeled T_H. T_H is

the homogeneous nucleation temperature, and at this temperature there are no energetic barriers to nucleation. The curve labeled T_G is the glass transition temperature. As can be seen, T_H decreases and T_G increases as the cryoprotectant concentration increases until finally, at some particular cryoprotectant concentration, T_H becomes equal to T_G. According to Fahy, this is the threshold concentration required for vitrification. The diagram shown is a generalized one for a hypothetical "average" cryoprotectant. The numbers will be different for different cryoprotectants, but the general trends shown are common to perhaps all cryoprotectants.

Just as there is extensive data demonstrating the ability of cells, tissues, and organs to survive freezing under appropriate conditions, so there is also data demonstrating the possibility of surviving vitrification. Fahy gave the following four examples. In 1953 Luyet and Gonzales showed that embryonic chick brains survive brief treatment with 60% ethylene glycol[7]. This concentration is high enough to vitrify[7b], and, in fact, the brains grew in tissue culture after warming from -196°C. 12 years later, Farrant reported cooling whole guinea pig uteri to -79°C without freezing[8]. He did this by gradually increasing the concentration of DMSO while lowering the temperature to minimize the toxicity of this cryoprotectant. He was able to demonstrate full recovery of function in uteri treated in this way, whereas uteri frozen in the usual fashion to the same temperature lost most of their contractile response to drug stimulation. Although these uteri were not vitrified, merely cooling them another 40 degrees or so would have indeed vitrified them since the final concentration of DMSO (55% v/v) was sufficiently high to have made vitrification possible. Later, G. Rapatz similarly "Farranted" adult frog hearts to -80°C by using ethylene glycol as the cryoprotectant in concentrations up to 11 molar[9]. The hearts completely recovered in several cases and could have easily been vitrified by further cooling. Elford and Walter[10] successfully cooled intestinal muscle to -80°C using techniques similar to those of Farrant and Rapatz. In fact, in some of their experiments muscles were successfully cooled to -196°C (vitrified) and rewarmed with complete functional recovery (unpublished results). Another example not mentioned by Fahy involved the "Farranting" of guinea pig brain slices to -80°C. These brain slices were able to consume oxygen at about 75% of the pre-treatment rate after rewarming and removal of the dimethyl sulfoxide[11]. Finally, it should be noted that vitrification of the interior of the cell is apparently the normal fate of all cryoprotected cells cooled sufficiently slowly to avoid intracellular freezing: although surrounded by extracellular ice, such slowly cooled cells have been observed to remain unfrozen at temperatures below the glass transition temperature[12].

There are presently four technical problems which must be solved before vitrification can become a perfected technique. The first is delivery of the high cryoprotective agent (CPA) concentrations to the cells of the brain and subsequent equilibration of the CPA into the cells and axons. The second problem is CPA toxicity. The third problem is shattering and the fourth problem is devitrification.

Concerning CPA equilibration, Dr. Fahy reported some exciting data showing that he had been able to successfully equilibrate rabbit brains with 3 M glycerol, with excellent retention of normal brain histology. This was possible at temperatures down to 10°C. Even more exciting, he was also able to perfuse the rabbit brain with 56% v/v propylene glycol

and subsequently vitrify the brain, although he reported no attempts to ascertain brain viability. In response to a question from Mike Darwin concerning penetration of CPA into nerve axons, which are surrounded by a relatively impenetrable myelin sheath, Fahy mentioned experiments conducted by Milton Brightman, a neuroanatomist at NIH, which indicated that CPA might be able to bypass the myelin sheaths rather than passing through them. He also mentioned research by Leo Menz showing indications of CPA penetration into myelinated axons. (Checking through the journal Cryobiology, I gather that the reference he was referring to is reference # 13 at the end of this article.)

Concerning cryoprotectant toxicity, Fahy reported two new developments which might be very helpful. First, he found that it is possible to neutralize DMSO toxicity by using either urea or acetamide in combination with the DMSO. With DMSO + urea, a total concentration of 40% CPA was almost completely tolerated by kidney tissue at 0^{0}C. Just how high it is possible to go with this mixture without subsequent injury was not indicated. The second development was the finding that high hydrostatic pressures can substitute for part of the CPA needed for vitrification. High pressures lower T_H and raise T_G, so that the intersection between the two curves is shifted to a lower CPA concentration. At 1,000 atm, the amount of cryoprotectant required to vitrify is reduced by about 5% w/v for every cryoprotectant and cryoprotectant mixture studied. At this pressure, it would take 44% DMSO or about 39% propylene glycol to achieve vitrification. Kidney tissue was injured by this pressure if no CPA was used, but if 30% DMSO was used, there was complete protection against the damaging effects of high pressure! Unfortunately, 40% DMSO did not give complete protection against high pressure. Fahy suspects that the 40% DMSO+urea mix might give complete "baroprotection", as he puts it, at 1,000 atmospheres, but the experiment had not been done as of the time of the meeting. Still higher pressures, if they could be tolerated, might cut the requirement for cryoprotectant more dramatically, for example, up to a one-third cut at 2,000 atmospheres. This would mean that concentrations on the order of 35% CPA might be enough for vitrification, and these are relatively non-toxic concentrations. Clearly, the prospects for avoiding CPA toxicity while retaining the ability to vitrify are exciting. This is particularly so considering that Fahy's research is only in its very early stages, and better ways of neutralizing CPA toxicity, or pressure injury, or both, might clearly be forthcoming.

The next technical problem is shattering.[14] Vitrified solutions of CPA generally shatter when cooled 10-40^{0}C below T_G. This shattering is caused by the fact that the container holding the glass does not contract with cooling at the same rate as the glass. The tendency of the glass to adhere to the container and the necessity of the glass to contract leads to cracking. However, Fahy was able to prevent shattering of vitrified rabbit brains by removing the container below T_G but above the anticipated shattering temperature. Applied to the problem of preserving a human's identity, this implies that the brain must be isolated in some way from contact with the skull and, quite possibly, the meninges, either by actual removal or by some other method. Needless to say, the prospect of removing the brain raises hackles. But the isolated, glassy brain could be thoroughly padded and protected. Judging from Fahy's observations, the internal structures of the brain do not appear to act as virtual "con-

tainers" for each other. As an alternative to removing the brain, it should also be possible to store the body, or the head, at a temperature between T_G and the anticipated shattering temperature[15]. This might be done, perhaps, by storing in some substance with a boiling or melting point in the correct temperature range. A search for substances having little or no toxicity and little or no explosion hazard which might be appropriate for this purpose has shown that either freon or krypton slush might be used. Needless to say, this system of storage would also suffer from many difficulties, and it may just be that the many advantages of being able to store in liquid nitrogen will prevail. Some of the engineers in the cryonics community should investigate the feasibility of reliably maintaining temperature near -145°C.

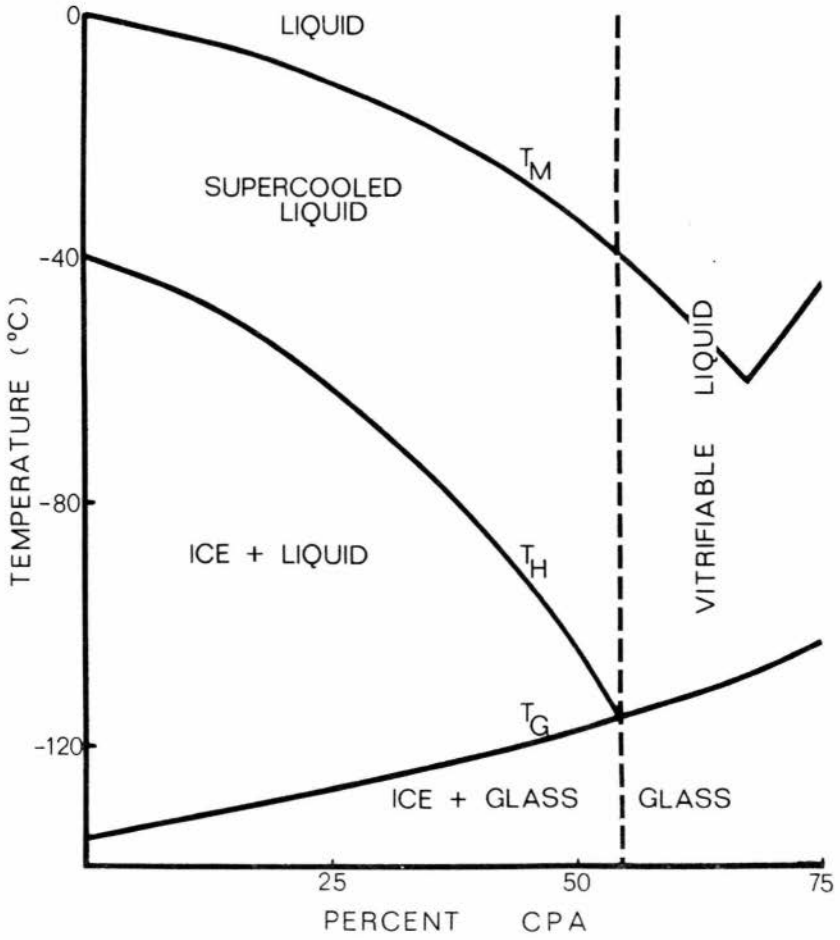
The last technical problem is devitrification, or freezing of the solution during the course of warming. Little seems to be known about the magnitude of this problem, but Fahy presented data suggesting that this problem might be avoidable even under unfavorable circumstances using currently existing rapid warming technology. Of course, from the standpoint of cryonics, we can wait indefinitely for appropriate rewarming technology to appear. It is enough that there are hopeful signs even with methods we can foresee now.

Since publication of The Prospect of Immortality, the problem of surviving death by utilizing low temperatures has grown progressively simpler. First it was realized that the goal of personal survival does not require the survival or repair of the entire body, but only of the brain, since a viable brain could be housed in a cloned or donated body or in an appropriate android body or other host. This realization reduced our major problem to one no more difficult than that which many cryobiologists are working on today: the cryopreservation of a single organ. Now the problem has been simplified still further. Instead of having to deal with a host of poorly understood destructive processes during freezing and thawing, we need only solve the three problems of cryoprotectant introduction, cryoprotectant toxicity, and shattering. (Devitrification we can leave for the future.) The first problem appears to be excitingly close to solution already. There are many hopeful signs that the second problem can also be disposed of sooner or later, and as a worst case it will surely be far more easy for the technology of the future to reverse cryoprotectant toxicity than to reverse the full spectrum of freezing injury. The final problem appears to be mainly an engineering problem and can probably be solved relatively easily, either by removing the brain or by storing at sufficiently high temperatures. (Temperatures 10-20 degrees below T_G should permit storage for hundreds of years.)

Although these considerations are exciting, much more research and effort will be required to solve the last three problems which stand between us and our goal. The research which remains to be done is unlikely to come out of any conventional cryobiology laboratory, including Dr. Fahy's, since the questions we must answer deal with the vitrification of large brains. We must show that large brains such as the dog brain or a brain removed from a freshly deceased human can be equilibrated with CPA and vitrified without cracking. We must learn how toxic high CPA concentrations are and how damaging high pressures are to the large mammalian brain. Finding the answers to these questions will require a major effort, but the prospect of vitrification is so attractive that a major effort in this area seems to be justified. With a lot of hard work, financial support from the cryonics community, and good luck, vitrification as an alternative to freezing may indeed eventually open a more promising door into summer for contemporary people.

REFERENCES

1. Cryo-Letters, 1: 83, 1979.
2. Brain Res., 70: 527, 1974.
3. Long Life Magazine, 4: 32, 1980.
4. Chem. Rev., 43: 219, 1948.
5. Science, 168: 939, 1970.
6. Knight, C.A. The Freezing of Supercooled Liquids. D. van Nostrand Company, Princeton, N. J., 1967.
7. Biodynamica, 7: 61, 1953.
7b. Biodynamica, 10: 167, 1968.
8. Nature, 205: 1284, 1965.
9. Biodynamica, 11: 1, 1970.
10. Cryobiology, 9: 82, 1972.
11. Unpublished research, Bioenergetics, 1974.
12. Cryobiology, 15: 257, 1978.
13. Cryobiology, 8: 1, 1971.
14. Biodynamica, 10: 47, 1966.
15. This concept is that of Michael Darwin.



EARLY STRUGGLES AND CRYONICS, ALONE by Thomas Donaldson, PhD.

Readers can hardly have escaped the thought that cryonics is just not a very popular movement. I'd be surprised if many readers of CRYONICS have more than 3 other cryonicists living within a radius of 50 miles. To anyone who seriously wants to be suspended, this situation is really very daunting. What would happen to YOU, if you had to be suspended? How many of those people around you could you trust to do what was nccessary, when not one of them has gotten up enough willpower to join a society as an Associate Member, let alone enough to be arrange for their suspension?

Many people will know me and the fact that I have lived (and still live) for the last 10 years in Australia. And if you think that you're alone in Iowa, you can imagine how alone I've felt in Australia! But don't despair; I'm writing this article because I felt that my own experience with cryonics ought to be interesting to all the rest of you sitting out in Oklahoma, North Dakota, or wherever you are. After a lot of false starts and wasted effort, I think I've learned a little about how to deal with this isolation, and write this to share it with you.

I remember being interested in cryonics way back when I was in Graduate School studying for my PhD in mathematics, which I now have. How I came to learn about cryonics is quite a long story, and not entirely relevant; but back in the sixties I was spending all my waking hours concentrating on my thesis, and cryonics was something very far away, something to do about someday. And perhaps I had been done a disservice by some well-known popularizations of the subject. I didn't really hear about cryonics from the horse's mouth, I heard about it first from Herman Kahn and a Delphi survey which he reported. This said that by about 2010, we are to believe, longterm suspended animation would be developed and we could all have ourselves frozen to go to the future. A big trouble with this, as everyone who reads this knows, is that it neglects the truly spectacular passivity people have shown towards the idea (There are lot of other problems with it too, but I won't go into that either). Perhaps a universally recognized suspended animation could theoretically be developed (as a pure matter of technology) by 2010, but if that's what you expect you might as well forget the whole thing, because it's not going to happen.

And so, with the back of my mind filled with the idea that someday I could buy my ticket to immortality and everything would be all right, I got a job in Australia, as a university teacher, and I've stayed there ever since. Mathematically it wasn't bad; I know for a fact that almost everyone I studied with lost their jobs when the big crunch on academic jobs came, and I've never heard of them since. Many of them were very bright people, too. But I was in Australia and I got tenure and still do mathematics research.

But along the way, while everything else was happening, there was CRYONICS. Ah yes, well, CRYONICS. I had not been in Australia for very long when it began to become quite painfully obvious to me that cryonics and suspended animation simply wasn't progressing at the dizzying pace that Delphi survey seemed to say it would. Indeed, it was hardly progressing at all. And I also knew about all those people back in the States whom I knew in Grad School, how they were all losing their jobs and failing to stay on as research mathematicians (which is what I had wanted to be, myself, and was). And so it dawned on me that if I wanted to be frozen, I'd simply have to do something concrete about it.

NOW.

IN AUSTRALIA.

Oh dear!

I wrote Ettinger, who sent me the address of two people who had, they said, founded cryonics in Australia. Their activity seemed to consist of giving one interview to the press and announcing to all the other cryonicists that they had founded a society. We put an ad in a national paper (THE AUSTRALIAN) and of course waited for the flood of replies and enquiries. This was about 1972, and I think we got 4 requests for information for an $80 ad. I answered them all. One man asked for my help in finding a charitable billionaire who would pay the cost of his suspension, because he couldn't pay it himself. Another man, living in Queensland, assured me that he'd been really interested in cryonics for years. He was a science fiction fan, and published a fanzine. And finally there was Tony; Tony ended up actually joining as a Suspension Member 3 years later, and has often gone on television (either with me or alone) to say to the Media Personality with the sport shirt and Ipana smile that, yes, he really did want to be frozen, and no, he didn't think they would revive his body so as to perfect advanced tortures on him. But Tony lived more than 200 miles away from me, and I realized quite soon that while Tony wanted to be frozen, he had no desire whatever to freeze. Which took the problem right back to where we began: if something happened to me, who would freeze me, after all? Response to our ad in THE AUSTRALIAN had not been such as to make us believe that Australia was filled with people eager to get involved in cryonics.

The first really concrete action I took was to start getting legal advice as to the best way to proceed. There was no uniform anatomical donation act in Australia; but on the other hand, there didn't seem to be any legal requirement to destroy people either. I started collecting together everything I could find about the legal situation in Australia. I took out an insurance policy. I almost made arrangements with the Cryonics Society of New York, with the idea that my body could be shipped to the US (what about problems with shipment? That is a problem to work on). But CSNY collapsed after the death of Gillian Cummings.

It was also in 1974, with my mind mulling over the problem of shipment, that I discovered a really important fact (I feel). I found out that the problem of shipment, although real, wasn't nearly as serious as I had thought, because MOST PEOPLE DON'T DIE WITHOUT WARNING. I had found Ann Cartwright's book, LIFE BEFORE DEATH, which gave the statistics on deaths with more than a week's warning. This meant that even if I COULDN'T solve the problem of shipment it would still make a lot of sense to join up. After all, an 83% chance of being frozen is far superior to a 100% chance of annihilation.

Then in 1975 I visited the US and on 1 January signed on as a Suspension Member of BACS. That was actually the beginning of a solution, but I didn't know that at the time.

My trip to the US was very illuminating in some other ways, too. It taught me that some people are so fascinated by cryonics that they can't ever do anything about it. The science fiction fan up in Queensland, when asked to try to maintain our correspondence list and publish a (2 page!) newsletter

wrote back that he was really spending far too much time on his fanzine and didn't want to get involved in cryonics because it would take time away from his science fiction. I was filled with sympathy towards him in his dreadful dilemma.

On my return to Australia in 1976 two things had happened. I had joined BACS, and I had started to write seriously for THE OUTLOOK, later THE IMMORTALIST, and later LONG LIFE MAGAZINE. My idea was, that some sort of magazine/periodical/newsletter would help to recruit people. I promoted it all over the place, in Australia. It must be said, though, that the continual changes of name and publisher did a disservice to any ideas I had about promoting cryonics by using a magazine. A lot of the people who subscribed were ultimately put off by an entirely reasonable feeling that this so-called movement was quite unstable and hardly worth risking one's life on. I still write for CRYONICS, but I feel less sanguine about the usefulness of a magazine for that reason.

Of course, in 1976 I was still left with the PROBLEM. BACS was on one side of the Pacific, and I was on the other.It may well be a much less serious problmm than I had first thought, but it certainly wasn't trivial. So that year I got seriously to work on the problem of shipment. It took a whole year to work out a partial solution, and it was only a partial one. What I did was to make arrangements in advance with a Sydney Funeral Director to collect my body and ship it in ice to the US. But that wasn't simple. For one thing, all the airlines were unanimous in believing that a body would have to be embalmed to be shipped to the US! Could they tell me why this was so? Yes, certainly, it was US law. Could they cite the law in question? Eventually, after a lot of work, US Customs Service was able to quote to me the law in question. Ah ha, I said. It doesn't say here that a body must ALWAYS be embalmed. It only says that a body must be embalmed if the cause of death was a quarantinable disease! And few people die of quarantinable diseases.

The airlines, however, were unmoved. If it says EMBALM in the IATA book, then embalm it is. (So you thought the matter was closed at that point, didn't you?)

I commenced writing letters to all the possible officials I could think of, asking them to verify that a body needn't be embalmed. I wrote to the US Customs, the US Public Health Service, the California State Board of Funeral Directors and Embalmers, the New South Wales Health Department, the Australian Customs Department, the Australian Health Department, and the Health Department of the Australian Capital Territory, where I reside. And all of them, after mulling the matter over for months and months and months, wrote me back a letter in which they said, yes, it looked as if my body wouldn't have to be embalmed. I was right, it said as much right there in the law.

So then, armed with this impressive pile of reading material, I wrote Panamerican and Qantas AGAIN. Both airlines thought the matter over and then wrote back, yes, in view of the letters I had brought to their attention, they would be willing to ship my body to the US in unembalmed condition. Qantas, however, only gave its permission if the shipment occurred that very year. Panamerican was a lot more forthcoming. They verified the US regulations for themselves and said they'd do it, no time limit, with the understanding that regulations DO change and they must always obey them.

And armed with THOSE letters I could get a Funeral Director to agree to handle shipment in unembalmed condition.

I'm not just talking about my problems here. I'm talking about YOURS. For anyone who lives outside a US state in which a suspension PLUS a shipment to Trans Time has NOT occurred already, the problem of legal shipment seems to be quite real. It is especially not one unique to people living outside the United States proper. Even in the US a recent suspension encountered a lot of difficulty just because the law seemed to say that embalming was necessary. The patient involved hadn't made any preparations at all; but with even a little bit of energy he might have found out that this problem existed and then devised a way around it.

But arrangements to have a Funeral Director ship you are really only partial. Is the Funeral Director going to take the right attitude? All I really had was a signed legal agreement and a vague possibility of lawsuit, which lawsuit if it happened would do nothing to bring me back. Besides, shipment in a coffin to the US would mean a delay of at least 14 hours minimum. So then, after 1976, I started working on Remote Standby.

The idea here was that Trans Time would fly 2 people down to Australia to freeze me if anything happened and I couldn't fly up to the US. A lot of problems existed for this idea, though. For one thing, just how was I going to pay for it? I'd LIKE for them to come while I was dying but not yet dead, and if I recovered I'd be up for some very heavy charges. Secondly, Trans Time or some other society would have to agree to do this in the first place.

I worked out a solution to the two problems through the next couple of years. Trans Time agreed to maintain enough supplies and equipment, and to maintain people with VISAS valid for Australia. I felt then and still feel that this was important not just for me but for anyone else in my situation. I can't possibly be the only person who lives far from a Suspension Center, or far from people who can be reliedupon to suspend me. Before Remote Standby was possible, anybody in my situation would simply have to find at least two other people who'd be willing and competent to at least commence their freezing. Plus all the necessary equipment and supplies, at a cost of $5000. Anything less would be worthless. But now with Remote Standby, that's no longer necessary.

Moreover, all readers out there in Isolation Land can note that before Remote Standby, if they wanted any kind of capability at all then the bare minimum would cost them $5000. As things stand now, they can purchase and hold some of the supplies and equipment needed and even a little bit helps. For instance, Trans Time would have to bring a lot of WATER. Water is heavy and so is freight cost for it. If you obtain and store enough WATER for a suspension you won't be up for a lot of money, but you'll still have helped to upgrade capability in your area. Even a little bit of money put into the problem every year can create something worthwhile: before Remote Standby this wasn't true.

That was one side of the problem. The other one was the COST. To fly two Trans Time technicians to Australia would cost over $10,000. Was I supposed to sell my investments and put them in a bank account at low interest just so Trans Time could use them to freeze me in the (objectively not immediately very likely) possibility that I needed freezing? Of course my insurance and other provisions for my Suspension

Fund would cover that cost, but then none of that would exist until I was dead, and I wanted Trans Time people on location and all set up BEFORE I had died and been put into the local mortuary for storage until TT came to save me.

There is a solution to this problem too. Insurance. I could write Lloyd's of London. They were well known for writing all kinds of strange insurance plans. Why not an insurance policy to cover Remote Standby?

But our problems were not over. How was it to be worded? After all, I couldn't expect Lloyd's to pay $10,000 every time I said that I was dying! A solution for this problem exists too; it turns out that Qantas was offering a special Family Reunion Insurance which would pay the airfares of Australian residents to the UK if any of their relatives became gravely ill there (lots of Australians come from the UK). All I had to do was to borrow the wording of the conditions under which this Family Reunion Insurance would pay off. And that insurance was underwritten by Lloyds in the first place. So I wrote to Lloyds.

I now know the names of two Lloyd's insurance brokers who will write Remote Standby Insurance. They won't yet do it on a group basis, though, although we have hopes that that will be someday possible. You have to write them individually. And it turns out that Remote Standby Insurance for $10,000 is very reasonably priced: for $150 a year you can get them to pay $10,000 in the event that you become critically ill. I have such insurance myself. If anybody wants to write to them, they are:

F. Barkworth and Co, Ltd, 62/63 Fenchurch St, London EC3M 4AQ ENGLAND

and

Crawley, Warren, and Co, Ltd, 8 Lloyds Avenue, London EC3N 3HD, ENGLAND.

The rates for $1000 Remote Standby Insurance should be about $50/year, and it is possible to get insurance for any amount up to $10,000. You have to write to them individually and negotiate. Take note: they are very very English, and I picture them sitting on high stools in a Ronald Searle sort of office.

It is now 1981, and I have a definite sense that PROGRESS has taken place in my situation. There is still a lot to do, of course. But something very funny seems to have happened: I started out alone, but now there are 5 other people in Australia with me, making use of the possibility of Remote Standby too. I'm no longer in Isolation Land! □

SCIENCE REPORTS

HOW TO TAKE CRYOPROTECTANTS OUT OF CELLS

When we put cells into a medium containing a cryoprotectant drug, the drug changes the osmotic properties of the water outside the cell. If the cell walls are more permeable to water than they are to cryoprotectant, the cell will first shrink and then swell up until enough cryoprotectant diffuses into it for the concentrations of drug inside and outside to reach equality. A reverse pattern happens if the cell is less permeable to water than to the cryoprotectant. Similarly, if we put cells which already contain cryoprotectant into a medium which contains none, then they will go through a reverse pattern as the cryoprotectant slowly diffuses outward through their cell walls.

Virtually all the cryoprotectants used to in practice are much less permeable to the cell walls than water, so that if we remove them from the cells the cells will tend to swell up. This shrinking or swelling stresses the cell walls, and a sufficient difference of concentration inside and outside the cell walls will cause them to burst, even without any other stress. However a variety of studies have shown that normal cells can easily withstand reasonable rates of addition or removal of cryoprotectants (cf. IA Jacobsen et al CRYOBIOLOGY 15 (1978) 302-311 for instance). On the other hand, cells previously frozen withstand this stress much less well. The edema (swelling) which happens after freezing is in fact one of the major practical problems to successfully thawing an organ or tissue.

We would expect that slow removal or addition of cryoprotectant to the solution would cause less stress to the cell walls. Up until now scientists attempting to freeze and revive tissues have chosen an exact protocol for removing or adding cryoprotectant more or less intuitively. However a recent paper by RL Levin and TW Miller at Cornell Universsity (CRYOBIOLOGY 18 9(198L) 32-48) has just presented a detailed theoretical study aimed at telling us exactly what sort of protocol is best for removing or adding cryoprotectant drugs to individual cell suspensions.

The full protocol is complex and I will not present it here. The basic method involves a stepwise process in which we first add cryoprotectant, then add water so as to counteract the swelling caused by the cryoprotectant, in such a way that the final concentration of cryoprotectant has increased. The process is then repeated until the desired concentration is reached.

In an appendix Levin and Thomas discuss how valid their work may be for freezing of tissues and whole organs. Simple modifications of their equations will allow estimates of the right method for tissues; however for whole organs the situation is much more complex and they are studying it now.

Since edema after thawing and with removal of cryoprotectant appears to be one of the most serious problems in freezing whole organs, methods to minimize it have obvious importance. We would hope for empirical verification of this work in the near future.

SWEETS FOR THE SMART: A SUGAR INCREASES MEMORY

By now we know quite a number of chemicals which will increase our ability to remember, if not our intelligence. They range from magnesium pemoline (Cylert) to the pituitary hormone L-vasopressin. Besides the possibility that such drugs may help us to improve our own memory and therefore the quality of our lives, such drugs are important because they help us to understand how memories are processed and perhaps eventually how they are stored.

A recent paper by a team of East German scientists (W Wetzel et al, PHARMACOLOGY AND BIOCHEMISTRY OF BEHAVIOR 13(6) (1980) 765-771) presents still another chemical, this time a sugar, L-fucose, which will improve memory ability. The connection between such sugar and memory consists of the fact that a class of proteins, the glycoproteins, which are proteins linked with sugars, may play a role in the storage or processing of information by our neurons (cf. H Mathies in ADVANCES IN PHARMACOLOGY AND THERAPEUTICS V, 1978). The particular sugar, L-fucose, seems to be one of the main sugars which make up the glycoproteins which may be involved in memory.

Wetzel et al report giving L-fucose to their test rats before training them on two differnt types of avoidance task. When they tested their animals 24 hours afterwards to see whether they had remembered what they had learned, the sugar increased ability to remember by about 50%, clearly significant. The isomer of L-fucose, D-fucose, had no effect on ability of the test animals to remember.

Even though Wetzel et al gave L-fucose to their animals by injection, these results are personally interesting because L-fucose may be much safer and easier to obtain that other drugs such as L-vasopressin. Furthermore, L-fucose is a new class of memory drug and the fact that it improved memory abiltiy tells us that glycoproteins are quite definitely involved in the processing of new information.

A STUDY OF THYMOSIN IN AGING

One of the characteristic changes of aging, known for decades, is the shrinkage of the thymus as we age. The thymus is a small gland in the upper part of our chest near our throat; by age 90, it is only 1/8th the size of that of a 9 year old. Ever since scientissts found that the thymus was important to our immune system, the fact that our thymus shrank as we grew older led them to believe that aging must involve important decreases in immune functiion. A second hormonal function of the thymus is to produce a hormone, thymosin, which improves the response of our white blood cells to foreign stimuli.

A full account of how our immune system acts would be quite complex. However it involves two main types of white blood cell, the T-cells and

the B-cells. The T-cells come originally from the bone marrow, but pass through a period of maturation in the thymus. Their role, among other things, can involve the direct killing of foreign cells, in particular such things as rejection of grafts and immunity against cancer cells. The B-cells stem directly from the blood-forming tissues in the marrow and act by producing antibodies to foreign substances.

A paper in MECHANISMS OF AGEING AND DEVELOPMENT 15 (1981) 29-39 by MJ Cowan et al presents some interesting information of the effect of thymosin on cell cultures of T-cells taken from old donors. Cowan et al had previously observed that the degree to which thymosin would increase the ability of T-cells in culture to attack foreign white blood cells would correlate with the ability of doses of thymosin administered clinically to improve the immune function of the patients who had donated the cells (DW Wara ewt al NEW ENGL JOUR MEDICINE 292 (1975) 70-74; DW Wara et al ANN NY ACAD SCI 332 (1980) 128-134). When they applied this same test to cells from aged donors, they found a similar response.

In addition to this test, Cowan et al also verified that the immune systems of the aged donors were weakened by showing that response of their cells to a foreign stimulus (phytohemaglutinin) was weaker than that in cells from younger donors. This adds additional support to work done by others (cf. HM Hallgren et al J IMMUNOLOGY 111 (1973) 1101-1107).

The major evidence presented in this paper concerns the effect of thymosin upon killing ability of the T-cells from aged donors. Even though it is only a test-tube study, the expense of carrying out a clinical test of thymosin in man means that it is important for providing evidence that such a clinical test is warranted.

AGING AND CANCER RISK

The continuing mania for cancer cures is one simple example of the failure of nonimmortalists to confront the real sources of their problems. It is easy to show that even a total ability to cure cancers would mean very little for our longevity. It is unlikely even to improve the quality of our lives, since we would replace cancer by other diseases as bad or worse, which now are rare only because few people live long enough to get them. Reasonable men cannot expect any improvement in lifespan or quality until something is done to retard aging.

Evidence exists suggesting that in fact we could only have significant success in curing cancer by directly dealing with aging. A fair number of animal experiments have shown that aged animals are more susceptible to cancer caused by chemical insults than younger animals of the same strain. These results vary with the strain of the animal and the particular chemical carcinogen used (P Ebbensen SCIENCE 183 (1974) 217; SD Vesselinovitch et al CANCER RESEARCH 35 (1975) 1963-1969; BL Van Duuren et al CANCER RESEARCH 35 (1975) 865-866). They are however not universal; some scientists have reported that with some strains and some chemicals, the ability of these chemicals to produce cancers did not vary with age or even became smaller with age (R Peto et al BRITISH JOUR CANCER 32 (1975) 411-426; DR Meranze et al INT JOUR CANCER 4(1969) 480-486). I believe that such variation in results is very likely and would not disprove a general trend of increasing susceptibility with age. The implication of such increasing weakness with aging is that even if no other cause intervened, aging people would soon become so delicate that even the slightest chemical insult would produce fatal cancer.

A recent study in JOURNAL OF GERONTOLOGY (36 (1981) 158-163) by Neal K Clapp et al provides one more experiment showing that aged animals grow more and more susceptible to cancers caused by chemical insults in their environment. Clapp et al report their study of cancers caused by diethylnitrosamine (DEN), a chemical known to cause cancer, when received by mice of varying ages, from youth to (2.5 months) to old age (17 months). They gave the DEN to the mice in their drinking water; the strain studied was the BALB female mouse. They found that the total number of mice in each age group which developed cancer after receiving the DEN was the same, but these cancers appeared much earlier in the old mice than in the young, on the average two months earlier. The DEN treatment changed the cause of death: control mice tended to die of leukemias, which were rare in the treated mice in preference to other kinds of cancer.

The psychological barriers among nonimmortalists against any frank attempt to deal with aging may be so great that even meticulous proof that cancer risk is increased by aging even in man would still fail to convince them to work against the problem. However this additional experiment, added to the others, may interest those willing to listen and hear. The strain of mouse used, the BALB mouse, shows a loss of immune ability with aging and may therefore allow us to relate the age breakdown of the immune system the increased risk of cancer shown by this experiment and others.

EVIDENCE THAT CHOLESTEROL IN FOODS INCREASES HEART DISEASE

A significant number of studies have implicated cholesterol in heart disease, even though the exact relation between the amount of cholesterol in the foods which we eat and our subsequent risk of heart disease remains imprecise. In particular, even now despite all the consensus among docctors on the subject, it remains unclear that moderate amounts of cholesterol in the diet of normal people, who are not suffering from any genetic condition which increases cholesterol level, will in any way increase their risk of heart disease. Several studies, in fact, have shown no relation between cholesterol in diet and heart disease for normal people (cf. for instance AB Nichols et al JAMA 236 (1976) 1948-53). Some doctors argue that these studies show that a general recommendation about cholesterol in the diet is not warranted (NAS, Washington, Food and Nutrition Board, NRC Guidelines Toward Healthful Diets 1980).

The arguments of course have continued. The other side of this question has recently been put in an article in NEW ENGLAND JOURNAL OF MEDICINE (304 (1981) 65-70) by RB Shekelle et al. Shekelle et al report the results of a follow-up study on cholesterol in the diet after more than 20 years. Twenty years ago they had studied 1900 middle-aged men, taking note of their diet, their blood cholesterol levels, and of some other variables. At the time of this first study, they made no suggestions to the men about how they should or shouldn't change their diet. Now, 20 years later, they studied the same group of men to see what the longrange effect of their diets had been. They report that among the population of men studied, higher intakes of cholesterol in the diet were associated with higher levels of blood cholesterol, and furthermore these average higher intakes of cholesterol over 19 years correlated with an increased risk of death from coronaries. Finally, most important with for anyone interested in changing their health situation, a change over the last 20 years in levels of cholesterol in the diet also correlated with changes in the level of blood cholesterol.

It appears from all the epidemiological and laboratory evidence that if food cholesterol affects levels of blood cholesterol, and blood cholesterol in turn affects levels of heart disease, then the correlation must be of a subtle kind at least as hard to identify and prove as that which takes place over time, with aging and antiaging drugs. It would be nice for antiaging drugs to receive even half the attention which dietary cholestrol has received. Nevertheless, we report this study because the information, and the debate, will concern anyone who wants to take longrange care of their health. □

AN INTERVIEW WITH CURTIS HENDERSON

"You gotta serve somebody."
---Bob Dylan

I first met Curtis Henderson when he was on his way across the United States in 1970 to attend the National Cryonics Conference that was held in Los Angeles. I was about 16 at the time and my impression of Curt was that he was a cross between Machiavelli and Mephistopheles. The ten years which have come and gone since then have shown him to be something rare and precious, far from my sinister first impressions. Above all Curt is an honest, reliable and unfailing friend. When I was 16, just before I met Curt, I called him up and asked many probing questions about how he was storing patients for the Cryonics Society of New York. Curt's response was to tell me to come out and SEE how things were done in New York. At the end of the summer, that's exactly what I did.

I have returned to Sayville, Long Island many times since that first summer. Curt and I have shared losses as well as victories. The comforting thing is that whether it's tragedy or triumph, Curt and his lovely wife, Diane, are always there to welcome me with the warmth of easily hospitality.

Perhaps the most valuable and important thing about Curt is his honesty and his advice. I have found both to be of the highest quality. Sometimes I have thought him to be mad or misguided. Usually I am proven painfully wrong. Curtis Henderson has taught me much of what I know about cryonics and has saved me an incredible amount of grief with good advice and stern admonitions. He has also taught me that sometimes you have to stand up like a man and say what you think regardless of what the timid tell you. He taught me that you must always stand by a friend, for if you can't do that, then even immortality isn't worth a damn. For that last lesson I am eternally grateful.

What follows is an interview with the self-described "last surviving member" of the Cryonics Society of New York, former C.S.N.Y. and Cryo-Span President, Curtis Henderson. The interview was conducted via telephone on June 5, 1981.

MD: The Cryonics Society of New York and Cryo-Span Corporation are no longer in existence. Obviously the approach used with those organizations failed to provide long-term stability. If you had it to do over again, what would you do differently?

CH: Well, there's not much I can say, because as far as I can see no one has yet found the best approach. Though I must say that the changes I would have made would have caused things to end up a lot differently than they did. Hindsight is always the best foresight. If we hadn't plunged ahead and frozen people we wouldn't know all the problems you run into.

MD: Would you go through those experiences again? Would you do it over if you could?

CH: Oh no! No, of course not! I think the approach would be one of much more deliberateness. I would have immediately obeyed instincts which told me: "This person isn't really serious; they don't understand what's involved and in the long run they're going to be a liability rather than an asset." I would never have involved myself in freezings where the relatives were just going through the motions without real psychological or financial preparation or commitment. If you take those kind of cases, then somewhere down the road you're going to find yourself with real problems. I would have done a lot fewer freezings.

MD: How would you have been more selective with respect to freezings?

CH: No people who call up in the middle of the night and say "Now I want to freeze Uncle Henry." These people get involved without really understanding what's required. The immediacy of the loss and the overwhelming panic they feel makes it impossible for them to understand the depth of commitment, year in and year out, that's required. If you take the approach we did then you quickly find yourself with a whole bunch of bodies that aren't being paid for. At that point an awful lot of nasty and very hard decisions have to be made. It's unpleasnt no matter how it turns out. It can turn out like Nelson's situation where he just drifted along until everything fell apart, or you can start taking positive action, in which case you're going to be called an S.O.B. for years.

MD: Why is that?

CH: 'Cause you're the guy that says if you don't pay up, then that's the end of the game. Unfortunately, that's about the size of it.

MD: Since disclosure of Nelson's mismanagement at Chatsworth how do you feel about him? In a way the whole Chatsworth mess has been something of a vindication for you. For years Nelson accused you of mishandling patients, I presume largely in response to your own serious questions about the nature and adequacy of Cryonic Interment's storage operations.

CH: What do you want me to say? I feel that for whatever reasons; madness or character defects, Nelson froze everybody that came along. Not only did he freeze everyone that came along, he lied completely about the price. He put those people in anything he had, and if he had ice

all right and if he didn't, well, that was all right too. He refused to allow anyone to see what was going on. Nelson was simply doing whatever would keep him going from week to week. If he could get someone to give him a few hundred dollars then that kept him going a couple of more weeks. It's as brutal and simple as that.

Any realistic evaluation of the cost of delivering storage he simply howled down. And that's what people wanted to hear. If you told the relatives of some of our suspension patients that storage was going to cost $150 to $200 a month, Nelson would come along and say he could do it for $50 a month. What chance do you have against that sales line? The people here were perfectly glad to hear that.

MD: Why was that the case? Weren't they concerned about possible differences in the quality of care? Didn't they investigate?

CH: In those days most of the people who had frozen relatives had done so for the wrong reasons. They acted out of guilt or because it was the dying individual's wishes. They didn't do it because THEY wanted it. So, they spent most of their time trying to escape from having to pay for it. Most of these people got involved because someone else wanted to be frozen and believed it would work. Unfortunately, these people didn't have the moral courage to say, "Stick it, forget it, we don't think this thing will work and it's a waste of our time and money." No matter how many times you gave them the opportunity to say "the hell with this stuff, I don't think it's worth it, " and end the whole charade they would continue on some weird basis or another. Inevitably, Nelson would say, "I'll do it, send me $2000, send me this or send me that and I'll do it and take the whole thing off your hands." That's exactly what they were looking for. It's the same kind of selling you see on TV everyday. It's the same way almost everything else is sold. The point is that everything else doesn't have to be delivered year in year out, who knows forever?

MD: How can you liken conventional salesmanship with what went on with Cryonic Interment?

CH: A similar situation exists with the stinking rotten US automobile industry. Well, the empire struck back. Look at Dresden today, then look at the South Bronx. Take a tour through Tokyo, then go to a Chrysler plant. You tell me who won the war?

The Americans for years made cars that were stinking rotten and fell apart. Never would they honor a guarantee. There you sat in the waiting room shuffled from recall to recall. Well, there's no need to park a lemon in front of the Chevrolet plant anymore. All you have to do is wave the Japanese flag. There was no quality in American workmanship and questions about economy, about WHO'S GOING TO PAY FOR THESE BIG CARS, were swept under the rug. Well, they got what they deserved.

MD: Do you have any advice for others active in cryonics at this time?

CH: If people really look at the profound changes we're asking for, they'll have a better perspective on the difficulties we'll encounter. Cryonics is only a small part of the total effort. I maintain that if you get to the point where you have to freeze someone he's in bad, bad shape. I mean really bad shape. And if he wasn't in bad shape before you froze him he will be afterwards. I lean much more towards aging

research. I feel this will make a lot of pressing social problems irrelevant. Take social security for instance. Well, now at last it's time for the government to start paying off. Only the payments are inconcieveably large and it just gets worse all the time. It would make a hell of a lot more sense to just do away with the problem in the first place.

MD: You mean eliminate the aging process?

CH: Yes, that's a very important point. You see most often science doesn't solve problems, it simply makes them irrelevant. Few people understand that point. If people don't get old then they don't retire. There's simply no need for a mechanism like social security.

Poor Reagan, he's really twisting on the pole now. The American people have paid into social security for 50 years and now they want to collect. They want to be supported in a style to which they should never have become accustomed. Reagan's either got to cut social security or raise taxes. It's just that we've reached the point where neither one of those things can be done. The only solution is to face the real enemy: people drying up on the vine, losing productive capacity and indeed consuming it.

MD: There's certainly a point in all that. It's a little known fact that better than one third of the BILLIONS spent on Medicare are spent on people during the last year of their life. Sophisticated medical care to treat symptoms of the underlying problem of aging is a vastly expensive and inefficient way to go.

CH: You and I know it, but they don't.

MD: You seem very pessimistic about cryonics. What do you feel people's chances are of surviving via cryonics today?

CH: Technically I don't think it's much of a problem. Sooner or later all the biology will be pretty well taken care of. The question is, "Who's going to pay for it?" Indeed, that's THE question of this age. On TV, every place you look the questions are not technical they are "Who's going to pay for it?" Whatever is suggested by anyone to solve any problem is seized on by politicians and salesmen who reassure you, "Don't worry about who's going to pay for it." That kind of approach has gone for years with cryonics and with the world at large. The only problem is that the time lapse between doing something and paying for it is getting shorter and shorter. That's what inflation is all about. Now, the question of who's going to pay for all these heroic life saving measures is the question of the hour. Who is going to pay for bringing these people back? More realistically, with double digit inflation who is going to pay for keeping them frozen?

MD: When did these realizations dawn on you?

CH: I think it was always there. When I got involved I certainly didn't envision things to turn out the way they did. When Mandell was frozen everything changed. Then we were faced with the hard realities.

MD: How is that?

CH: Fred Horn, CSNY's mortician, more or less bankrolled Mandell's freezing insomuch as the insurance policy never paid off. Which is not uncommon! Most people don't realize that when they buy insurance all they are buying is the right to sue the insurance company for payment.

MD: Why did the insurance company refuse to pay off on Mandell's policy?

CH: Because they thought maybe they could get away with it. The policy was going to be used to freeze the body and that was one of the reasons they cited in their refusal to pay.

MD: The whole issue of "no insurable interest" was raised?

CH: Yes, but then insurance companies will do whatever they can to get out of paying on a policy. ALWAYS! I can't say it often enough, ALL you buy when you buy insurance is the right to sue the insurance company.

MD: Was Mandell already dying when he purchased the policy?

CH: Well, there's another whole series of questions. They claimed he was. But they wrote the policy anyway. It's an important lesson because most people believe the insurance company will pay off without question. In truth the insurance company does everything it can to avoid paying off. Everything legally, of course.

MD: When and why did you first get involved with cryonics?

CH: I think it was 1964. It was before we froze anybody. It was then just a matter of getting out a newsletter, meetings, social gatherings. Cocktail cryonics. We assumed large corporations would ultimately get involved and manufacture capsules. We were wrong, and as you know, even to this day no large company will tolerate having their name associated with cryonics.

MD: For a while Minnesota Valley Engineering built capsules.

CH: That was a personal thing between Saul Kent; Ed Shuster, MVE's president; and myself. That resulted from just a chance meeting in a bar around '64 or so. We met at one of the Society for Cryobiology's annual meetings. It was just one of those things. At the time Shuster was interested but his company could not make tanks big enough. Later, MVE bought Hoffman Cryogenics, enlarged considerably and was able to handle the manufacturing of such a unit. We sat down and worked out a simple straightforward design.

Shuster made the first tank for us at cost, and that was strictly the result of a personal relationship between Shuster and us. In fact, all the capsules were made at or a little over cost.

MD: The Trans Time people are convinced that the multiple storage approach with very large dewars holding 10 or more patients is the best approach. Do you have any comments on this?

CH: As you know these things have a way of suddenly needing to be

moved. The minute you say you don't have to move them something will come up within the next 30 seconds to make you move them. When one goes bad there's a big difference between having a multiple storage unit (MSU) and having a single or dual patient tank (DP). When the can goes on a big one then you've really got a hell of a problem. Transportation of the tank becomes next to impossible. And the economy isn't that good. If you've got that many bodies in the first place there isn't that much difference in economy. You still get a signifigant cost reduction because your volume liquid nitrogen purchases are greater regardless of what kind of container you are using. Also, reducing liquid nitrogen costs isn't as critical as it seems when you look at the practical aspects of giant dewars. You can put just as many people in MSUs as you can in DPs, depending on how fat they are of course (laughter). The DP's give you flexibility and allow you to operate with a small or fluctuating number of bodies.

What I want to know is what do you do if an MSU goes down? I don't know what the hell you do. Put them all back on dry ice? That's a hell of a lot of dry ice!

MD: What are your plans for the future?

CH: Oh, I don't know. I guess they're not that much different from anyone else's. Survival, I suppose.

MD: Do you plan to get involved in cryonics again?

CH: Cryonics is going as fast as it can go. It's still in the get-people's- attention phase. Not guerrila theater, mind you. We've come along way from that. I think now you can credibly freeze someone with a technical chance, a good <u>technical</u> chance of bringing them back.

MD: Do you feel that was not the case in the early days?

CH: It's a matter of degree. I'm not going to speculate. Let's just say that things have improved. Improved much faster and better than I hoped they would. It's important to remember that it's not just a matter of odds and no one knows the answer to that question right now.

MD: What do you feel most needs to be done to change public attitude towards cryonics ?

CH: I think someone prominent needs to be frozen. The resulting publicity if it's handled right will result in the beginings of change in public attitude.

MD: What is your opinion of cryonics operations today?

CH: I believe that Trans Time is the most viable operation I know of.

MD: What about the Cryonics Institute?

CH: Well, they haven't frozen that many people. Are they really in

a position to do it? You may be able to answer that question better than I can. Have they got the equipment, morticians and technical people all lined up so that all you have to say is "give the word," send a certain amount of money and THE JOB WILL BE DONE? Trans Time has done that. When people call here I refer them to other organizations. They may bitch about Trans Time's prices but they pay and the JOB GETS DONE. What more can I say? I'm sure Trans Time has its problems, but for now...

MD: Is there anything else you'd like to say? Any important advice?

CH: Anybody that's really in this knows what the hell we're trying to do and realizes at some point the situation that they personally are in. When the light hits them it's like being saved (laughter). I love that Falwell, Jerry Falwell. I like that man. He's a man that's utterly honest and direct, you see. He tells it like it really is; if you listen to him. He says the world is divided into two groups; it's not fundamentalists and liberals, or communists and capitalists,--it's those who love Jesus Christ and those who hate him. And that's exactly right (loud) laughter). I mean, he's chosen his side. What can I say beyond that?

If you really face the fact that you're growing old and you're gonna die unless YOU do something about it... you see the light and your side on the battle is taken.

Those few people who finally come out of that tunnel and decide that they really hate humanity and love themselves are going to be the only ones with a chance of survival. I don't know if cryonics will be successful or even if gerontology will be successful. But I do think things are happening much faster than I ever thought they would.

MD: Well, I guess that wraps it up?

CH: No, you should tell people, "Do you want to be the last man to grow old and die?" There you'll be STUFFED in the museum of natural history and those 400-year-old people looking 13 will be filing by saying, "Jesus Christ, what did they have in mind then? Didn't they know it was the fleas on the rats?" If you want my personal opinion, 20 years ago I was certain nuclear war was going to blow everybody up, but it hasn't. I'm <u>still</u> certain nuclear war is going to blow everybody up.

MD: But we're still here!

CH: Yeah, yeah, I know. And isn't it wonderful? □

WAS IS REALLY NECESSARY?

The wave of litigation associated with cryonics which is currently sweeping California leaves us wondering "Was it all really necessary?" We are deeply saddened by the procession of grief and greed that the Nelson debacle has unleashed. Our only comment on this question is below, in the form of an editorial printed in Cryonics Reports in December of 1969. That editorial is reproduced below with the kind permission of Saul Kent, former editor of Cryonics Reports. Keep in mind that this editorial was written six years before the first lawsuit was filed. Also remember that several of the plaintiffs in the lawsuit that was just successfully prosecuted were referred to Nelson by individuals and/or cryonics groups that had access to this editorial and who should have pursued the questions it raised. They failed to act; they made referrals without investigating; they acted without a clear set of written ethics or standards; and most importantly they acted without certain knowledge of the conditions and facilities offered by Nelson and his organizations. The passage of time has demonstrated that these were deadly mistakes. Had the questions posed by Saul Kent been answered, much of the damage that cryonics has suffered in recent months might have been avoided.

Trouble in Southern California?

At last years' national cryonics conference in Ann Arbor, Mich., Marshall Neel's presentation concerned a new cryonic storage facility which, according to Mr. Neel, was close to completion. Slides showing the process of construction were offered, and it was stated that within a short period there would be a grand opening before the media, at which several bodies then in individual cryonic storage would be placed into a large multiple-body unit. Cryonic Interment Inc. was the name of the company that was said to own the facility; Mr. Neel was announced as President.

Since the conference there have been continual statements emanating from the leadership of the Los Angeles based company about the imminence of the opening of the facility.

As of December, 1969, the facility has not been opened and there is no evidence to indicate that it will.

We don't know what has been going on in Southern California because the entire operation has been veiled in secrecy. It is just this air of secrecy that troubles us.

A primary requisite for the credibility of any new program is the willingness of its' proponents to produce evidence of their claimed accomplishments; the absence of such evidence leads inevitably to suspicion and distrust. Honesty and openness is particularly necessary with regard to cryonics. We are dealing with the most serious of matters - an attempt to preserve life that requires considerable expense - and we simply cannot afford any actions that might lead to a lack of public trust.

We therefore plead with the leadership of Cryonic Interment Inc to set the record straight. What stage of development is your facility in? How many bodies are in your possession and what condition are they in? What problems are you having and how can these problems best be solved? We await answers to these questions, as well as evidence to support them. □

SCIENCE, MONKEYS AND THE MEDIA

by Jerry Leaf

I have often debated with myself about the value of interacting with the news media. If research is to have public support, the public needs to be informed. However, each of my personal encounters with the media has been followed by disappointment and regret. I want to share with you a perfect case of how not to deal with the media, along with some advice, from actual experience, that may reduce your own such regrettable encounters.

It began last April when representatives of Asahi Television, a Japanese network, arrived at the thoracic surgury research laboratory at UCLA. They said they wanted to document on video tape the research being done at UCLA by Dr. Gerald Buckberg, a well-known heart specialist with whom I am an associate. In addition, Asahi wanted to cover the research done at Cryovita Laboratories (my own laboratory, and not associated with UCLA). They claimed to be making a documentary about advances in medical research that could affect important changes in future medical practices. Dr. Buckberg declined the Asahi offer to videotape his work, since he would have no control over the context in which his research would be presented. Dr. Buckberg is not only a brilliant cardiac research investigator, but also a prudent and wise man regarding the media. Cryovita Laboratories and I, being less endowed with research funds, were inclined to allow Asahi to record an experiment, if Asahi paid the cost.

The next day, during a lunch engagement with the Asahi representative and a 15-man assembly of cameramen, technicians, directors, etc., we discussed the proposed videotaping at Cryovita Laboratories. After discussing the experimental design and laboratory environment, the Asahi representative asked if I would also be willing to place a human, whom they would provide, into deep hypothermia at 15°C. They were seriously requesting that I reduce a living human to a state close to clinical death, then reanimate him, all for a few feet of videotape to amuse their Japanese television viewers. This segment would dramatize the future possibility of human suspended animation. I told them how life-threatening such a procedure would be and that it had no scientific merit. I also pointed out that such drama goes beyond the format of a documentary on scientific research. Later, after considering their ignorance of the subject matter they were supposed to be documenting and the obvious intent to dramatize, I declined to allow them videotaping privileges at Cryovita Laboratories. My laboratory would not be a stage for docu-dramas.

In the interim, the Asahi crew had gone to the San Francisco Bay Area to videotape cryonic storage capsules at the Trans Time facility and document Dr. Paul Segall's experiments in deep hypothermia with hamsters. Later that week, Paul called and asked if I would come to the Bay Area and do an experiment, using a primate, for Asahi. Paul wanted to try his hypothermia experiment on primates and Asahi had offered a package deal if he and I would do two experiments. I was to do a total body washout using hypothermia with blood re-perfusion, possibly using some flurocarbon blood substitute to supplement blood requirements. I would be helping a friend and getting surgical

experience with primates, in this case Cebus monkeys, that may be valuable in the future. So I packed up my equipment and flew to the Bay Area that weekend.

Upon arrival in the Bay Area, I found the Asahi crew---all 15 of them---engaged in videotaping the dramatization of a human brought back from a state of suspended animation. For this purpose they were using a coffin with a plexiglass cover. Inside was a Japanese national, whom I assumed was only an actor, pretending to be frozen. For effect, they placed dry ice in the coffin, which was somewhat disconcerting since the actor was inside with the plexiglass cover in place. As the CO_2 vapor swirled about his face I hoped they wouldn't inadvertently launch another cryonaut into time travel.

I later met three Cebus monkeys that were purchased from the used animal pool at a nearby university. These were the most available animals and the least expensive, since Asahi wanted to keep costs as low as possible. Unfortunately, these animals were from a gerontology experiment and were over ten years old. Older animals would not be very resistant to physiologic stress. Normally we would expect to work with healthy, young adult experimental animals. Asahi was unable to secure the flurocarbon blood substitute they thought they had the influence to purchase, so they asked for the experiment to be changed from the planned total body washout to a cryoprotective perfusion and cooling to liquid nitrogen temperature for storage, similar to cryonic suspension procedures. Perhaps an aging monkey would be an appropriate model after all. Fortunately, Trans Time was able to provide additional supplies for the change in experimental protocol. In addition I insisted Asahi pay for one year of liquid nitrogen storage at Trans Time, to give us time to prepare for tissue analysis and electron microscopy.

Asahi didn't want to pay for storage cost and wanted us to thaw immediately after freezing. They didn't understand how uncontrolled thawing would affect the analysis. They didn't care if we did a legitimate experiment as long as it looked good on videotape. We spent considerable time explaining that we could not justify using an animal for an experiment unless it served some scientific purpose. Apparently, in Japan a monkey has little more status than a rat does in our country. Paul insisted that they purchase standard stainless steel holding cages, as required by the USDA, which are expensive. Using Paul's analogy, "to the Japanese, these expensive cages seemed like buying gold-plated rat cages." We were faced with demands to use an expensive animal model and experimental protocol, yet Asahi resisted paying the actual cost required. Asahi was constantly asking for more, wanting to evade the expense required, and making requests which would interfere with the experimental design. We finally did two experiments.

The first Cebus monkey was used to simulate a cryonic suspension. The animal was anesthetized and surface cooled with ice packs. Perfusion was done through the aorta and the right atrium with a glycerol perfusate and recirculation system such as we currently use with humans. Glycerol concentration was slowly increased to 30%. After perfusion, the animal was placed in a dry ice and alcohol bath by Art Quaife and cooled to approximately -75°C, then transferred to liqid nitrogen vapor for further cooling toward final storage temperature. Later this year we hope to do electron microscopy on the major organ systems, as well as other analysis.

The second Cebus monkey was used in an attempt to duplicate Paul Segall's hamster experiments. Harry Waitz and Paul Segall did most of the work on this experiment. The monkey was anesthetized, and respiration was supported on a ventilator. Deep hypothermia was induced by surface cooling with ice packs to a final systemic temperature of $6^{o}C$. Hyperventilation with 100% oxygen was used, as suggested by studies at UCLA, rather than the hypoventilation (high CO_2) used in the hamster model. Rewarming produced inadequate cardiac function and resulted in cardiac arrest. Contributory factors may have been: lack of an IV for pharmacological intervention, to rapid rewarming, waiting too long to begin CPR, and the age of the animal. Harry and Paul did a fine job, and I was sorry I was unable to assist them to a more favorable outcome.

Both of these experiments were carried out in the hope that we could study viability in hypothermia, above and below $0^{o}C$ in the primate model. Unfortunately due to the pressures of scheduling, and especially because of Asahi's reluctance to accept actual costs of the expensive primate model, the research environment was poor. Those of us who participated must bear some of the responsibility for not placing enough demands on Asahi. We were too generous due to our desire to do the research.

Once again I am asking myself, is it worthwhile allowing media into the laboratory when we do research? It may be that June Goodfield in her book REFLECTIONS ON SCIENCE AND THE MEDIA (pub. by AAAS, Cat. # 15BNO-87168-252-4, April, 1981) will be right about the media not making the distinction between fact and fiction for profit's sake. However, both the scientist and the journalist have professional obligations to the public, namely, accurate reporting of their findings. What can we do to promote accurate reporting? How should we deal with the media when asked to allow them into the laboratory?

Usually any representative of the media will tell you who he or she is, the organization that person represents and the specific reason for contacting you. Beyond this volunteered information it is important to find out how they were referred to you. What qualifications do they have for reporting science? What specific background information have they researched? Interview your media representative, and if that person doesn't seem qualified or professional, you can be assured he or she will not produce qualified, professional results. It is particularly important that they have done background research before they interview you. The truth concerning complex subjects does not come easily, especially about controversial ones. A media representative who has not done any homework will not have been exposed to enough information to ask key relevant questions. They will then leave you thinking they have "the" answers, only to find new questions you have not answered when they finally do background research. Then you are unlikely to have the opportunity to challenge misinformation they find in newspaper files and magazine articles.

An independant writer selling stories may feel he needs something "extra" to make his product attractive. The resulting exaggeration or falsehood, in either a positive or negative sense, is undesirable for us. Deal only with those independant media people who are willing to show you past work they have done demonstrating their quality and professionalism. Know where they will try to sell their story. Don't bother with anyone who sells stories to such unprofessional publications as the National Enquirer. Never give telephone interviews. If a media

representative hasn't time to see you personally, then he hasn't time to do your work justice. A face-to-face encounter gives you a chance to know him or her and avoids the unintentional impression that you are a faceless scientific instrument unleashed on an unsuspecting world.

Of particular relevance to the Asahi affair is establishing exactly what the media wants from you and communicating what you expect from them. There are two reasons I have associated with the media in the past: 1) to provide accurate information about low-temperature biology and medicine, and 2) to be able to do more research by requiring the media to pay for experiments they wish to record. If the media is ever allowed into Cryovita Laboratories, there will have to be a written agreement. Only experiments that fit into the experimental series I am working on will be done. I will provide a written protocol and cost sheet, then the media will be able to ask relevant questions and see exactly what expenses are involved. This is a valuable part of journalistic education. The agreement should designate exactly what the media will record and the conditions under which they will have to work. Never make changes in an experimental design that will jeopardize the actual scientific value of the experiment, as was requested by Asahi, and refused by me. These kinds of requests can be rebuffed more easily if you are <u>paid in advance</u>.

Media people always seem to be in a hurry to finish their assignments, as is to be expected since time is money and they have deadlines to meet. It is up to us to stand firm on what we think are the necessary conditions for a cooperative effort. Always be willing to say <u>no</u>. If the production company or writer involved doesn't have the time, money or knowledge to do the subject justice, why should we risk the negative potential of an unjust treatment? □

Time heals what reason cannot.
---Seneca

I always knew everyone died,
but I always thought in my case an exception would be made.
---William Saroyan 1908-1981

TRANS TIME, INC.

Life Extension through Cryonic Suspension

We offer the complete range of cryonic suspension services, currently maintaining ten patients in long term storage. We also offer cryonics videotapes, slides, and photos.

1122 Spruce Street
Berkeley, California
94707
for information:
(415) 525-7114

A PARTING THOUGHT

What follows is a quote brought to my attention by a patient on an artificial kidney machine who is awaiting a transplant. In sharing this quote with me she remarked that it gave her hope in her darkest hours and made the pain and complications of her medical care seem worthwhile. She gave it to me because she felt that being involved in cryonics I too would understand the frustration of always working and waiting for life to emerge from darkness. This piece speaks especially to those who have a loved one waiting in darkness now. It is with pleasure that I share it with you. M.D.

"Some will wait no more, and so they live not by choice but by supposed necessity with the conviction that every good thing in life will have a begining but no worthwhile end. They number the death of their hopes and watch their dreams dissolve into despair. Those who will wait no more see all the beauty of the world flower for a desperate moment and fade into insignifigance.

If we choose instead to wait, we must realize that at times the waiting may seem endless. Sometimes the waiting will occur in the darkness. But every man waited once in the darkness for his birth to be accomplished. Life manages in the darkness to take strong root and to await dawn. Even in the darkness there is a worth to waiting.

We wait because we are strong in the memory of all that life has been. Some say we are foolish to wait. No life comes from a tomb; death gives life no second chance. We wait because we realize we were born from the silence and the darkness and we are willing to wait even through the silence and darkness of death to be born once more.

- Rev. Anthony T. Padovano
Dawn Without Darkness
Paulist Press, 1971

INSTITUTE FOR ADVANCED
BIOLOGICAL STUDIES, INC.
1720 North Layman
Indianapolis, IN 46218

TO: