

CRYONICS

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EDITORIAL MATTERS

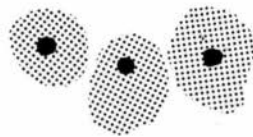
Things were looking pretty depressing for CRYONICS at year end. Many of our gift subscriptions were clocking out and few new ones had come in to replace them. We lost a fair number of subscribers when BACS withdrew from bulk purchase of the newsletter for their membership. Our mailing list had contracted by nearly a third and after a year of hard work to bring billing and mailing lists under good control and balance the books, we were once again staring the prospect of a DEFICIT in the eyes. The frustration was mounting.

Then, in the closing days of 1983 we received several checks in support of CRYONICS totalling almost \$1,500!!! That support has made all the difference in the world. Because of the belief and commitment of a few people we can enter the new year firmly on our financial feet ready to stride forward and take on new challenges and continue the battle with old ones.

We believe we are doing some important things with CRYONICS. We wish our efforts had broader appeal and that instead of 200 eagerly renewing subscribers (an a hundred or so less enthusiastic ones) we had 2,000 or 20,000! Being realistic we know that there is no way that is possible right now or in the immediate future. But we believe it will be possible someday—in the forseeable future. Until and/or if "someday" arrives, we will be heavily dependant upon the kind of support which was shown us in the closing days of 1983.

As the Editors of CRYONICS both Steve Bridge and I would like to sincerely thank the people who contributed in support of CRYONICS. Know that you have gone a long way towards eliminating some of the grinding frustrtion associated with the job of putting out the newsletter, and know that your generosity will not be forgotten by ALCOR.

LONG TERM STORAGE OF CELLS IN LIQUID NITROGEN



One of the less examined tenets of cryonics is that long term storage of living systems at liquid nitrogen temperature (-196 degrees centigrade) is possible without deterioration occurring. Theoretical support that this is the case comes from the Arrhenius equation, a mathematical predictor which matches observed rates of chemical/biological activity versus temperatures quite nicely. A great deal of practical evidence that long-term liquid nitrogen storage is possible is available in the form of sperm and tissue banks which engaged in the preservation of body tissues for transplantation, transfusion or reproduction. Unfortunately, most sperm/tissue banks are not really engaged in "long-term" storage" the way cryonicists mean long-term storage (decades or even centuries). A close examination of the literature quickly reveals that there are virtually NO good, systematic studies of the effects of prolonged storage time on tissue or even reproductive cell viability or fine structure.

Unfortunately, now and again little bits of evidence surface that perhaps all may not be well over long periods of time at liquid nitrogen temperatures. In the late 1970's two scientists, G. W. Salisbury and J. R. Lodge working at

the University of Illinois published a series of papers purporting to document very significant reductions in the viability of cattle semen with prolonged storage in liquid nitrogen. In 1979 several directors of the Institute for Advanced Biological Studies (now merged with ALCOR) visited with Dr. Salisbury and examined his data, facilities and techniques. We passed this information on to a qualified cryobiologist who provided us with much insightful critical commentary on Salisbury's and Lodge's work. The conclusion was that these researchers used poor experimental technique, sloppy handling of data, and drew unwarranted conclusions over and above the defects resulting from poor experimental design and execution. Still, the question of long-term effects of liquid nitrogen storage remained. As our cryobiologist consultant concluded in his commentary to us in April of 1979: "Nevertheless, there are other claims for deterioration at liquid nitrogen temperature. Takahashi has reported that sea urchin eggs deteriorate at that temperature. Therefore, although the evidence is patchy, I still favor going to liquid helium if at all possible. I have had my doubts about liquid nitrogen for some time. Nobody has stored anything at that temperature for 50 years yet, and I could easily believe that observable effects are possible after that time. Hence, whatever the merits of the semen data, the postulated safety of liquid nitrogen for storage over several decades is also unproven and is presently only theoretical. The practical tradeoffs of liquid nitrogen versus helium storage and the theoretical uncertainties deserve to be given more attention."

After much debate, it was decided to continue with liquid nitrogen storage for suspension patients. The extreme cost of helium (\$7.00 per liter vs. .36 for liquid nitrogen) and the need for vastly more expensive storage dewars for use with liquid He made switching impractical on the basis of the sketchy evidence that liquid nitrogen might not be cold enough for really long-term storage.

In the five years since the debate over the adequacy and safety of liquid nitrogen began little has changed. There have been a few anecdotal reports of lost viability with prolonged storage; however, good follow-up on those reports has usually disclosed that the material being evaluated was stored with sloppy technique: it was transferred frequently from dewar to dewar, cycled between liquid and vapor phases of nitrogen repeated over many years, or otherwise subjected to handling practices which raise questions about the quality of the data. This situation is unlikely to change. As far as we know, NO ONE ANYWHERE IN THE WORLD is conducting a systematic study to evaluate the effects of truly long-term liquid nitrogen storage on tissue viability. One of the reasons no such study has been or is being attempted is that aside from cryonicists, few people have any interest in storing any tissues for that period of time. Sperm bank people are banking sperm for living customers, and it has already been established quite well that sperm can be stored sufficiently well for 15 to 20 years to allow for successful insemination. Few if any of a sperm bank's clients would be interested in, or even around to, reproduce 50 years after making a deposit. With tissue banks, the need is more for temporary preservation until the material is needed: trying to better match up the availability and need. Farmers and those interested in banking animal semen have virtually no interest in long-term storage of animal gametes. The rate of "breeding up" or genetic improvement through artificial selection in livestock is so rapid that sperm or embryos from a mere five years before from a prize cow has little commercial value. Gamete storage for the farm industry is not so much to allow for the movement of the tissues through time, as it is to solve the logistic problems of getting one bull to inseminate a thousand cows scattered all across the United States or even the globe.

Short of conducting a systematic study on the effects of storage time on

our own, all we can do is to keep our eyes open and look for good anecdotal reports in the literature or even small controlled studies which indicate that liquid nitrogen is either safe or unsafe for long-term storage. Recently, our cryobiologist consultant who was previously mentioned sent us along just such an anecdotal report. This report was entitled "Successful Recovery of Cells Following Long-Term Storage in Liquid Nitrogen" and was reported on in the quarterly newsletter of the American Type Culture Collection, the world's largest repository for cell cultures which is located in Rockville, Maryland. This brief communication is by Robert N. Hull, Ph.D. of the Eli Lilly Research Laboratories in Indianapolis, Indiana. Dr. Hull's short paper reports on "successful" liquid nitrogen storage of seven cell lines from periods ranging from 16 to 22 - 1/2 years. Because the communication was so brief and many details were absent, we contacted Dr. Hull in Indianapolis and spoke with him about his work. Dr. Hull's laboratory was among the first in the United States to begin use of the liquid nitrogen storage of cell lines. At the time he began his work in this area, many of the preparation techniques were still being investigated. Dr. Hull employed relatively low concentrations for glycerol (10%) making the stored cells particularly vulnerable to recrystallization damage should any thermal cycling occur during storage. When we spoke with Dr. Hull we asked in detail about the storage protocol that was followed and the reliability of the personnel carrying it out. Dr. Hull reported that all his samples are maintained under liquid nitrogen and that not once in 22 years had there been a lapse in immersion storage! The dewars in his laboratory have been continuously serviced by the same two technicians for a quarter of a century, a record any cryonics organization would find enviable.

Dr. Hull did not evaluate the viability of the cell lines in any quantitative way. The cultures were simply thawed and plated out and success was determined by repopulation of the culture. Nevertheless, as he pointed out in our conversation with him, much can be inferred by the character and rapidity of repopulation of the culture. Cultures with few surviving cells or even a significant loss of cells following freezing do not plate out or grow as rapidly as cultures which have a large number of surviving cells. Dr. Hull stated that there appeared to be no difference in the plating efficacy of cultures stored for 22 - 1/2 years and those stored for a few days or weeks. While this report does not really answer the question of whether or not some deterioration does occur with prolonged storage, it does provide much reassurance that massive loss of viability over a 20-year storage period does NOT occur at least with somatic or body cells, as had been suggested to happen with gametes by Salisbury and Lodge. It also points up something which is becoming ever clearer as we track down more and more anecdotal reports: good storage technique has a tremendous amount to do with the stability and long term viability of cells stored at liquid nitrogen temperature. It would behoove us to learn this lesson well and take every precaution to avoid even transient "slight" warming of our suspension patients during storage or transfer operations.

THREE WHOLE-BODY PATIENTS CONVERTED TO NEUROPRESERVATION

On November 1st, 1983 two ALCOR whole-body patients were removed from liquid nitrogen storage and converted to neuropreservation. These two patients were without funding for long-term care and were faced with traditional interment unless a cost effective solution could be found. After nearly two years of complicated legal negotiations the patients were finally converted to neuropreservation and the rest of their remains disposed of conventionally. Since these patients had no trust funds and were essentially "charity" cases,

they were converted to neuropreservation first in order to evaluate the high speed electric sawing technique we had developed for this purpose. The operation went fairly well with a few logistic and technical snags developing, but with exposure time out of liquid nitrogen being confined to 3 to 5 minutes.

With the experience gained from these two initial operations we made a few changes in our protocol, undertook better organization and proceeded to the Bay Area to assist Trans Time with the conversion of one of their whole-body patients (who has an inadequate trust fund) to neuropreservation. This operation went much more smoothly than the first two with patient exposure to ambient being approximately 1 minute or less, and with the patient's head being sprayed with liquid nitrogen for all but 15 seconds of that time. Total time from the application of the saw to completed conversion was 61 seconds with immersion in liquid nitrogen following immediately afterwards.

ALCOR has had the opportunity to perform a thorough post mortem examination on all three bodies and we will report on the results of this examination in a future issue of CRYONICS. We can say right now, even before the final draft of the paper has been written, that we have learned a tremendous amount of direct importance to cryonics and the preparation techniques we are and have been using.

A great deal of thanks and credit belongs to the Trans Time team for their good organization and outstandingly well designed and executed plan for isolation to protect personnel from contamination with tissue particles generated during conversion. Without any doubt this was one of the most smoothly executed cryonics operations ever undertaken, with every detail planned out and every likely contingency covered. The entire operation was a testimony to the importance of practice and the development of skill in carrying out cryonics operations. Our thanks to Trans Time for allowing us to participate and our congratulations on a well-organized and well-planned operation.

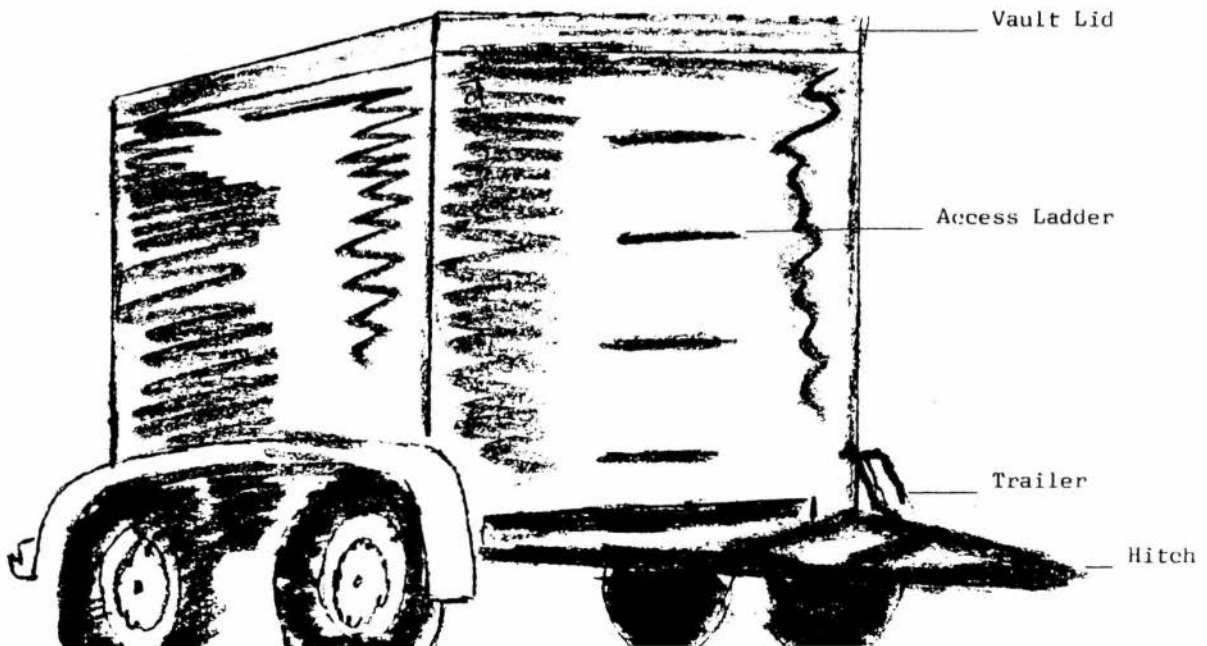
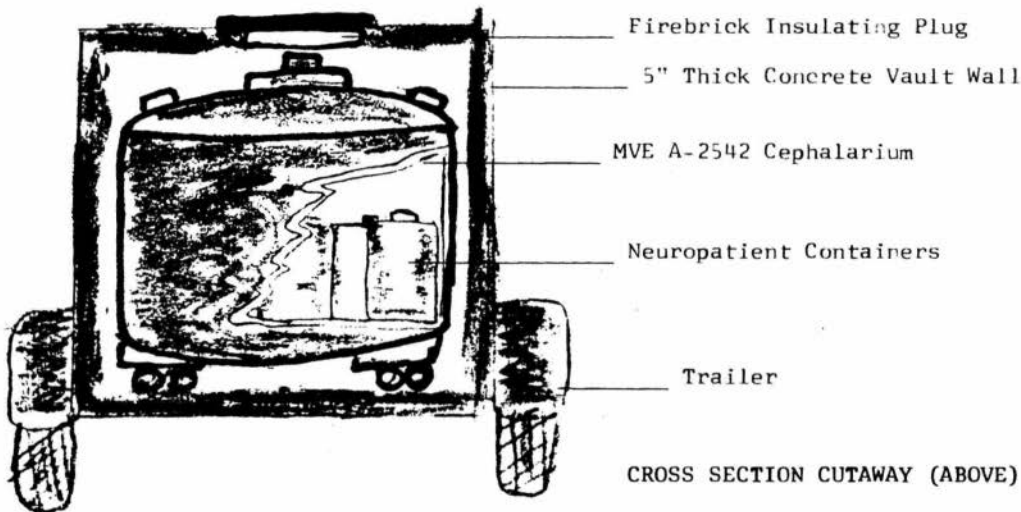
PROTECTIVE VAULT PROJECT

In the December 1983 issue of CRYONICS we reported on plans to construct a heavy, steel reinforced concrete vault mounted on a trailer for protection of our A-2542 cephalarium. Preliminary sketches of the unit have now been developed and several quotes have been obtained which reflect some changes in design plans which have occurred over the past month. A more or less final configuration for the vault is shown below. We anticipate that the vault will be a cube 45 inches on an outside edge with 5-inch thick walls, weigh 7,624 pounds and be mounted on a trailer with two 6,500 pound capacity axles. We are hoping to be able to cover the outside of the vault with Cease-Fire 2000 high temperature insulating foam. The Cease-Fire foam is a relatively new product which is normally used to make repairs to or insulate blast furnaces, coke ovens and other high temperature devices. The material is about 1/3rd as dense as concrete and when applied to the surface of the vault should protect the mechanical strength of the concrete during even an extended fire as well as increase the time it will take to reach the boiling point of water inside the vault from 30 minutes to over 2 hours. No doubt a number of other design modifications will be made in the course of building the vault--IF THE VAULT GETS BUILT.

In order for this project to go forward we will need your help in the form of financial assistance. The majority of the officers of ALCOR are agreed that this project should be paid for in large part by directed donations--in other words, by money contributed expressly for this purpose. If there is any way you

can help, please, now is the time to do it. There is little doubt that successful completion of this project will result in much greater security for all of our patients. Once the dewar is positioned in the vault we should be highly resistant to damage by earthquake or fire. In fact, if the vault performs to design criteria it should allow the cephalarium to withstand a massive earthquake with collapse of the structure and even a fire following the earthquake. At no time in the past has such security been available to suspension patients. It is precisely this kind of high quality safeguarding of our patients which will be necessary if they are to have a good chance of remaining in suspension over the really long haul. We owe it to them and to ourselves to take these kinds of protective measures.

Steel Cover Plate



WHEN TO SEND LITERATURE

Periodically we all read or hear in the news media about tragedies which seem to cry out for cryonic suspension. For some of us the loss of an admired celebrity or writer may fill us with frustration and loss and motivate us to try to contact surviving family and friends with information about cryonics. About a year and a half ago we reported on the attempts of some well meaning people to get Ayn Rand frozen shortly after her death (CRYONICS #22 May, 1982.) At that time we pointed out that the time to tell someone about cryonics is before they or someone they love and care about dies. In view of an article which appeared in the Los Angeles Times on November 24, 1983 this advice is probably worth repeating.

The L.A. Times article we are referring to tells of the case of a young Long Beach couple, Ginger and Adrian Roberts, whose two-month-old daughter Starla suffered a cardiac arrest (apparently as a result of Sudden Infant Death Syndrome, more commonly known as "crib death") and subsequent brain death. The Roberts's, a devoutly religious couple, have refused to believe the physicians attending their daughter and insist that God will restore their daughter to good health and normal mental function. Physicians attending the child wish to discontinue life-support and pronounce the child dead. The Roberts' have refused to allow them to do this and have even threatened court action should the physicians halt "life-support." It is obvious that these sincere, if simple people are suffering a great deal and that they do not really understand what has happened to their daughter. Judging from some of the mail they have received, some cryonicists or some people with access to cryonics literature don't understand the situation either. We say this because the L.A. Times article in reporting that the Roberts's have received a lot of harrassing and hateful mail (in response to an earlier article written about their plight in the Times) mention that "There was even a brochure from Trans Time, Inc. suggesting that Ginger and Adrian Roberts freeze Starla through the company's process of cryonic suspension—the freezing procedure by which patients are preserved after pronouncement of death for possible future restoration to life, health and youth." The implication was that the literature sent by some well-meaning person out there was just another slap in the face of these bereaved and financially overextended people (the child's medical bills were reported in the initial article to be over \$1,600 per day).

The point of all this is that the time of death is NOT the time to tell people about cryonics. Indeed, as we have repeatedly pointed out in these pages, when someone has died or is very near death the family has little or no ability to consider things carefully and make an informed decision. In the long run (and as recent events with BACS/Trans Time have shown) and sometimes even in the not-so-long-run this means bad consequences for the cryonics group and the next of kin who made a decision based on desperate impulse rather than careful consideration. It should also be noted that in the case of little Starla Roberts there was probably little even cryonic suspension could do for her after many days on a respirator in the absence of any blood flow to the brain. As we have repeatedly tried to emphasize, brain "death" with no blood flow followed by days of respirator support of the patient at normal body temperature results in complete disintegration and liquification of the brain. Seven days after Starla was pronounced brain dead, when an article first appeared about her in the L.A. Times the question of her cryonic suspension would have been as inappropriate as suggesting cryonic suspension seven days after burial—in the absence of embalming.

While the intentions of the person who sent along the literature to the

Roberts's were probably good, the results were simply counterproductive. Thousands of people no doubt read the L.A. Times article mentioning Trans Time and cryonics in a very negative way. Cryonics already has enough of a reputation of preying on the grief and panic of the dying or their relatives without this kind of inappropriate action—no matter how well intentioned.

One final word of advice is probably in order. For those who simply feel compelled to tell grief stricken or bereaved people about cryonics it is certainly best to do this in person or by telephone—not via the mail. Most people respond better to a genuine, emotional expression of sympathy and a desire to help than they do to a few cold, impersonal sheets of paper. In a situation like the Roberts's, a package of cryonics literature is just another assault by a hostile and cruel world. Such assaults are something all of us can well afford to live without.

REFLECTING FORWARD

Despite some problems and setbacks, 1983 has been a pretty good year for ALCOR. On the minus side, we experienced a number of serious headaches with our mailing list and billing system which required a great deal of time and effort to correct. We also experienced some expensive problems with our computer system, as well as the usual quota of minor headaches and administrative inconveniences. But all in all it has been a year of steady progress. Looking over "Reflecting Forward" from February of last year, I am very gratified to see that we have achieved most of our objectives. We have continued to accumulate a solid core of workers who are willing to spend their time and energy working to improve ALCOR and their own chances. The tremendous effort put in by Hugh Hixon and recent new ALCOR member Simon Carter on the computerized mail handling and billing system is an impressive feat in and of itself. I believe the appearance and character of our literature has improved steadily over the past year and this is the fulfillment of yet another milestone we set for ourselves over a year ago.

Certainly, there can be little doubt that there has been a vast amount of improvement in the emergency responsibility and perfusion capability here in Southern California. As far as we know ALCOR is the only cryonics organization with an active on-call system employing 24-hour coverage with a trained rescue technician carrying a paging unit. The several training sessions we have had over the course of the past year have served to better acquaint team members with their roles and responsibilities and to build skills which are essential to quality cryonics operations.

Most importantly, ALCOR has moved quite aggressively to protect its suspension patients and has achieved the milestone of three conversions to neuropreservation preventing the loss of three people who would have otherwise had no chance. As a consequence of these actions we have learned a great deal about the physical and biological effects of cryonic suspension which was previously unsuspected or unconfirmed.

In a related area, the ALCOR research project which involves glycerol perfusion of the cat has moved slowly forward, and is in fact picking up again after a hiatus of nearly four months as result of other cryonics activity.

Perhaps the most impressive milestone achieved (and the one which we had the least hope for) was to improve our cash flow situation. In these, the closing days of 1983, we have so far received \$8,000 in donations—with \$7,000 of that being "undirected" or for use as ALCOR chooses to further cryonics. In two years our cash flow has gone from a little over \$2,000 a year to nearly \$30,000! This is kind of growth in support we need if we are to survive. A big

part of our objective for the coming year will be to demonstrate that we deserve such support and to give everyone who has helped us in the past every reason to continue doing so. It is a big responsibility.

Our goals for the coming year will be even more challenging than in the past. We want to expand the number of speaking engagements and seminars we give (at present time the average is about one every six weeks). We want to bring up our high school out-reach program and begin making changes in our educational/promotional approach to bring in more new people. We sincerely hope we can wrap up the ALCOR research project and get the paper written by the end of 1984.

On the physical front we would like to see vault construction completed by 1984 and our patients moved into it. Procurement of better facilities to house our research animals and the beginning of the brain preservation project are two priorities we hope to see realized by the end of 1984.

All in all the past year has been an outstanding one for ALCOR. We believe we have made a lot of good decisions. We hope our judgment remains sound in the coming year, and that we continue to receive the ever broadening and generous support of you, our members. I believe ALCOR is headed for great things. I believe we have a good chance at success in our ultimate endeavor—the development of suspended animation and the rescue of those we love and care about who are now waiting in liquid nitrogen. Stick with us and we might just all make it!

Michael Darwin (Federowicz)
President, ALCOR Life Extension
Foundation
December 25, 1983

SOME OF THE LAWS WE LIVE BY

Bucy's Law: Nothing is ever accomplished by a reasonable man.

Levy's Eighth: No amount of genius can overcome a preoccupation with detail.

Weiler's Law: Nothing is impossible for the man who doesn't have to do it himself.

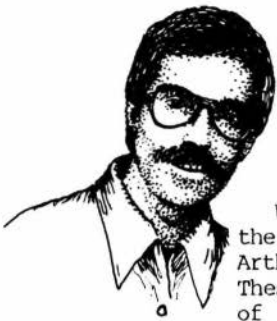
Clarke's Laws:

1) When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.

2) The only way to discover the limits of the possible is to go beyond them to the impossible.

3) Any sufficiently advanced technology is indistinguishable from magic.

The Golden Rule of Arts and Sciences: Whoever has the gold makes the rules.



INTERVIEW WITH MICHAEL DARWIN (FEDEROWICZ)

By Simon Carter

Work on this "interview" began in December of 1982. Many of the questions, and more than a few of the answers, have come from Arthur McCombs, Hugh Hixon, and most recently, from Simon Carter. These people are by no means in agreement with all, or even most of what I have to say here. However, singly or as a group, I think they would all agree with the closing statement and I thank them for that, as well as their patient assistance.

--M.D.

Why did you first become interested in cryonics?

I was extremely attracted by the power and beauty of the idea. Control over life and death always seemed to me to be the central issue in human existence. Cryonics offered me an opportunity to be a part of that issue and to participate immediately in a meaningful way, even as a teenager.

How were you able to participate?

Initially just by proselytizing. I formed a branch of the Students Cryonics Association in Indiana during my high school years and began accumulating the equipment required to carry out a suspension. The basic elements which were required at that time; chemicals, pumps, dry ice storage chest, and so on, were fairly simple things to acquire or build. Part of the attraction of cryonics to me then, and now, was that there were lots of things I could DO which would have a big impact on my chances of getting suspended and staying suspended. Indeed, the fruits of those early efforts are still around. Trans Time now has the dry ice box I started work on 14 years ago and is still using it! The telethermometer we use for research work here at Cryovita also dates from my early efforts in Indiana and much of the other "early acquisitions" went to Australia recently to help establish a cryonics capability there.

Why have you remained involved in cryonics?

Because I believe it is only approach available which offers me any real chance of long term survival. I do not feel that the rate of advance in medicine and biology is fast enough to save either myself or most of us now living. In fact, I think it highly unlikely that anyone now alive will live long enough to reach a point in time where indefinite extension of the lifespan is possible. We are just at the beginning of unraveling the fundamental mechanisms of aging and genetics. While we are making tremendous strides, I think it will be a long, long time before we have the kind of control over ourselves that will be required for really vastly extending the life of people already born. In any event, even if I assume that vast life extension will be available to me personally, it doesn't solve the problem of accidents, or of what I'm to do if I or someone I love, dies today. In that respect cryonics is the most important idea to have been put forth in a long time.

The most important idea?

Yes, I stress that because cryonics is very basic, aesthetically it is very powerful. It offers a solution to the ultimate problem of human existence: death. It is there when all other things; medicine, security, power....fail or become irrelevant. The world doesn't know it yet, but cryonics is a very powerful idea. It will increase human security a great deal and in the long run people will pay a great deal for more security of that very basic kind.

In what way do you feel that cryonics is aesthetically powerful? That's rather an odd way to describe it, isn't it?

Not at all. Consider the alternative: death, dissolution, decay. Cryonics is an alternative to the loss of the most complex and marvellous thing in the universe; ourselves. It is the only alternative to the disappearance of our loved ones, our friends, people we need, believe in, and admire. When you look at cryonics for what it really is, it becomes very aesthetically compelling: light against darkness, rebirth versus annihilation... There is great drama to what we are doing: a handful of passionately committed individuals refusing to let go of those they love and wrap them up like so much garbage to burn or bury, a group of people who are willing to fight for life regardless of the odds, a group of people unwilling to surrender and willing to confront the enormous task of restoring ourselves and our loved ones from the ashes of so-called death. When you think of the enormity of such a task and the courage required to confront it, you cannot help but be awed. The idea of cryonics is at least as powerful and aesthetically beautiful as the Christian concept of the resurrection of the dead.

If that's the case why haven't people flocked to the idea of cryonics already?

Cryonics is an extremely simple idea which hinges on a great deal of complex insight and understanding. Cryonics also requires that such insight and understanding be present on an emotional basis as well as an intellectual one. In other words it is necessary for people not only to academically agree that great strides in human capability are possible, but to believe that such strides will occur and that they can benefit personally. I think all too many cryonicists take for granted the amount of education and information they have. We have to understand that most people out there simply do not think of dying as a process, as a progressive loss of structure and information content which proceeds over a long period of time. Even those few people alive today who realize this fail to have a grasp of the coming explosion in our biotechnical skills which the next century or two will bring. Even the most brilliant researchers working in this area suffer from a profound lack of vision. They simply cannot imagine how the crude beginnings represented by their work will grow into a sophisticated and powerful technology which will allow us to repair age, disease, and freeze-damaged brains and integrate them into new, young healthy bodies. These possibilities are too remote for almost everyone to cope with. Even if someone is willing to admit that such developments are possible that is a long way from deciding that such developments could have personal relevance. Cryonics simply isn't real to most people. This will take a great deal of time and education to overcome and a great deal of patience.

But surely people have an incentive to really consider cryonics before dismissing it out of hand? Why in a world of four billion people have there only been a few hundred people even interested in the idea?

There are lots of reasons other than the ones I've just cited. Sometime ago Steve Bridge and I went over those reasons exhaustively in an article entitled "Bricks In The Wall" (CRYONICS #16, November 1981). I think the reasons we discussed in that article are still relevant. It is also worth pointing out that we are up against a pretty successful and well designed previous product: religion. It is of real importance that every cryonicist understands that the problem—on a social plane anyway—is not that we die, but rather that we know we are going to die. Dead men don't have any problems, so it must of necessity be the living we deal with. The approach of religion is to say that you can achieve salvation by certain thoughts, or actions, or both. They virtually guarantee it! We are in a much poorer position. We can't guarantee anything—not even that you won't come back if you aren't frozen, as Ettinger and others have said. Religion is a pretty good product if you look at it from that point of view. Once you realize that the important ingredient is eliminating the perception by the individual that he is going to die, then you are yards and acres ahead. Whether a person really ceases to exist or not is irrelevant—he will never know it if he does. I think this is a hard thing for most cryonicists to appreciate because they have already rejected the religious option for any number of reasons and thus this kind of thinking ceases to be operational for them.

But isn't cryonics much the same as religion? Isn't our faith in the future like religious faith in God's merciful plan for our salvation?

Very much so. Except, if anything the cryonicist must have more faith, more guts, more purity of spirit, because, you see, the cryonicist is dealing with the real world and all its imperfections and uncertainties. People hate uncertainties, they hate the possibility that life has no more meaning than what they are able to give it themselves. People hate the idea that death could come at any time for no good reason at all—at least no reason that has any relevance to their values. Cryonicists must then be viewed as either very strong believers or very naive fools. I mean, let's be realistic, look at what we are counting on: we are counting on everything working out so that we get frozen (by a tiny handful of people), stay frozen, and then are revived. We are counting on people we don't know and who don't know us to revive us. We are counting on civilization as a whole to hold up without any major upheavals so that our supply of refrigerants and people with the incredible wealth of time, energy and money (compared to the majority of the world) that we now have can attend to the business of keeping corpses frozen. No wonder, in a world where young, otherwise healthy, living human beings are starving to death, people think it a bit odd that we would freeze "worn out" old corpses. If you look at the world from that point of view we do come off leaving something to be desired. And, the fact is, we don't have any answers, not even faith to offer to all those people who are starving right now—many of whom could live for a year on what we spend on liquid nitrogen in one month. A person has to have a monumental amount of faith in his own worth, in the skill and cunning of the people who will care for him after he deanimates in order to believe in cryonics. This is the big difference between a cryonicist and the cattle herd of humanity. WE LOVE LIFE SO MUCH WE ARE WILLING TO PAY ANY PRICE FOR IT! We have a tremendous need to believe that these things will be possible, a tremendous motivation to reshape the entire world if necessary. The only difference between cryonics and religion is that cryonics has as its god not an omnipotent, perfect being, but man and his drive for knowledge and power with all the flaws and foibles those commodities carry with them.

That's a very hardened view of the world. Do you feel guilt that thousands of others will die just so you can have a chance at immortality?

No guilt, though at one time I did. Now I feel only sadness. There is a great distance between guilt and sadness.

Why no guilt?

Because I realize that it is in the nature of me to want the best for myself, to want to survive. This is what makes living things go on, this is what drives them, from carnivore to spiny plant, all living things are built to attempt to survive, to grow and flourish—even if it means the death of other organisms. Now, this isn't to say that we just go about pillaging and killing whomever or whatever we choose. That's obviously a pretty stupid and counter-productive thing to do. However, it does mean that we will do it when it is necessary and practical to do so, when it is safe, productive and profitable over the long haul. Who makes those decisions? We all do. The people who make the right ones are the ones who survive. Some have said that this is what makes our world fundamentally "corrupt." In a way they are right. Human beings are parasites. We don't get our livelihood from rocks and sunlight in the absence of competition. We get it by taking the lives of other creatures, sometimes by taking the lives of other humans as well. This is the very nature of us. It is our greatest strength and our greatest weakness. It is a strength because it has made us cunning, intelligent and swift. We are very clever, we are the ultimate parasite, we have learned how to defeat the survival strategies of many living systems and in some instances to turn them to our own uses—to even control them to the extent of reshaping them so they cannot survive without us! It is a weakness because the same qualities required for that kind of dominance make us ruthless, often stupidly ruthless. Our reason and drive to survive, coupled with our fundamental nature as parasites, is an incredibly powerful thing. The bottom line is that (while there may be many individual exceptions) we will always act to survive no matter what the price. No matter what we have to do.

Are you sure this world view is justified? What about the niceties of civilization? What about self sacrifice and altruism?

I often turn such questions around on the people who ask them. How much of the comparatively high standard of living is the average Westerner willing to give up in order to save some starving segment of the Third World. What the average person spends on Coca Cola, cigarettes, or blue jeans would save hundreds of lives a year. Those things are luxuries, cryonics is survival.

Altruism and self sacrifice are nothing more than ruthless mechanisms developed by evolution to get individuals to dispose of themselves so that his genome or "group" can go on. Humans are not just ruthless as individual "survival machines", they are part of a much larger and sophisticated system. Of course, very few people ever see the big picture. All that the average individual experiences are strong feelings of emotion, of what is right or wrong. The average soul is much like a body cell reacting to hormones that float by, secreted by a larger, integrated organism. If those messages tell a cell to multiply, it will multiply, if they tell it to die, it will die. Realizing this, seeing the big picture, is a kind of enlightenment. A dark kind of enlightenment, but still enlightenment.

You speak of this world view as if it were a path to salvation.

It is. But not salvation from the system, from the nature of us as humans. Realizing how the system works will allow us to consciously manipulate it and control it to our benefit. That will be very powerful in improving our chances for survival.

Undoubtedly, some will walk away from this part of themselves and seek transformation to a different state which requires only space, sunlight and rock. In the long run, I believe this will be a mistake because there will always be those willing to do the things we are now willing to do, and they will always occupy the apex of the food/resource pyramid. The trouble with the delicate, gentle Eloi of H.G. Wells's Time Machine is that there will always be the ruthless, carnivorous Morlocks. In a way, human beings represent a fusion of both of those types. I think that is a desirable situation and that the alternative to being in fair part Morlock is oblivion. It is the nature of the world.

What is the biggest problem confronting cryonics today?

Ask me that question in twenty years and I'll give you the right answer! For now, it is almost impossible to say. If you ask me what the most IMMEDIATE problem is, I could answer you a lot better.

O.K., what IS the most immediate problem facing cryonics today?

The problem of burnout, of inadequate commitment on the part of those people already convinced that cryonics is a good and necessary thing. All of cryonics now and in the past has been the product of a very few individuals' intense effort. These "activists" labor long and hard to make things happen with very little support from those who have chosen to be supporters. Indeed, often with nothing but harassment from the "supporters." The magnitude of the job, of the problems which confront an active cryonicist are just overwhelming. There is very little support, real support from the membership. If all of the signed up cryonicists out there would give cryonics the kind of support that any church asks of its members, the burnout rate would be far, far lower. If cryonicists did the equivalent of tithing, burnout would be far less likely to occur. We burn out active cryonicists by overloading them; expecting them to work, handle extensive cryonics problems, take criticism of their efforts and, worst of all, indifference. If cryonics is to be stable over the long haul, the membership is going to have to become more supportive of the leadership, of the workers carrying the day to day load. The alternative is what we have had in the past: people burning out, giving up and organizations falling apart or becoming moribund. Many cryonicists seem not to realize our fragility.

What can be done to reduce burnout?

The responsibility to prevent burnout lies to some extent with the activists themselves. They have to set limits on what they can and cannot handle, and they have to demand from the members the kind of support they need in order to go on. They also have a responsibility to each other. One of the most frustrating things is to see people scattered all over the globe duplicating with horrid inadequacy each other's efforts. Worse still is to see competent cryonicists just sitting out in the boonies doing nothing, or at least doing very little, compared to their possible productive output on a team. This was a hard thing for me to realize. It took a great deal of personal sacrifice and discomfort for me to act on that realization.

How did you come to that realization and how did you deal with it?

I was sitting in Indiana, trying to build a good, versatile cryonics capability and really making only SLOW progress. When I saw what was available in Southern California I realized at once that throwing my efforts into an already going concern would result in much faster growth and progress. At that point I gave up trying to re-invent the wheel in Indiana. So, I left Indiana and moved to Los Angeles. I believe that cryonics in Southern California has benefitted from this move. Since my arrival, Jerry Leaf and I have encouraged others to come here and several people have. There has been a tremendous improvement in our capability because of these people and their willingness to make such a commitment. I am now very anxious to get still more people. It is apparent that there is a critical mass of support and staffing that is necessary if we are to have the kind of time and energy required to try new things, or even to just stay afloat. I think this is something which has been generally missed. Thomas Donaldson, for one, has written all kinds of platitudinous things about "what you can do" if you live in the middle of nowhere. It is really hard to find fault with Donaldson for these fine efforts to get others to DO something. But the fact is, cryonics is so small and undercapitalized in every way that the most important thing you can do is MOVE and help consolidate resources so that FOR THE FIRST TIME a cryonics group finds itself in a position where it is not burning out its leadership and destroying itself. If this sounds like an incredibly hard sacrifice to ask someone to make, well, it IS. The question is, how much is cryonics worth? For most, the answer seems to be "not that much!" So be it, but then don't expect much in return if that's the kind of limits you put on your convictions. Great things are rarely achieved by the expedient or the convenient.

To summarize, I guess you could say that the burnout problem has a two pronged solution: more support and better concentration of that support. Historically, perhaps because of our individualism, we've been like unfocused sunlight falling on kindling at dawn. What we need is to brighten our output and magnify ourselves if the fire is ever to get started.

END OF PART I

"There's hope for you after all, Sara. You're getting a taste of it, Sara, a taste of where the world's really at. It's all out there, every dream, everything anyone wants. But you don't get it by talking about it or dropping acid and wishing. You got to get out there in the nitty-gritty and grab it, take as much of what's out there as what's inside you can get. That's reality. Not what's inside or what's outside, but how much of what's inside you can make real. I'd rather be a cop-out than a one eyed cat forever peeping in a seafood store. Wouldn't you? Is being hungry all your life really being true to yourself?

—Norman Spinrad
BUG JACK BARRON



A LIFE IN SCIENCE

reported by Enlis Bacchanal

Bay Area Cryonics Society

Most BACS Members know Dr. Pall Seagull as a long-time cryonicist, gerontologist, and suspended animation researcher. But it will not be amiss to again recount the history that led him to his current position of eminence. We resolve to let Truth be our only Beacon, except where Good Breeding dictates that some of Pall's story remain untold (which policy accounts for the shortness of this biography).

We must lamentedly admit that Pall was raised without the the benefit of clergy. But -- and who would believe it -- how he could beat a drum! Thus was his early childhood.

Pall's fascination with the phenomenon of death dates back to his early readings of the exploits of the mass butcher Genghis Khan, as told by one of Genghis' direct descendants (1). At this early stage of his thinking, Pall (with his faithful Eskimo companion Iceberg) was led to formulate an approach he called the Dead End Beliefs: Denial, Anger, Bargaining, Depression, and Acceptance. (His thinking later evolved differently).

Pall's first outstanding biological insight was his well-known resolution of the Nature-Nurture controversy. Like the serendipity of Newton's falling apple and of Einstein's falling elevator, Pall's flash of inspiration came about from falling on his head. This happened while he was boogieing at an Elvis Presley concert at Rock Crowd's Playground. While the stars in his head subsided, he ruminated on the extraordinary success that Elvis had achieved in his chosen field. But Pall knew that Elvis the Pelvis was born with a dead twin brother Enis. Yet Enis has accomplished nothing of significance. In fact, Enis has exhibited no observable behavior at all! Since Enis is genetically identical to Elvis, Pall reasoned that their extraordinary difference in behavior must be entirely due to their subsequent rearing.

Quick to generalize, Pall reviewed the literature on dead twin siblings. He found that out of 534 reported cases, in every case the living twin had performed better than the dead twin. His subsequent article (2) definitively resolved the heredity-environment issue and is, of course, what led to receiving his first Nobel prize (established by the dynamite cryobiologist Alfred Corey Nobel).

Well. So much for nature! This discovery led to Pall's interest in cloning, and to his well-known maxim "If cloning works, then to hell with nature. We must rise above nature and all clone live twins!"

But Pall was not one to rest on gloryseeds alone while he now felt his very life at stake. Having become an advocate of the visionary program "Life Extension through Four-Wheel Suspension", he soon applied for a grant for "Resolution of the Paradox of the Twin through Study of Pair-Frozen Hamster Siblings" (3). NASA, seeing the obvious relevance of his work to extended space travel, as usual warmly received Pall's grant proposal and funded it with giga-dollars (amount still classified).

Then the experimental interpretation took a curious twist. On testing frozen hamsters for physiological age, they nearly always scored older on the tests than their live control twins, being unable to complete the tests at all (4). Their extraordinarily aged response challenged Pall's thinking: "Why do I want to freeze humans when [cautiously extrapolating from his animal work] it looks like they will be worse off than if they were still alive?" This is the dilemma that Pall now grapples with night and day: it is the "Durk" hanging over his head.

But just as Einstein's "riding a ray of light" gedanken-experiment eventually led to the "falling elevator" breakthrough, Pall's followers all expect him to crash though with a fresh insight. We merely urge Pall's friends to try to change his mood to one of optimism, to try to convince him that the science is right there, we are moving now, it's happening, and that immortality is right around the corner.

Acknowledgments

Many thanks to Dr. Crypton, Mark Twain, and Henry Fielding for their undying assistance and inspiration in the preparation of this biography.

Apologia

Enlis Bacchanal is not my real name. I have heard told that people in cryonics sometimes use false names to protect their secret identities. Forgive me for not revealing the Secret of my Birth. Nonetheless, the story revealed above is mainly the truth. Well maybe one or two stretchers, but mainly its the truth.

References

- (1) Elizabeth Kublai Khan, "Turn on, Tune in, Drop Dead", Harper's, July 1982, pp. 32-42. Herein are extolled the joys of "Diddling with the Dead", which topic originally brought this article under Pall's intense scrutiny.
- (2) Journal of Irreproducible Results, I can't reproduce the rest of the reference.
- (3) Pall Seagull and Iceberg Willie, Cryonics #31, Feb. 1983.

SCIENCE UPDATES

by Thomas Donaldson

GENETICS OF CELLULAR IMMORTALITY

Cryonicists will all know about the idea that aging in whole organisms may relate to the limited lifespan of cells in culture. Unfortunately a great distance, in terms of assumptions and hypotheses, still persists between cell lifespans in culture and lifespans of whole animals. Regardless of this distance our understanding of aging would certainly increase if we understood the limited lifespan of cell cultures.

We don't even understand cell culture lifespan as yet. However in SCIENCE (221 (1983) 964) OM Ferreira-Smith and JR Smith have recently published some quite suggestive evidence bearing on the genetics of the lifespan phenomenon.

As readers who have followed the issue of cellular lifespans in culture may already know, many ordinary lines of cell culture can sometimes become transformed into a strain of cell which will divide and persist indefinitely. Both cancer, and the right kind of viral infection, will cause this transformation. It is said that these cultures have become "immortal", which means simply that unlike normal cells they can undergo an indefinitely large number of cell divisions. In some sense of course this "immortality" must depend on the genetic structure of the cells, and a cell line becomes immortal through some kind of change in genetic structure, whether induced by a virus or by cancer.

The authors of this paper took cells from several different strains of "immortal" and normal cells and fused them to produce cells containing the genes of both types. The question at issue was the inheritance of "immortality"; it turns out that if they fused normal cells with immortal cells the hybrids would uniformly have a normal, non-immortal, ability to divide and a limited cell lifespan in culture. The suggestion, therefore, is that whatever properties produce limited lifespan are genetically dominant over those which produce immortality. Even more interesting, the authors fused two different strains of immortal cell and got a mortal hybrid, which suggests that two different specific mutations can produce immortality and the normal parts of each of the fused parts made up for the abnormal part of its partner to produce a normal cell.

I believe that this paper may turn out very significant indeed for the explanation of limited cell lifespans in vitro. Since we probably won't understand how this phenomenon relates to aging without understanding how it works in the first place, the paper means a lot for aging also. The point is that once we understand the inheritance of this trait, we are very close to understanding its biochemical and physiological nature, so that this paper makes a significant milestone.

FURTHER DEVELOPMENTS OF AID TO CRYONICS

Every cryonicist will recognize the intimate relation between work on organ transplants and cryonics itself. Briefly, it is that as doctors become more successful in making transplants, they will increasingly suffer a severe logistic problem of providing organs to transplant, and that this logistic problem will force the development of means to store whole organs, regardless of whatever opposition to the idea may exist in the minds of some cryobiologists. Means to store whole organs will of course mean also that relatively simple work will provide means to store brains; means to store intact, viable brains will then start causing some interesting cryonical developments among the public at large.

All of this, of course, would be denied by many cryobiologists working today. The fact that it is obvious is more a reason for denying it than the opposite. Almost every cryonicist would probably agree that neither most cryobiologists, nor most medical scientists, really know where they are going and what they will do when they get there; self-glorification by scientists aside, the main purpose of scientific activity consists of the giving of talks (for grants and employment) and the production of published papers. Discovery of new and worthwhile knowledge is a side benefit rather than the aim of most participants; consequently we would not expect most cryobiologists, who are merely busy with the promotion of their careers, to pay much attention to the purpose and nature of cryobiology.

However the basic logistic problems caused by easier transplants will, it seems from a recent article in SCIENCE (221, July 1983), shortly become much more pressing. The drug cyclosporin has shown great effectiveness as a means of suppressing immune reactions and helping prevent rejection. Cyclosporin first became available in the United States in 1979. Using cyclosporin the rate of graft survival in liver transplants has increased from 35% before to 65% to 70% now; 80% to 90% of all transplants of cadaver kidneys survive with cyclosporin while before only 50% would survive. Heart transplants have also shown vastly increased success rates.

Cyclosporin acts by reversibly suppressing T-cell mediated immunity. The T cells are part of the immune system, a type of white blood cells which undergo a kind of "education" in the thymus and exercise a guiding effect on the other white blood cells, the B-cells. T-cells start multiplying when they find a foreign substance; cyclosporin acts by inhibiting this multiplication. The other drugs taken to suppress immunity to transplants act by actually killing the T-cells, but cyclosporin does not. There are even some indications that someday patients can discontinue taking cyclosporin without losing their graft.

As yet, true to form, the FDA has only licensed cyclosporin for

use in some selected hospitals. However doctors expect cyclosporin soon to become generally available. We may then expect the logistic problems discussed above to become more and more pressing.

Doctors have not remained unaware of the logistic problems which more common and more feasible transplants will cause. In the same issue of SCIENCE a news report describes the present shortage of organs for transplant. Of course no technological solutions are envisioned.

Statistics are that between 6000 and 8000 patients await kidney transplants, surviving on dialysis until their transplant comes. Heart, lung, or liver transplant patients of course cannot await a replacement. Doctors who survey this scene expect cyclosporin to cause an immediate doubling of the number of centers doing heart and liver transplants. The US House Committee on Science and Technology has waffled around with several possible solutions of a social nature, including efforts to educate donors, improving the legal statutes relating to the so-called "brain death", requiring people to designate whether or not they wish to become donors, and finally, most drastic, passing laws which would presume that someone wanted their organs transplanted unless they had specifically indicated the contrary. Many foreign countries have already passed such laws, including Austria, Denmark, France, Italy, Israel, Poland, Norway, Spain, Sweden, Switzerland, and Czechoslovakia. Various ethicists and lawyers are quoted to assure everyone that this presumed consent is legal, moral, etc.

Clearly from a cryonics standpoint the expected vast increase in demand for organs to be transplanted has both its opportunities and its dangers. As for opportunities, cryonicists all know of eminent and influential cryobiologists who have opposed development of organ storage precisely because of its implications to cryonics. What this demand for organ storage will probably mean is that one way or another this opposition will cease, either by the conversion of those cryobiologists or by their eviction from positions of influence. This process will take some years and along the way improved means of organ storage will come into being. These changes create a possibility for cryonicists to help them along, mainly by stressing (but never as cryonicists) the benefits to logistics which improved methods of storage will bring about.

The danger is also very real. In theory presumed consent would not impede our attempts at cryonic suspension; however we can expect a very large grey area in terms of just HOW VIGOROUSLY a patient's LACK of consent must be brought to the attention of their doctor before the doctor must take official notice. If organs are really so much in demand, we may have to be very vigorous indeed in insisting on the lack of consent, and even our present cryonics donation cards might create an excuse to remove our organs, bake our brains on a respirator, and allege merely an "unfortunate misunderstanding". Indeed the need for organs may

BRAIN GRAFTS TO REPAIR AGE-DAMAGED BRAINS

We all recognize the faulty motor coordination and learning ability which comes with age. We have also all thought seriously about taking drugs to prevent this condition, and some of us have gone on to actually take such drugs. Two recent articles in SCIENCE 221 (1983) 966-969, and a commentary by Gina Kolata in SCIENCE 221 (1983) 1277, present us with another possible treatment and partial cure for the condition, transplantation of cells from fetal brains. Furthermore, although the noncryonicists appear to be consistently paralyzed by so-called "ethical problems" in this field, this work shows some prospect of producing serious interest from mainstream medicine in the problems of brain cell preservation by freezing.

A Bjorklund et al from the University of Lund in Sweden report their work with brain cell transplants in aged rats. They prepared cell suspensions from two different regions of the brain of embryonic rats, the substantia nigra and the septal region of the embryo brains. They then grafted these cell suspensions into brains of aged rats; these grafts flourished, producing many new neurons containing two of the chemicals normally deficient in aged brains, dopamine and acetylcholine. The brain regions into which they inserted these grafts were the neostriatum and the hippocampus.

After grafting, they tested the motor coordination of those rats which had received a graft compared to those which had not. Their tests included tests of the animal's balance, ability to hold itself up when suspended from a wire, and ability to descend from a pole. While young rats can easily maintain themselves on a tightrope, for instance, aged rats will rapidly fall off. The grafts improved the motor coordination of the old rats almost to the level of that of young rats; for instance, just like young rats they could maintain themselves walking across a tightrope. Improvement, however, wasn't complete; the grafted animals could not descend a pole as well as young animals. Bjorklund et al also tested the ability of their rats to swim, and found again that their motor coordination equaled that of young animals.

In the news report in SCIENCE Kolata quotes Bjorklund on further related successes. For instance, surgical damage to the hippocampus will cause a loss of the ability to form new memories, but grafts of embryonic tissue will repair this fault in most animals receiving them. This kind of damage to the hippocampus produces behavior very similar to that of aged people with senile dementia, and Bjorklund speculates that brain grafts might help cure senile dementia.

I confess to total consternation as to why "ethical problems" exist in transplanting human embryo brains from aborted fetuses which would otherwise simply rot. The very act of practising

A NEW HORMONE FOR NEURON GROWTH?

Many cryonicists will have heard of nerve growth factor or NGF, a hormone necessary for growth of peripheral neurons; most cryonicists will also know that NGF does not seem to affect growth and survival of neurons from the central nervous system. If we had a similar hormone which worked for neurons from the central nervous system, we might reasonably expect progress in repair of damage to the central nervous system and further progress in culture of brain neurons, which would thus mean increased understanding of many aspects of brain function, growth, regeneration, and memory.

Exactly what progress of course we won't know until extensive studies of the substance. However a recent paper in SCIENCE (220 (1983) 1394) has presented evidence for a fraction of normal blood which specifically supported neurons from the central nervous system.

Neurologists presently do cell culture of neurons by using whole blood serum as their culture medium. Serum clearly has a lot of complexity and it's hard to find out exactly which factors in blood serum help the growth and survival of the neurons and which merely happen to exist. Furthermore, blood serum definitely contains some factors which cause cell multiplication in brain cells other than neurons; one problem of neuron cell culture consists precisely of the fact that whole blood serum causes a proliferation of glial cells and other cells too, which tends to overwhelm the slowly-growing culture of neurons. Furthermore, blood serum lacks precise quality control, so that neuron survival varies from lot to lot of serum without any obvious reasons for the variation.

L Kaufman and JN Barrett of the Department of Physiology and Biophysics, University of Miami, present in their paper a report of their fractionation method (acid gel filtration at pH 3.6) and their evidence for believing that their serum fraction acts specifically to promote the survival of neurons. Their fundamental reason, of course, was that their fraction supported the neurons when added to a version of "Eagle's medium", a basic nutrient medium. Their fraction did not support overgrowth of glial cells and supported neurons more reliably than serum supported them.

The substances in their serum fraction had molecular weights about 55000. It could survive changes in temperature and pH fairly well: two successive freeze-thawings caused no significant loss of activity, and the substance survived a temperature of 56C. Treatment at a pH of 1.6 for 30 minutes destroyed all activity. They could recover similar fractions, at similar molecular weights, from blood of many different kinds of animals tested.

This blood factor seems to support survival rather than proliferation, and had similar survival-promoting effects on other cell types. For instance, myoblasts (cells which would later form muscle tissue) could survive in this medium, but did not grow.

Unfortunately Kaufman and Barrett proposed no name for their substance; I shall leave that right to them.

As yet we don't really know what role this new substance plays. It certainly is not a "nerve growth factor". However because it supports the nerve cells it must play an important physiological role, probably even in regeneration. We'll have to wait and see how far this discovery will lead.

(continued from page 16)

(4) Pall Seagull, "Skin Transplants for the Hamster", Scientific American, v. 208 #1, 1963. In this article Pall demonstrates his erudition in etymology: "The hamster's parsimonious habits are the source of its common name: hamster in German means 'to store or to hoard' "(pg. 119). Similarly, we know that the seagull was named after Pall because of its angled beak.

(continued from page 19)

produce a much more pressing need than now for someone to arrive on the scene very swiftly and armed with all possible legal authority. Cards stating a refusal to donate might, for instance, become conveniently lost. On the positive side, this problem won't arise for most cryonicists, simply because ideal transplant donors usually are YOUNG; heart donors should be under 35 for men and 40 for women, liver donors must be under 40, and kidney donors under 55 (that's getting uncomfortably old).

We live in interesting times indeed!

(continued from page 20)

birth control, of course, sacrifices potentially existent persons for the benefit of people who are now living. Transplanting brains hardly creates any new conditions. As a longterm matter, considering especially the VERY many people who suffer from senile dementia, we'll probably have to find means to grow this tissue in vitro, but that is a practical problem rather than a moral one. Nevertheless, these "moral problems" will certainly slow acceptance of this technique and of the further work on cryopreservation of brains needed to support it. However the foundations for such work now lie in place.

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