CRYONICS

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EDITORIAL MATTERS

As you've probably discovered by now, tucked into the middle of this issue of CRYONICS is a glossy, four-color ALCOR brochure. In fact, there should be five of them. These brochures are part of a unique and unprecedented experiment in the history of cryonics. It's an interesting story, and it's one we want to share with you -- not only because it is interesting and exciting, but because you can help.

There are a lot more than the 1,200 or so brochures which are going out with this mailing of CRYONICS. There are, in fact, 198,800 more! Why did

we print 200,000 of these brochures? What on earth do we plan to do with them? How much did all this cost? The answers are long and complex, but we'll summarize them here.

For years, people both inside and outside of cryonics have been complaining that cryonics has not been promoted right, that there is really nothing "wrong" with cryonics other than that sophisticated promotion is required. These folks argue that success may be had by use of a professionally prepared mailing/advertising campaign aimed at an audience that market research indicates is a good target for the idea. And, for years, those of us battle-scarred, combat-fatigued shocktroops who've been manning the trenches on a day-to-day basis have responded by pointing out that the money, talent, and time to mount such an offensive simply aren't available. The bottom line has always been: "OK, if you think this will work you pay for it!" In the meantime, it's everything we can do just to keep the operation running and our heads above water.

In the past, there's been another problem or two standing in the way of such a promotion campaign, even leaving the immense cost aside. Those problems are:

1) The presence of competent, professional personnel with the required expertise to reliably carry out cryonic suspension.

2) A physical plant and adequate technical facilities to support the

personnel and to provide the required degree of professionalism and competence people will expect before trusting themselves to such an operation.

3) Sound business, administrative, and legal frameworks to support the facilities and personnel listed above.

4) A reasonably detailed scenario for repair and revival which is consistent with known physical law.

5) Some direct research results which indicate that existing freezing techniques are preserving an adequate amount of structure to allow for restoration of life and health within the limits imposed by current scenarios for repair.

Any student of cryonics who's been around for a while will quickly realize that until quite recently, several of the elements above either have not been present or have been present in a very shaky way. Before anyone can promote an operation like cryonics, an operation which is heavily dependent upon a perception of trust and of security, the above elements simply have to be in place.

Over the past decade or so, cryonics has been slowly, painfully achieving the five milestones listed above. A consequence of that has been renewed pressure to undertake more sophisticated promotional campaigns than have been attempted in the past.

Recently, several individuals came to us and said "what needs to be done is to establish a sophisticated market research and marketing program to promote cryonics." Naturally, we gave our usual answer: "You pay for it." Surprisingly, they did.

The brochures in this issue of the magazine, and the 198,800 others like them, are a small part of that commitment. Over the next few months, 150,000 of those brochures will be mailed out to a range of target mailing lists which preliminary research has demonstrated have a greater than average interest in or susceptibility

to the cryonics "meme".

An integral part of that effort, as you can see from our cover, is the acquisition of a nationwide TOLL FREE "800" WATS line to facilitate response from the mailing and provide the "human touch" so essential to making cryonics seem a reasonable, down to earth, and "real world" option. Coupled with the mailings and the 800 number will be numerous ads in specialty publications which our research indicates will augment and reinforce the approach of "shotgun" mailings.

Already we are starting to see comments from people to the effect that they've heard of us repeatedly, through a variety of media, and that it was these repeated hits which caused them to contact us.

Of course, the campaign isn't just these PR battles. It has been much more carefully planned than that. If you've been watching closely, you've probably noticed that we've upgraded CRYONICS, issued more sophisticated

and more professional appearing promotional literature and, perhaps most importantly, established a nationwide network of coordinators to serve as a first response system for information and for physical support in the event of emergencies. It has been a difficult and complex task, and in the process ALCOR has become the first truly national cryonics organization.

Will these efforts pay off? Will we get an overwhelming or even a significant response from the brochures and the public relations campaign? We don't have the answers to those questions. All we can do is try. And if we don't succeed with this approach, then we'll try something else. One thing is certain: we're not giving up.

Some of us, including me, have questioned the wisdom of expending tens of thousands of dollars for this kind of promotion. I've argued from the start that our top priority has to be research and that nearly all of our available resources should flow towards supporting that objective. One of the things I've had to learn the hard way is that people will always spend their money (whether by contribution, investment, or a direct purchase) on what they want. Naturally, I and the other officers and directors of ALCOR have a duty to argue strongly for how we think money should be spent, but having done this, it is not our position to refuse to act, as long as such action is moral, addresses important questions of relevance to cryonics, and offers the possibility of progress.

Over the past year or so we've put together the experimental promotional campaign which is unfolding before you. The total cost of this preliminary effort will be in the neighborhood of $30,000! That's a trivial budget by most commercial standards, but by cryonics standards it's immense.

** PHOTO SPACE ** ** CAPTION -- "Brochure author Luigi Warren" **

Over the next year or so, we should be able to answer a number of important questions:

1) Will the public, or at least an educated and future/health oriented subset of the public, respond to the cryonics message if it is attractively, professionally packaged?

2) Can the response, if any, be turned into increased suspension membership and research and educational support?

3) Will consciousness-raising using a variety of media (direct mailing, select ads, radio and television advertising) result in higher overall interest in cryonics and/or more suspension memberships and actual suspensions?

Another key element in our marketing strategy is you: Our associate members and suspension members. In addition to mailing out 152,000 brochures, we have 50,000 available for one-on-one distribution. That's where you come in. If you are going to be attending a science fiction, computer, or other technically oriented convention, consider passing out our literature. In fact, anywhere you think you can distribute brochures to advantage, let us know, and we'll see to it that you get some. We will make our brochures available to anyone who can use them. 50,000 brochures is an a lot of paper, and it isn't doing us any good sitting around and gathering dust. If you know people who might be interested in cryonics,

here is your chance to put high-quality literature in their hands free of charge. All your need to do is to call us, toll free, and we'll have literature in your hands within a few days. All we ask is that you keep us posted about the ways in which you distribute it, so we can tell what works and what doesn't.

Regardless of how this experiment turns out, we're very excited about it. At long last, we're going to be able to know, really know, whether or not cryonics can be promoted in this particular way. It's been a long time coming. We're offering you a unique opportunity to be a part of this experiment. Don't pass it up! -MD-

CRISIS TIME

That's the good news. Now for the bad. Some months ago we ran an article about the liability insurance crisis which is going on around the country. This crisis is the result of at least three things: 1) Massive, totally irresponsible judgments awarded to plaintiffs in liability suits, 2) An attitude of the American public, fostered by trial lawyers, that is best characterized by the notion that no one should suffer "unjustly" if someone can be made to pay, and 3) Poor financial management and investment by the insurance industry. The end result of all of this is that many insurance companies who formerly provided liability coverage are no

longer doing so. Some are going bankrupt. If you have a high risk business, or even a business, like cryonics, where the risk to personnel cannot be assessed, you simply cannot get liability insurance.

ALCOR and Cryovita will soon find themselves in this position. It is our understanding that Trans Time and ACS are already in this position and are currently "going bare" -- in other words are without any liability coverage. The consequences of this are profound. For one thing, it means that patient operating funds are exposed to risk in the event of a lawsuit as well as the property and the other hard assets the corporation owns. It also means that it is impossible to lease commercial or industrial space, which zoning requires us to occupy.

In a few months, ALCOR and Cryovita will be facing eviction from our current facilities, because our current liability coverage will not be renewed and we cannot find a new carrier. It doesn't matter that we've done nothing wrong. It doesn't matter that we've contacted over thirty insurance agents and over a hundred underwriters, including Lloyd's of London, and been turned down invariably. It doesn't matter that we've never had a suit, let alone a judgement against us, or that in fourteen years of operation we've never had a serious injury or accident (or that in twenty years of operation the entire cryonics industry has never had a serious injury or accident)!

Over the past year ALCOR, Cryovita and a group of other interested individuals have been working very hard to put together an ambitious facility near Perris, California (out on the high desert, secure and away from prying eyes and other risks). Now, due to time and funding constraints, after the purchase of 10 acres of land and the expenditure of over $20,000 by private individuals, we are going to have to walk away from this plan and get into a "turnkey" structure within the next few months. Due to the liability insurance crisis we will need to vacate our current facility within the next six months or so. There is no time to proceed with the plans for fund raising and construction of the 6,200 sq. ft. research and patient care facility which we've spent the last year hard at work designing (the final "working" architectural drawings were just recently completed).

We are reasonably optimistic about being able to find a "turnkey" building to purchase within the time and money constraints we have. We want to reassure our members that we have contingency plans which will assure continuity of patient care, and provide some level (albeit of reduced quality) of emergency responsiveness in the LA area, even under the worst of circumstances. But it won't be easy, and it's no doubt going to cost us dearly in terms of progress. For one thing, in order to protect ourselves, within a few months (when our current coverage expires) we will be dropping to a skeleton crew operation. No

visitors will be allowed into the facility and volunteers will be held to a minimum. Those activities that can be shifted outside of the facility, and which carry little inherent risk, such as magazine production, data processing and so on will be moved to members' homes.

We still can't believe this is really happening to us. There aren't any easy answers in sight and we don't know when, if ever, we'll be able to get liability coverage again. All we can do is to take a conservative posture, protect our patients, maintain continuity of services, and hope for the best. Because of the risk, all research has been put on hold pending a resolution of this issue.

If you think you can be of help to ALCOR in its fund raising efforts for acquisition of a new facility, please call us immediately: (714) 738-5569 in California, (800) 367-2228 in the rest of the US.

LAKE TAHOE FESTIVAL

As you can also see from the inclusions in the center of the magazine, The Lake Tahoe Life Extension Festival will be held this year on August 29th to September 1st (Fri-Sat-Sun-Mon Labor Day weekend). A reception will be held on Friday evening, technical presentations on Saturday and Sunday (At a somewhat more relaxed pace than in previous years.), a Saturday evening banquet, and a cruise on the paddlewheeler Tahoe Queen on Monday afternoon. Labor Day is one of Lake Tahoe's busiest holiday weekends, so make your plans and lodging arrangements as soon as possible!

CALIFORNIA NO AUTOPSY LAW GETS A WORKOUT

In November 1984 we ran an article on SB 1824 (now Section 27491.43 of

the Government Code of the State California) which prohibits "voluntary" autopsies on the bodies of people whose religious belief forbids such postmortem procedures. At the time we didn't quite know what to make of the law. In April 1985 we made copies of the Certificate of Religious Belief (prepared by lawyer and ACS President Jack Zinn) available to our members so that they could execute them and claim protection from voluntary autopsy under the new law.

It was unclear what protection the law would provide should push come to shove in a "questionable" case where the coroner really wanted to perform an autopsy even after a physician signed the death certificate (such as where the physician was a cryonicist and death occurred in a cryonics care facility, at home or in a nursing home under close supervision of a "cryonics" physician).

Well, the answer seems to be in. On January 21, 1986, L. Ron Hubbard, founder of the "Church" of Scientology died, at the sprawling, high security complex of buildings he called home in San Luis Obispo, California. Many if not most of our readers will have at least some passing familiarity with Hubbard's life and career. For those who don't, a little background is in order because it will help to make the relevance of Hubbard's death to cryonics more

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comprehensible.

** PHOTO SPACE **
** CAPTION --

"Scientology founder L. Ron Hubbard"

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In 1954 Hubbard founded Scientology. It gained significant notoriety in '60s and '70s as it began to accumulate tremendous wealth. Scientology employed a mixture of high pressure sales, Freudian psychology, Eastern mysticism and good old fashion "big lie" storytelling with a science fiction twist, to attract and hold adherents. On the surface, there may seem to be little relationship between Scientology and cryonics. The primitive "E" meters (tin cans hooked to a galvanometer) and the childish and bizzare philosophy of the Scientologists coupled with the brain washing and high pressure sales tactics they employ would seem to have little to do with the approach taken by cryonicists. Certainly one key difference is that Scientology, unlike cryonics, has somewhere between 2 and 6 million adherents and brings in a whopping $1 million a week, which cryonics is a long, long way from doing.

But there are similarities, and they are important ones. First, Scientologists are considered frauds, frequently held up to public ridicule and are uniformly disparaged by the scientific community. Despite their wealth and growing numbers they have not been accepted into the mainstream of society and as a consequence they are fiercely protective of each other and tend to keep to their own. And, also like cryonics, they have been subject to harassment and litigation from the powers that be, often unjustifiably so (from a constitutional and even from a fair-play standpoint). This constant harassment and litigation had resulted in L. Ron Hubbard simply disappearing from public view, Howard Hughes style. Despite the fact that the IRS, the FBI, disgruntled relatives (including a son) and church members all wanted to get access to him, Hubbard was nowhere to be found. Hubbard's wife, Mary Sue, is currently in prison

serving a four year sentence for bugging and burglarizing government agencies, including the IRS. It's more than fair to say that Uncle Sam wanted Hubbard badly.

Hubbard was nowhere to be found. So complete was his disappearance that in recent years, one of Hubbard's sons, Ronald DeWolf (who changed his name to disassociate himself from his father) had even claimed that Hubbard was dead.

All of which brings us back to that multimillion dollar, 80-acre hideaway, in a remote part of San Luis Obispo County (only 150 miles northwest of Los Angeles). A few days before his death, Hubbard is reported to have suffered a stroke. Now, most people who suffer a stroke would be taken to a hospital for medical care. If you survive the first 48 hours after a stroke without losing consciousness, the prognosis for continued survival is reasonably good. However, Hubbard was not taken to a hospital. Instead, he was attended by Dr. Eugene Denk, a physician who is also a dedicated Scientologist. Four days after his stroke Hubbard died at home.

Dr. Denk signed the death certificate and the church applied for a removal and a cremation permit at the time the coroner was notified. Naturally, the coroner wanted to do an autopsy. He probably took for granted he was going to do one. Wrong! The Scientologists presented the coroner with Hubbard's signed

and witnessed Certificate of Religious Belief as well as with Dr. Denk who had signed the death certificate and attested that Hubbard's death was due to natural causes. For those of you who are not residents of California, we would like to tell you that you missed a rare audiovisual treat. Watching George Whiting, the San Luis Obispo county coroner, turn on the spit was pure delight. Because a licensed physician had pronounced Hubbard dead and testified that the death was a result of natural causes, Whiting was limited to fingerprinting, photographing, and externally examining Hubbard's body. He could not take custody of it, and he could not autopsy it. In fact, he could not even delay the almost immediate cremation of Hubbard's remains until positive identification via FBI records could be obtained.

The Scientologists had Hubbard's remains cremated and his ashes scattered at sea before the coroner could scratch his head and wonder what to do. The relevance for this to cryonicists is obvious and does not need to be belabored here. There will be many situations in the future where we may be subject to the gratuitous intrusion of local coroners and medical examiners. As we grow and become more independent of existing medical facilities it will be desirable and necessary to take care of our own and handle deanimation in a fashion which is consistent with our needs and beliefs. Section 27491.43 of the California Government Code may provide us with some much needed help in that department.

Our only reservation about this law is that it is just too good to last. It was pretty apparent from the televised coverage of coroner Whiting's reaction that the impact of that bill is just now starting to sink in on the medical people. We simply hope that they are unwilling or unable to muster the effort that would be required to overturn it.

A final piece of advice to California cryonicists (and even to

cryonicists who live outside of California now, but who might deanimate here): fill out your Certificate of Religious Belief and get a copy to us ASAP. The silly thing might just actually work!

STUDENT RATE SUSPENSION MEMBERSHIPS

One of the complaints we hear with frequency is that cryonics isn't "affordable." For most people this simply isn't true. For those in reasonably good health, cryonics is very affordable. With life insurance the cost is rarely more than several hundred dollars per year. Students, however, are often faced with very limited resources and are often discouraged from participating, in part because of the $160 dues/emergency responsibility fee charged by ALCOR. Anyone who remembers what it was like to be a student can sympathize with the need for affordable suspension coverage during this period of "undercapitalization."

In the past, we've seen several people put off making suspension arrangements as students because 1) they didn't have the money, 2) they felt their risks of dying were so low the wait wouldn't hurt. It's hard to argue with point 1) and point 2) makes sense too. . . except that the risk of dying isn't all there is to it. While the risk of death in young people is low, it is not

as low as one might think. The risk of death for the population as a whole in the 18 to 22 age range is about 1.5 per thousand per year. But, risk of death isn't everything. Risk of becoming uninsurable is far higher. We have not yet been able to get reliable statistics on this, but the indirect evidence that we've been able to get is that the risk of becoming uninsurable during this period may be 10 or 20 times as great as the risk of dying. We know of several situations in recent months alone, where young people with a low over all risk of mortality have developed problems which will make insurance coverage problematic or even impossible to acquire.

The message here is that students need to sign up. In fact, it should go without saying that everyone, student or not, should make cryonics arrangements as early in life as possible. Not only is every year of delay going to increase the financial burden; it is going to increase the like-

lihood that a chronic ailment will emerge which will render you uninsurable. Even something as minor as seeking psychiatric help for depression can render you uninsurable for several years, and a serious problem (chronic depression, mood swings, etc.) may even make you uninsurable indefinitely. At the very least, most chronic health problems greatly increase the cost of insurance.

ALCOR is trying to get young people signed up and involved in cryonics. We firmly believe that a pattern of involvement and commitment established early will mature into a lifelong commitment to cryonic protection. We know that our "risks" of having to suspend full time students are much lower than they are for the population as a whole (mortality rates for 45-year-olds are 5 per

thousand, about three times as high). For these reasons we've decided to offer a special student rate membership for $80.00 per year. With term insurance coverage of $250,000, a 21-year-old male could pay as little as $190 per year for suspension coverage. A competitively-priced whole life policy for $35,000 would raise the cost to about $250 per year.

These are rates which most students should be able to afford. If you are interested in our Student Suspension Membership program, drop us line or give us call. We think it's an outstanding opportunity which can't be beaten anywhere.

SUMMUM -- THIS IS ONE YOU'RE NOT GOING TO BELIEVE

by Mike Darwin

We get some pretty strange mail and run across some pretty strange individuals from time to time here at ALCOR. Recently, we had an experience which was probably the closest thing we'll ever have to knowing what kind of emotional reaction cryonics invokes in the average person.

Recently, someone sent us a brochure from an organization called Summum, which is based in Salt Lake City, Utah. The brochure opens with the following quote:

"No one, no matter how close they are to you, thinks just like you do or knows your innermost wishes. That's why some decisions shouldn't be left to anyone else. You deserve the best."

And just what is "the best" that Summum is offering? Why, mummification, of course. No, not embalming, good old mummification, Egyptian style. To quote again from the Summum literature:

"The instructions during mummification, given by Summum initiates, help the deceased by guiding their spirit through Transference, the events that take place during this particular movement of the soul. Those who choose this unique method of interment, are provided a dowry assisting them as they make this grand journey.

"While mummification aids the deceased through knowledge imparted, it maintains the integrity of the genetic message within the cells of the body. Placed inside the womb of creation, (a pyramid), the body is preserved through the suspension of time. As a result, the genetic message can be used in the future for cloning a new body into existence. The final link is added to the chain, and dispensation of eternal life is granted."

The Summum literature is not

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cheap. Their brochure on mummification is considerably classier than the ALCOR brochure enclosed in this issue of CRYONICS. We contacted Summum for more information, and discovered that mummification is only part of a range of religious services they offer. They claim to be in possession of sacred information from spiritual Masters of ancient Egypt (who recently returned to earth after a long absence. . .)

According to Summum spokesmen in Utah, they have 40 people with full legal and financial preparations, a contract with a mortician in the Anatomy Department of the University of Utah, and a patented procedure for mummification which guarantees not only "complete preservation", but complete preservation in "perfect consciousness." Summum's financial operation is much like that employed by cryonicists: they are paying for mummification, which is rather pricey, through insurance policies issued under the aegis of Transamerica Insurance of San Francisco (the people with the famous pyramid-shaped office tower).

For those who can't get or afford insurance, time payment plans with convenient terms are available. Services run from a bargain basement deal of $7,500 to a luxury option for $35,000. Of course, the sky's the limit. As one Summum official told me, "you will of course have a life mask made now, and this will be cast into bronze and plated with gold for the mummiform." When I asked if they could accommodate me if I wanted a solid gold face mask, the answer was a heartwarming "Yes."

Despite this, in all honesty Summum seems to be a religion, rather than a commercial affair. The people I spoke seemed charged with enthusiasm and anxious to perform their first mummification. The spokesman, who goes by

the name of Ra, sounded genuinely dispirited when I asked if they had actually mummified anyone yet. "No," he replied somewhat ruefully, "you see most of our members are young, and none of them has died yet."

Summum has acquired some caves on property located in the Manti-La Sal mountains in Utah, about 100 miles south of Salt Lake City. Each crypt or "sanctuary" will be constructed as needed from slabs of granite hauled to the site and paid for out of members' insurance policies. Current plans call for sanctuaries to be furnished so that relatives may come and visit.

In looking over the Summum literature, I was struck with a sense of alien uneasiness which must be very like that experienced by the average man or woman when they first hear of cryonics. It was an interesting and perhaps useful insight.

Oh yes, one other very important piece of information I almost forgot: when asked about cryonics, the Summum "initiate" gravely informed me that frozen bodies "do not have kirlian auras" which is, no doubt, a very grave sign!

If you would like a good laugh and perhaps a slightly different perspective on cryonics as well, you can request information on Summum (if nothing else, it's certainly a conversation starter!) by writing them at 707 Genesee Avenue, Salt Lake City, Utah 84104.

LETTERS TO THE EDITORS

Dear Editors:

This is about the recently enacted California law that allows individuals to protect their remains from autopsy if they're opposed to it on religious grounds. Since we, as cryonicists, hardly favor the carving up of our remains (including the brain) following deanimation, this legislation is very much in our interest. To regard our objection to autopsy as essentially religious in nature and thus valid under the new law is not at all far-fetched, I think, and need not lean heavily on the position that "religious" is a vague term that can be adapted to cover practically any motive whatever. (Even though, for example, my Webster's Collegiate is lenient enough to define "religious" as "relating or devoted to the divine or that which is held to be of ultimate importance.") In fact I think it is not hard to argue in favor of cryonics along something that closely approaches traditional religious grounds, though without invoking supernatural powers or events. Toward that end I have been working on a book, tentatively entitled An Immortalist Theology, which attempts to establish immortalism on a par with other philosophical or religious systems. As yet the work is only in the early stages, but here is an excerpt from the introduction as it now stands:

"That the book is entitled a 'theology' -- a 'study of God' -- may seem misleading, but the term is to be understood in the sense of natural theology. Thus 'God' is not conceived as a supernatural power to be feared and ritually worshipped, but as a formative, preservative, and developmental principle, by following which the individual assists in realizing the highest good for himself and all others. The totality of individuals thus engaged comprises the 'mind' of God, their thoughts his

thinking, their actions his conscious work, their purpose his will, their discoveries his truth. At the same time God is also present in a larger manifestation, the totality of all events, which contribute ultimately to the highest good since all beings act through them or react to them. But evil too must be included in the progression of events and thus ascribed to God who nevertheless is held to be the ultimate good. This seeming

contradiction is resolved by the viewpoint that evil and hardship constitute obstacles whose overcoming defines and ennobles the individual and justifies his indefinitely continued existence. [Arguments are given that all evils may be overcome in the end and all wrongs righted, though it may require a very long time for the more important cases.] Thus a life rightly lived can never be rightly terminated. And God in the broader sense furnishes the necessary inspiration and occasions for the self-redeeming and ennobling existence, while God in the narrower sense supplies the means for its realization, in this case the power to do good by free choice.

"The aim of the individual life is seen as perfection; in happiness, knowledge, unity with all others, and self-sufficiency. These interlocking goals cannot be reached in a finite amount of time but can only be approached asymptotically as time goes to infinity. An unlimited existence is required for their full realization, so that survival always has a purpose. . . in particular placing one's remains in cryonic suspension, . . . for possible later revival is seen as a highly desirable and rational alternative to the usual surrender to decay."

So there is a very real sense in which cryonics can be viewed as an instrument of the divine plan and its interference opposed on religious grounds. By seeking survival, perfection, and harmony we cryonicists are acting, in a self-regulatory way, to carry out the divine will even as man's developing awareness reveals our task with increasing clarity and offers increasing means for its fulfillment.

Mike Perry
Boulder, CO

"Disney's World"
by Leonard Mosley
Stein and Day, New York, 1985, $18.95

Reviewed by Luigi Warren

Announce to anyone that you are a cryonicist and the chances are good that the response will be, "Yeah, I heard they did that to Walt Disney." The persistent rumor that Disney has been lying in suspended animation since his death in 1966 receives a boost from Leonard Mosley's best-selling new biography.

Mosley's book is a readable, popular account of the animator's life and death. The picture emerges of a prototypical self-willed, individualistic innovator: the scourge of his accountants and creditors, a chain-smoking, tyrannical employer, and a perfectionist where his art was concerned. The section dealing with Disney's early struggle to revolutionize film animation will be instructive and inspiring for anyone attempting to create

something new in the face of hostility and indifference.

Disney's childhood appears to have been conventional enough. The hard-working midwestern kid had a keen interest in drawing, and was an acute observer of animals. He studied art and became a successful commercial artist. Disney's

talent for animation surfaced after he joined a cartoon studio in Kansas City. An initial attempt to build his own company failed, due to his lack of financial acumen. Persevering, he joined with his brother Roy to found the Walt Disney Studio in Hollywood. Fueled by the success of his famous cartoon characters and several landmark animated features, the company grew into one of the giants of the industry.

Disney was committed to continuous improvement in the art and technology of his productions. Sound and color were added to Disney features soon after they became available. He set up an in-house art school at the Studio, and a small zoo in which animators could observe real animals. Artistic shortcuts which would have compromised the quality of his films (and do compromise the majority of animated films made since his death) were forbidden.

Walt Disney believed strongly in the humanistic benefits of scientific and technological progress. In the fifties his TV shows brought Wernher von Braun's exciting vision of man's future in space before the American public, years before Yuri Gagarin's orbital flight. His plans for EPCOT, the Experimental Prototype Community of Tomorrow, far exceeded the World's Fair-style theme park which arose years after his death. He wanted to create a utopian city, based on ideas from experts in every branch of science -- with a special emphasis on the preservation and prolongation of life through new medical technologies.

Thoughts of EPCOT preoccupied Disney during the fall of 1966. His health was deteriorating rapidly, and he was in constant pain. He apparently had little enthusiasm left for film-making, or for the Disney World project which was only just getting under way. Disney became increasingly alienated from associates who did not share his vision for EPCOT. According to Mosley, Disney's nurse, Hazel George, was probably responsible for suggesting that he might "come back later and clean up all the mistakes your relatives might be making with Disney." Mosley reports that Disney became interested in the subject of "cryogenesis" (cryonics) and was convinced of its workability. Disney's World does not attempt to give a definitive answer to the question "Was Walt Disney frozen?" but ends with quotations from some of Disney's closest associates hinting that, perhaps, the rumor is true after all.

It's hard to believe that Walt Disney is (or was) frozen. His death from lung cancer at the age of 65 came only two years after "The Prospect of Immortality" was published by Doubleday (Ettinger had published the book privately two years earlier). The first public cryonic suspension came the following year. Mosley has some of his facts wrong:

> It was about this time [the fall of 1966] that Walt Disney became acquainted with the process known as cryogenesis, or what one newspaper termed, "the freeze-drying of the human cadaver after death, for eventual resuscitation." He was shown a report that in

> California, in the small town of Emeryville, across the bay from San Francisco, a medical laboratory called Trans Time had begun experiments with human cadavers to preserve them for the future.

In fact, Trans Time did not come into existence until 1972! Such sloppy research makes one wonder about the accuracy of "Disney's World" as whole.

> Mosley's book will perpetuate the legend. Walt Disney believed in the promise of the future -- he was capable of the
>
> imaginative leap needed to understand the logic behind cryonics. If by chance Disney did manage to put together some secret operation to have himself frozen, then everyone associated with it has kept improbably quiet in the 20 years that have passed since his death. The question remains open.

CASE REPORT: NEUROPRESERVATION OF ALCOR PATIENT A-1068

By Michael G. Darwin, Jerry D. Leaf, and Hugh Hixon

Part 2 of 2

SURGICAL PROTOCOL FOR CEPHALIC ISOLATION

Following termination of cryoprotective perfusion a circumferential skin incision was made at the base of the neck extending anteriorly and posteriorly to just below the margins of the clavicle. The skin was dissected free from underlying connective tissue up to the level of the 5th cervical vertebra to form skin flaps. The muscles of the neck and other structures were then severed with a #10 scalpel blade down to the junction of the 5th and 6th cervical vertebrae. A Gigli saw was passed under the vertebral column and a cut was made between the 5th and 6th cervical vertebrae, which freed the head from the body.

Skin flaps were then closed over the stump of the neck using a skin stapler, after the edges of the flaps were first approximated using interrupted 2-0 Tycron sutures. Because the perfusion cannulae were in the thoracic vessels no decannulation was required before cervical transection. This resulted in a savings of several minutes of surgical time. Use of the Gigli saw also proved superior to the previously employed technique of separating the cervical spine with a Satterlee amputation saw (Leaf and Quaife, (1981)).

TISSUE SAMPLE COLLECTION

At 0736 hrs PST (deanimation + 31:48 hrs) on 2/13/85 the sternotomy wound was extended, a laparotomy performed, and dual samples of the

following tissues were collected using clean, but nonsterile technique: spinal cord, heart, liver, intestine, skin, lung, spleen, kidney, and muscle. The tissue samples were placed in 5 ml Nunc Cryotubes where they were glycerolized at room temperature in 2.0 M glycerol in mannitol-HEPES base perfusate. Similar samples were taken and fixed in 4% formaldehyde in normal saline neutralized with calcium chloride for subsequent histological evaluation. The tubes containing the samples were placed in a weighted plastic bag (to prevent floating) and were transferred to the cooling bath containing the patient at 0803 hrs PST (deanimation + 32:15 hrs) (bath temperature of -12øC).

COOLING TO DRY ICE TEMPERATURE

At 0621 hrs PST (deanimation + 29:33 hrs) the patient (head) was enclosed in two polyethylene bags and submerged in an insulated bath containing 20 liters of Dow-Corning 5 centistoke silicone fluid (Silcool) (Figure 7). The Silcool had been precooled to a temperature of -6øC. The frontal sinus, oral, and cerebral cortex temperatures at the start of cooling were 13.0øC, 13.0øC and 11øC respectively.

** TYPIST'S NOTE: THIS SPACE ORIGINALLY CONTAINED Figure 7, A CUTAWAY LINE-DRAWING OF THE "Dry Ice Cooling Bath" FOR NEUROPATIENTS. **

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 8, A GRAPH OF "Temperature During Dry Ice Cooling," IN DEGREES C VS. HOURS, FOR COOLING BATH, SINUS TEMPERATURE, FRONTAL CORTEX TEMPERATURE, AND ORAL TEMPERATURE. **

A surface-to-core temperature differential of no more than 10øC -+2øC was maintained at all times once the patient's core temperature went below 0øC. Due to the patient's undesirably high temperature at the conclusion of cephalic isolation a differential of nearly 20øC was considered acceptable at the start of cooling in order to rapidly reduce the core temperature of the head.

Figure 8 shows the patient's frontal sinus, frontal cortex, and oral temperature during dry ice cooling. Cooling to -77øC required 28.5 hours. Silcool, which was employed clinically for the first time during this suspension, performed as expected with excellent retention of clarity (allowing observation of the patient and samples for ice formation) and low viscosity over the entire temperature range of dry ice cooling. No leakage of the fluid into the plastic bags containing the patient was noted.

COOLING TO LIQUID NITROGEN TEMPERATURE

Because of serious problems with tissue fracturing which have occurred in the past (Federowicz, Hixon, and Leaf, (1984)), it was decided to cool this patient as slowly and with as small a differential between surface and core temperatures as possible. While it is unlikely that such a maneuver would eliminate the occurrence of fractures, it was hoped that it might

reduce their frequency and severity.

** PHOTO SPACE **
** CAPTION --
"Plate 10. Neurocan"
**

After dry ice cooling the patient was removed from the Silcool bath and transferred to a -50øC chest-type freezer, the floor of which was covered with a bed of dry ice. In this environment the protective polyethylene bags were removed and (using gloved hands) the patient was rapidly transferred to a heavy "flannel texture" polyester pillow case. The pillow case containing the patient was then lifted by the "tail" of excess material and the patient was positioned inside a heavy-walled aluminum "neurocan" containing Dacron wool as packing to protect against mechanical shock (Plate 10). The neurocan had previously been nested inside a polyethylene tank with the space between the two filled with dry ice. The lid of the neurocan was closed and covered over with additional dry ice.

The polyethylene tank containing the patient was then placed inside an MVE TA-60 cryogenic dewar. The TA-60 was closed and placed on a support platform of 3/4" plywood which could be lowered or raised on a chain hoist. The TA-60 was then lowered into a modified MVE A-9000 dual patient storage dewar to which 160 liters of liquid nitrogen had previously been added (Figure 8).

Over the following 12 days the assembly containing the patient was slowly lowered toward the liquid nitrogen in the bottom of the A-9000. An effort was made to hold the surface-to-core temperature differential to no more than 10øC throughout cooling to -196øC. Cooling to -196øC was carried out over a period of 294.5 hours (Figure 9).

TRANSFER TO LIQUID NITROGEN STORAGE

When the patient's core temperature reached -176øoC the TA-60 (still containing the patient) was removed from the A-9000 and filled with liquid nitrogen to a level 6" from the bottom. The patient's core temperature was then allowed to drift down to -192øC at which time the TA-60 was slowly filled with liquid nitrogen.

When the patient's core temperature reached -196øC the neurocan, which was full of liquid nitrogen, was transferred to a styrofoam work box where final preparation

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 9., A CUTAWAY LINE-DRAWING DIAGRAM OF THE "Apparatus For Cooling TO -196øC." **

of the patient for long term storage was carried out. Final preparation consisted of adding additional Dacron wool packing and proper identification of the patient by attachment of identifying stainless steel tags to the cloth bag containing the patient and to the lid of the neurocan. Thermocouple lead wires were stowed inside the neurocan and the lid was secured in place with stainless steel wire.

The patient was then transferred to ALCOR's MVE A-2542 storage dewar where she was immersed in liquid nitrogen for long term cryogenic care.

LABORATORY EVALUATIONS

In an effort to evaluate the patient's physiological condition during resuscitation, extracorporeal support, total body washout, and cryoprotective perfusion, samples of blood and arterial and venous perfusate were collected as often as feasible. These samples were later subjected to analysis for glycerol concentration and electrolyte, tissue enzymes, and metabolite levels.

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 10., A GRAPH OF "Temperature During LN2 Cooling," IN DEGREES C VS. HOURS, FOR EXTERNAL, SINUS, AND ORAL TEMPERATURE. **

Clinical chemistries were performed on a SMAC-2 autoanalyzer by a reputable veterinary clinical laboratory. Following analysis, two sets each of 3 ml aliquots of the samples were pipetted into 5 ml Nunc tubes, cooled to -40øC in a mechanical freezer, further cooled to liquid nitrogen temperature and then transferred to the neurocan containing the patient.

CHEMISTRIES: RESUSCITATION AND TOTAL BODY WASHOUT

Results of chemistries on blood and perfusate samples collected during resuscitation, extracorporeal cooling, and TBW are shown in Table 3. Sodium, potassium, chloride, and total calcium levels are shown in Table 4, and are consistent with the patient's history and present no anomalies.

Electrolytes

As a result of fluid support during her agonal course and the administration of over 1,500 cc of non-electrolyte-containing fluid during resuscitation and transport (i.e., 500 cc each of mannitol, tromethamine, and Dextran 40) sodium, calcium and chloride levels are predictably below normal. The markedly elevated resuscitation potassium (K+) of 10 mEq/L is

typical of hypoxia/ischemia. The presence of these elevated levels of K+ also reflects some inadequacy of HLR transport in supporting metabolism well enough to allow for reabsorption of lost intracellular K+. Despite 3 hours and 22 minutes of HLR support in the presence of moderate hypothermia, serum K+ levels were still nearly two times the accepted clinical maximum. Ischemia was already present before the patient deanimated, due to the massive edema evident in the extremities and low perfusion pressure (30 - 50 mmHg 50 to 60 minutes prior to deanimation). An additional factor in elevated serum K+ is the administration of hypertonic and hyperoncotic I.V. solutions, i.e., mannitol, tromethamine, and Dextran 40 which are known to elevate serum K+ (Makoff et al, (1970)).

The reduction of electrolyte levels during extracorporeal support probably reflects the effects of further hemodilution from the 2400 cc prime present in

Table 3. Blood and Perfusate Chemistries

Sample Chemistry	Normal Range	Resuscitation	Pump Cooling	End of Washout	End Washout Resuscitation (r)
Albumin	3.3-4.5 g/dl	1.1 g/dl	0.5 g/dl	0.1 g/dl	.091
Alkaline Phosphatase	87-250 IU/L	690 IU/L	361 IU/L	10 IU/L	.014
Amylase*		100 IU/L	100 IU/L	100 IU/L	(1.0)
Bilirubin	<0.5 mg/dl	3.2 mg/dl	1.6 mg/dl	0.1 mg/dl	.031
Blood Urea Nitrogen	8-20 mg/dl	50 mg/dl	43 mg/dl	19 mg/dl	.380
Cholesterol	120-330 mg/dl	105 mg/dl	48 mg/dl	0	(0)
Creatine Phosphokinase	15-57 IU/L	107 IU/L	93 IU/L	5 IU/L	.047
Creatinine	0.6-0.9 mg/dl	1.8 mg/dl	1.8 mg/dl	0.5 mg/dl	.278
Lipase*	----	2.2 Neph. Units	1.5 Neph. Units	0.8 Neph. Units	(.364)
Total Protein**	6.6-7.9 g/dl	2.4 g/dl	1.7 g/dl	1.2 g/dl	---
SGOT	8-20 IU/L	432 IU/L	10 IU/L	52 IU/L	.120
SGPT	9-24 IU/L	118 IU/L	119 IU/L	7 IU/L	.059

Abbreviations: g-grams; dl-deciliter; mg-milligrams; mEq-milliEquivalents; IU/L-International Units per Liter; SGOT-Serum glutamic-oxaloacetic transaminase; SGPT-Serum glutamic-pyruvic transaminase.
Sampling times after deanimation: Resuscitation-1:37 hrs; Pump cooling-3:22

hrs; End of TBW-3: 52 hrs.
Normal ranges from Hamilton, H. K., Ed., Diagnostics, Springhouse Publishing Co., Springhouse, PA, 1984, pp1076-83.
*Amylase and Lipase levels shown here reflect the low end sensitivity of the SMAC-2 and are not accurate.
**Total protein by SMAC-2 is inaccurate in the presence of HES.

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the extracorporeal circuit. In particular, slight reduction of the K+ concentration from 10 mEq/L near the end of HLR support to 8.2 mEq/L is almost certainly due to hemodilution since the rapid induction of deep hypothermia as a consequence of extracorporeal heat exchange would probably have precluded any metabolic reabsorption of K+ (Messmer, Brandel, Reulen, and Nordmann, (1966)).

At the conclusion of TBW, sodium, calcium, and chloride levels had, as expected, declined to values intermediate between prewashout serum levels and levels present in the perfusate. The relatively low levels of extracellular K+ at the termination of TBW compared to the K+ concentration present in the perfusate suggests a need to raise perfusate K+ levels closer to those present intracellularly. Larger volumes of flush solution may also be necessary to

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Table 4 Blood and Perfusate Electrolytes

Sample Chemistry	Normal Range	Resusci-tation	Pump Cooling	End of Washout	Perfusate Concentration
Calcium	4.4-5.0 mEq/l	3.2 mEq/l	2.6 mEq/l	0.8 mEq/l	0.6 mEq/l
Chloride	100-108 mEq/l	113 mEq/l	107 mEq/l	85 mEq/l	47.0 mEq/l
Potassium	3.8-5.5 mEq	10 mEq	8.2 mEq	24.9 mEq	37.7 mEq/l
Sodium	135-145 mEq	129 mEq	126 mEq	76 mEq	9.6 mEq/l

Abbreviations: g-grams; dl-deciliter; mg-milligrams; mEq-milliEquivalents; Sampling times after deanimation: Resuscitation-1:37 hrs; Pump cooling-3:22 hrs; End of TBW-3: 52 hrs.
Normal ranges from Hamilton, H. K., Ed., Diagnostics, Springhouse Publishing Co., Springhouse, PA, 1984, pp1076-83.

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impose the desired electrolyte milieu on the extracellular space, particularly in cases where massive systemic edema is present.

Tissue Enzymes and Metabolites

The patient's extremely low resuscitation levels of serum albumin (1.1 g/dl vs. 3.3-4.5 g/dl normal value) and total protein (2.4 g/dl vs 6.6-7.9 g/dl normal value) reflect both hemodilution and her severe liver disease. The moderate elevation of resuscitation BUN (50 mg/dl) and creatinine (1.8 mg/dl), in the presence of such marked hemodilution is indicative of emerging renal failure which again is to be expected considering the patient's hepatic status and overall disease burden.

Resuscitation levels of SGOT (432 IU/L), SGPT (118 IU/L), and bilirubin

(3.2 mg/dl), even in the presence of significant hemodilution, do not adequately reflect the massive compromise in hepatic function present in this patient. As subsequent autopsy and histological study disclosed, there was little remaining hepatic parenchyma to be injured and thus release enzymes. Pathological and histological examination of the patient's liver revealed over 90% replacement of the hepatic parenchyma with lymphomatous tissue. Reasons for the patient's abnormally low cholesterol levels, in probable order of importance are: hemodilution, hepatic insufficiency, and poor nutritional status prior to deanimation. Elevation of alkaline phosphatase and creatinine phosphokinase levels are probably a direct consequence of the malignancy and the hypoxia/ischemia the patient experienced prior to, during, and after deanimation. Unfortunately, laboratory data on the level of these enzymes prior to deanimation is not available to us. Serious predeanimation hypoxia and reduced perfusion were evidenced by the presence of nail bed and limb cyanosis in the patient beginning nearly 24 hours prior to deanimation.

The effect of TBW on the levels of these metabolites and enzymes was profound and indicates, as does the unreadable hematocrit, the efficiency of TBW in removing formed elements and high molecular weight compounds from the vascular space. By contrast, levels of BUN and creatinine were only reduced by approximately 2/3rds. Tissue enzymes, which have a larger molecular weight and which do not move freely across the cell membrane (except as a consequence of cell lysis or injury) were reduced to very low levels, or to levels below the

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low-end sensitivity of the SMAC-2. The reduction or virtual elimination of the concentrations of these enzymes to very low levels is positive evidence of the integrity of the overwhelming majority of the patient's cells at the conclusion of TBW. Failure to similarly reduce the levels of BUN and creatinine is consistent with movement of these comparatively low molecular weight compounds from the relatively large reservoir represented by the intracellular and interstitial fluids into the vascular fluid (perfusate).

The values for amylase, lipase, and total protein are inaccurate and reflect a limit on the low end sensitivity of the SMAC-1 and the interfering effects of HES on the total protein test. If the end of washout value for a given compound divided by the resuscitation value of the same compound is denoted as r (see Table 3) then a comparison of the high molecular weight vs. the low molecular weight compounds shows a mean value of 0.329 -+.072 versus a mean value of 0.0603 -+.039, a difference which is significant at the $p<0.001$ level.

ELECTROLYTES: CRYOPROTECTIVE PERFUSION

As a result of the high concentrations of glycerol present in the perfusate samples collected during glycerolization, it was not possible to subject them to analysis for tissue enzyme or metabolite levels. A preliminary study to evaluate the accuracy of the SMAC-2 in determining electrolyte concentrations in the presence of high concentrations of glycerol was made using both the SMAC-2 and flame photometry. Values obtained in this fashion were found to agree well with each other and the remaining analyses were conducted using the SMAC-2.

Of special concern was the concentration of ionized calcium in the recirculating perfusate during glycerolization. As can be seen in Figure

11 the SMAC-2 determination showed a terminal calcium level of less than 0.5 mg/dl. While this is an adequate level of total calcium to prevent injury due to elution of cell membrane calcium (Zimmerman et al, (1967)), it is below the threshold of reliability of a clinical test. For this reason ionized calcium levels using the ion-specific electrode technique were run on both terminal

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 11., A GRAPH OF "Calcium Concentration During Perfusion (Colorimetric Method)," IN CALCIUM mg/dl VS. HOURS, FOR ARTERIAL, VENOUS, AND BH CONCENTRATION. **

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 12, A GRAPH OF "Calcium Concentration During Perfusion (Ion Specific Method)," IN CALCIUM mEq/l VS. HOURS, FOR ARTERIAL, VENOUS, AND BH CONCENTRATION. **

perfusate and burr hole samples. Calibration runs using glycerol containing calcium solutions were first performed to establish the reliability of this technique in the presence of multimolar concentrations of glycerol. Additional tests were conducted on base perfusate from the same batch which had not been perfused (quality control samples) and finally on a hydroxyethyl starch solution of the same concentration employed in the perfusate. As can be seen from Figure 12, the calcium levels in both the burr hole and the recirculating cryoprotective perfusate were well in excess of the 50 uM/L threshold below which membrane damage is known to occur.

The levels of sodium (Figure 13), chloride (Figure 14) and phosphorus (Figure 15) during the course of perfusion reflect continued decline in the tissue concentrations of these electrolytes. This is due to their dilution in the recirculating system as a consequence of the continual addition of cryoprotective concentrate (which had a lower concentration of these agents than the tissues).

Conversely, the concentration of potassium (Figure 16) in the recirculating

** TYPIST'S NOTE: THIS SPACE CONTAINED Figure 13, A GRAPH OF "Sodium Concentration During Perfusion," IN SODIUM mEq/l VS. HOURS, FOR ARTERIAL, VENOUS, AND BH CONCENTRATION. **

** GRAPHS --

"Figure 13. Sodium Concentration During Perfusion"

"Figure 14. Chloride Concentration During Perfusion"

"Figure 15. Phosphate Concentration During Perfusion"

"Figure 16 Potassium Concentration During Perfusion"

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perfusate consistently increased as the depleted intracellular levels of potassium were restored.

The final venous reading on all of the cryoprotective perfusion electrolyte evaluations is spurious. The sample from which these evaluations was derived was collected, in error, immediately after the perfusion pump had been turned off. We know from animal work conducted in our own laboratory and in others, using an isolated head model similar to the one employed on this patient, that an accurate venous sample cannot be obtained after the pump is shut down, presumably as a result of seepage of fluid from the rest of the patient's circulatory system into the venous drainage. We include this datum as a point of information and as a caution to others who may use this technique in the future, since it demonstrates the profound distortion of data which taking samples after perfusion has terminated can result in.

GENERAL DISCUSSION AND CONCLUSIONS

Given the constraints of space, it is impossible to fully discuss the tremendous wealth of logistic, clinical, and physiological information which was obtained from the cryonic suspension of this patient. We will thus confine ourselves to issues which bear directly on the care of future suspension patients.

MEDICAL RECORDS

The authors have previously repeatedly emphasized the need for access to the patient's medical records as long in advance of carrying out a suspension as is practical. Much of the delay and difficulty encountered with this patient could have been completely avoided had we only had access to this patient's records. During the three and a half days we waited for deanimation to occur we could have been thoroughly briefed on every aspect of this patient's prior medical history, and thus have avoided the loss of over an hour of surgical time in futile pursuit of a femoral vein which had long ago been obliterated by disease -- in an episode well documented in this patient's medical records. As a consequence, the patient suffered an unnecessary additional hour of low-quality HLR support as well as greatly increased risk of systemic bacterial contamination due to poor preparation of the alternate surgical site (of necessity we carry only limited quantities of sterile disposable drapes and prep supplies).

It is often difficult to convince the next of kin or the attending physicians of the importance of providing medical records before deanimation occurs. Often, suspension members and patients fail to appreciate the enormous potential for complications and harm which can arise from lack of such information. This case should serve to illustrate the importance of obtaining and utilizing medical information before deanimation occurs.

EXTRACORPOREAL SUPPORT AND TOTAL BODY WASHOUT

Where possible, extracorporeal support should begin in the hospital or nursing home prior to transport. This will require the development of portable, gurney mounted, self contained perfusion units incorporating a blood pump,

membrane oxygenator, and heat exchanger. The inadequacy of HLR support, particularly in the presence of pulmonary edema or reduced gas exchange from pulmonary malignancy is likely to be a recurring problem. The logistics of transport, often over considerable distances, to a mortuary or other facility result in too much HLR time with resultant poor cardiac output and slow heat exchange using surface cooling.

When field TBW is undertaken in the future it is highly desirable that two blood pumps be available. Considerable delay and inconvenience resulted from having to thread and rethread recirculating and perfusate filtration pump shoes into the pump head. The presence of an additional pump as well as a hemodialyzer and circuit would also allow for intensive ultrafiltration of the edematous patient during pump-supported cooling. Early correction of edema will almost certainly result in better tissue perfusion during transport and TBW, as well as better cryoprotective equilibration during cryoprotective perfusion. To this end we have upgraded our remote standby kits to include two blood pumps and appropriate hemodialysis equipment for hemofiltration.

A major barrier to prompt initiation of extracorporeal support of this patient was the presence of massive fluid accumulation in the surgical wounds, coupled with poor lighting. Obviously it is impractical to transport operating room lights or other heavy fixtures to the site of remote TBW operations. However, a variety of portable, battery operated head lamps such as those used by spelunkers and outdoorsmen are available. We have purchased two Model 04419 electric headlamps manufactured by Justrite Manufacturing Company of Mattoon, Illinois and have found them very satisfactory in trials.

Controlling fluid accumulation in the wound due to bleeding or drainage of interstitial edema into the wound can only be effectively achieved by electrically powered suction equipment. We rapidly exhausted all available gauze and sterile absorbent material during attempts to raise this patient's femoral vessels and finally had to resort to use of nonsterile suction equipment (which was kept to the margin of the wound) provided by the mortuary. We have since added suction equipment to our remote standby kit to cope with future episodes like this one.

CRYOPROTECTIVE PERFUSION

Aside from the previously discussed problem with bacterial contamination, the extracorporeal circuit and surgical approach employed during glycerol perfusion were extremely satisfactory. As previously noted, we were surprised by the precise demarcation of glycerolized from unglycerolized tissue. This sharp and uniform demarcation was present not only cutaneously, but also in the other tissues of the neck as well; unglycerolized tissue which was especially soft and gelatinous in consistency due to edema was separated from firmer, dehydrated, glycerolized tissue by a zone only several millimeters in thickness.

Significant cellular dehydration coupled with the development of interstitial edema during glycerolization remains a major barrier to adequate cryoprotection of patients. We attempted to circumvent these problems by providing a slower rate of increase in glycerol concentration and by using a colloid which animal research has demonstrated provides excellent oncotic support, even in deep hypothermia (Leaf, Federowicz, and Hixon, (1985a)). It was also anticipated that edema might be less of a problem in this patient due

to the absence of vascular obstruction resulting from cold agglutination and postmortem clotting.

To some extent this last anticipation was justified. In the past, typical perfusion flow rates during whole body cryonic suspension operations have been in the range of 700 to 800 cc/min with perfusion pressures (70-80 mmHg) being the limiting factor. In this patient, a cephalic flow rate of 500 cc/min was maintained consistently with a mean perfusion pressure of 30 mmHg. In other words, perfusion flow to this patient's head was approximately 2/3rds of the maximum tolerated flow to the entire body of previous suspension patients who were not subjected to prompt extracorporeal support and field TBW.

The failure of maintaining a narrow spread between arterial and venous glycerol concentrations (100 mM or less) to ameliorate cellular dehydration and prevent the development of interstitial edema argues for reevaluation of glycerol as the cryoprotective agent of choice. Since extending the length of the glycerol introduction ramp was not effective in reducing or eliminating these undesirable effects it would seem prudent, at least until a replacement agent can be found, to increase the rate of glycerolization. Increasing the rate of glycerolization would minimize patient exposure time to cryoprotective agent and might conceivably allow a higher terminal glycerol concentration to be reached before edema becomes limiting. An exponential rate of concentration increase should be roughly optimal for reasons indicated by Meryman elsewhere (Meryman and Williams, (1985)).

An urgent priority is the evaluation and selection of a cryoprotective agent or mixture of agents which better penetrates cells and which does not compromise capillary membrane integrity. Previously discussed problems with assessing cryoprotective agent concentration in real-time via in-line refractometery remain unresolved primarily due to the expense of in-line refractometers adequate for this type of application.

TECHNICAL EXCELLENCE

As can be deduced from this technical report, even though we placed into the field two of the most experienced personnel ever dispatched to recover a suspension patient, and provided the most sophisticated technical support package ever deployed, there are a number of areas in which improvement is needed. Where economically feasible, we have acted to make such improvements.

More attention needs to be paid to post perfusion temperature control during cephalic isolation. In the future, whenever possible, perfusion temperature should be lowered toward 0øC at or near the conclusion of the cryoprotective ramp. The burr hole should be closed as quickly as possible, preferably immediately before the conclusion of perfusion so that

the head may be adequately refrigerated during cephalic isolation by completely packing it in ice.

In order to reduce the risk of future errors in perfusate preparation a system employing not only a checklist, but second person verification has been instituted. Weighing of perfusate components now must be done by two individuals; one who performs the weighing operation and a second who verifies it. This two-person policy applies also to addition and mixing of perfusate components as well as adjustment of final pH and osmolality and cryoprotectant

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concentration. The use of such safeguards should virtually eliminate such potentially disastrous errors in perfusate preparation as occurred in this case. As soon as economically practical we will acquire analytical equipment which will allow for quality control checks on perfusate prior to its administration.

In terms of cost-effectiveness we were able to offer a high degree of technical sophistication and yet stay well within budget requirements. This was due largely to the outstanding cooperation and support of Cryovita Laboratories and the support of an all-volunteer suspension team. We wish to extend our sincere thanks to Cryovita Laboratories and to the ALCOR Cryonic Suspension Team whose professionalism and dedication contributed so greatly to the high quality of care this patient received.

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SLOPPY SCIENCE, PART 2, OR: DOES QUANTUM MECHANICS THREATEN CRYONICS?

By ALCOR Staff

The February, 1986 issue SCIENTIFIC AMERICAN contains an article by Soviet scientist Vitalii I. Goldanskii, which concludes with the following provocative statement:

> "The fact that tunneling allows chemical reactions to occur at extremely low temperatures adds yet another reason for doubting the possibility of reviving complex organisms that have been frozen a long time."

The basis for this obvious reference to cryonics (not cryobiology: cryobiologists don't freeze complex organisms for a long time, and the simple organisms, cells, etc., they do freeze for long times seem to do just fine) is the existence of what Goldanskii calls the "quantum low temperature limit" on thermal suppression of chemical reaction rates. A few words of explanation of this concept are in order.

Cryonics is predicated on the premise that low temperatures suppress both chemical and physical reactions virtually completely, which is the reason indefinite biological preservation is possible. This notion is well supported by both experimental work in cryobiology and by the Arrhenius equation, which reliably predicts vast reductions in chemical reaction rates with reductions in temperature (see Hixon, CRYONICS, 6(1), 19-25, (Jan, 1985)). In fact, the predictions of the Arrhenius equation are undoubtably conservative because this equation assumes no changes in the ability of molecules to diffuse together so as to make reactions possible. At temperatures below the glass transition temperature (-130øC or thereabouts), however, diffusion is for all practical purposes abolished, as

all the reactive molecules are frozen in place.

The reason low temperature suppresses physical and chemical events is because these events require a certain amount of

energy, called the activation energy, in order to proceed. At cryogenic temperatures, thermal energy is so much less than the activation energy that thermal motions cannot be converted into chemical or physical events.

But quantum mechanics, as usual, makes life more complicated than this. According to quantum mechanics, atoms and electrons are not just particles but are also waves, and their positions are not precisely defined. Because of this uncertainty in position, there is a finite chance that an electron or atom will suddenly appear in a location it does not have the energy to reach. According to Goldanskii, this effect, in which an atom or electron "tunnels" through an energy barrier rather than passing over it in the usual way, could allow chemical reactions of relevance to cryonics to occur at liquid nitrogen temperatures or even below and might seriously limit the amount of time someone could be stored pending development of revival technology. In fact, Goldanskii presents several examples in which chemical reaction rates continue unabated as the temperature is lowered from as high as 120øK (-153øC) down to 4.2øK (-269øC). In one example involving the polymerization of formaldehyde, the reaction rate at 4.2øK was 110 orders of magnitude higher than the reaction rate predicted by the Arrhenius equation!

** TYPIST'S NOTE: THIS SPACE CONTAINED A GRAPH OF "QUANTUM MECHANICAL COUPLING" WITH THE EXPLANATION, "The activation energy is normally required to push the reaction over the activation barrier. In tunneling, no energy is required, as the reaction apparently ignores the barrier (tunnels)."

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Both cryobiologists and cryonicists have long been aware of the time limits imposed by the free radical reactions caused by cosmic rays, normal background radiation, etc. It is known that these reactions can occur, at least to a point, even at very low temperatures. But it is also known that irradiation is less damaging to frozen living systems than to living ones, even though no repair can occur in the frozen state. On the basis of available information, estimates anywhere from 300 to 30,000 years have been proposed for the storage limit imposed by injury from this source. In reality, since this type of damage ought to be easily repairable by a mature nanotechnology, it is actually likely that the real time limit in the light of such technology is longer than these conservative guesses which place no burden on future repair. Since it is hard to imagine repair technology not being available 1,000 years from now (the probable minimum available storage time), cryonicists have justifiably felt that this particular limit is irrelevant.

Does quantum tunneling represent an additional, previously unrecognized source of damage at liquid nitrogen temperature which seriously shortens the time available for revival techniques to be developed? Judging from the data in Goldanskii's article, at least, the answer is an emphatic no!

Goldanskii's suggestion, at least based on the experimental evidence known to him as reported in his article in SCIENTIFIC AMERICAN, is instead just one more example of sloppy science, or at least sloppy science writing similar to others we have considered before in these pages (see CRYONICS, 6(1), 7-11 (Jan, 1985)).

** TYPIST'S NOTE: THIS SPACE CONTAINED A GRAPH OF THE "EFFECT OF QUANTUM TUNNELING ON FORMALDEHYDE POLYMERIZATION," WITH THE EXPLANATION, "The time required to add a molecule to the chain is shown as a function of temperature. The Arrhenius prediction is the nearly vertical line. The flattened curve reflects the effect of quantum tunneling, as the time required for addition does not exceed a few milliseconds."

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Consider the following problems.

In the first place, every single one of the examples mentioned by Goldanskii appear to be free radical mediated reactions which can only be initiated by such means as bombarding the specimens with electron beams or gamma rays. Whether you call the resulting reactions tunneling or not, they have already been assessed by biologists as described above and found to be essentially irrelevant. Goldanskii's examples offer no evidence that biologically relevant, non-free radical mediated chemistry is known at cryogenic temperatures. Indeed, biological molecules are rather inert compared to the types of reagents studied by Goldanskii and other workers in this field, such as sodium hydroxide solutions and chlorine gas, and far less likely to react at any temperature.

In the second place, the reactions observed appear to have been obtained using pure substances as reactants. For example, the polymerization of formaldehyde was achieved by irradiating pure formaldehyde. But this sort of experiment really says essentially nothing about what might happen to frozen patients for several reasons. For one thing, if nothing is present but formaldehyde, it is not necessary for diffusion to occur in order for a molecule to be added to the chain, since formaldehyde is always available near the required site by default. In contrast, the inability of most molecules of interest in a frozen patient to diffuse to participate in chemical reactions of any kind will greatly limit the range of possible events, even given tunneling. In addition, these molecules will be surrounded by vast excesses of water and cryoprotectant molecules which will not only shield them from each other but which will also make tunneling across these barriers virtually impossible. Goldanskii in fact admits that molecular separation

drastically reduces the potential for tunneling reactions, but he fails to take this into account in predicting the fate of frozen biological systems. The final reason using pure substances as reactants is misleading is that the probability of even free radical reactions depends on the concentration of potential targets. If there is nothing in the sample for a

gamma ray to hit but formaldehyde, it will hit formaldehyde. But if the sample consists of 80% water and cryoprotectant, most hits will be irrelevant. Most biological molecules are present in very low concentrations as opposed to the 100% concentrations studied by Goldanskii.

The third reason Goldanskii's proposal doesn't wash is that the temperatures at which Goldanskii observed tunneling are so low as to make the reaction rates produced by tunneling negligible. For example, the tunneling phenomenon in the formaldehyde polymerization reaction began to be appreciable only at temperatures below roughly -173øC, behaving as predicted by the Arrhenius equation down to that temperature. The tunneling reaction declined with temperature down to about 10øK (-263øC), at which temperature it was equivalent to the rate which would have been predicted by the Arrhenius equation at about 50øK (-223øC). Big deal! If we've been willing to accept injury on the basis of Arrhenius behavior at -196øC, any tunneling effects of the kind postulated by Goldanskii, even if they did occur, would not be of concern to us based on numbers like these. In general, the reaction rate minimums attributable to quantum tunneling occur at 50øK or below, and probably correspond to Arrhenius behavior at -150øC or so, i.e., to reaction rates which need not concern us.

Although it is too bad it has been necessary to spend time rebutting Goldanskii's comment, perhaps a quote from Goldanskii's own article can be taken to heart: "The eternity is ours, so why not spend a couple of hours."

SCIENCE UPDATES
BY Thomas Donaldson

A NEW THEORY OF FREEZING DAMAGE

Stripped of complications, current theories of freezing damage as developed by Meryman and others suggest that freezing damage to cells occurs because of osmotic strain on cell walls. (This is a highly simplified pr'ecis of the theory). However, such a theory has problems, most of all the fact that not all cells sustain equal amounts of damage

after freezing. We would like to know how to account for this variation in survival, for the very good reason that if we understood it, we might protect cells much better against this damage. Not all

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cell walls respond the same way to freezing.

Recently, P. J. Quinn of Kings College, London, writing in CRYOBIOLOGY (22, 128-146 (1985)), has presented a new and interesting study of freezing damage and how it may happen in cell membranes. Even if his theory is not the whole story (which it probably isn't), further work with it should suggest some significant means to improve survival and decrease damage.

Quinn's theory depends upon a deep study of the physical behavior of the fat-based chemicals which form into cell membranes.

Cell membranes are made of several different kinds of fatty chemicals. Like most oils (everyone knows of how oil will spread over water in a layer one molecule thick), these chemicals will form quite characteristic structures. Cell membranes contain several different classes of such chemicals, each with a tendency to form a structure in water at normal temperatures. These chemicals form two different classes, the first of which is the phospholipids, all of which are chemically related to glycerol (an old friend which is chemically an alcohol). The second class of lipids which form cell membranes is the sphingolipids, all of which relate to another complex alcohol, sphingosine, in the same way. Many cell membranes also contain large amounts of cholesterol.

These chemicals will spontaneously form structures in water. These structures will depend on temperature and concentration. They can form into two-layered membranes in water, with the molecules all facing outward. Alternatively, they can form into cylindrical stacked structures, or even into a kind of cubic crystalline phase.

We all know of the phases of water in the sense that water can be gas, liquid, or ice, depending on the pressure and temperature. These different structures of membrane lipids behave like phases in the same way: they are affected by their concentration in water and their temperature. They will also change phase in response to changes in acidity/alkalinity of the water and the presence of other molecules. These chemicals will undergo complicated electrical effects between one another and other chemicals in the membrane, and these effects can also preserve or destroy phases and stability. Furthermore, these structures can combine with water in further characteristic structures.

Predicting the exact structure of membrane fatty chemicals therefore seems extremely difficult. However, THE PRIMARY FACT ABOUT SUCH CHEMICALS IS THAT THEY WILL CHANGE THEIR PHASE (AND THEREFORE THEIR STRUCTURE) IN RESPONSE TO CHANGES IN TEMPERATURE.

There's a second very important physical effect for such chemicals. When sea water freezes, the salts dissolved in it come out of solution. Similarly, the phase changes which the lipid solutions which form cell membranes will undergo with changes in temperature will not just involve a change in their chemical form, but their actual physical separation into

aggregations of different chemicals. The cholesterol in many cell membranes will also affect this separation. The key idea here, however, is that when the temperature changes, these complex mixtures of lipid chemicals which make up cell membranes will tend to spontaneously separate.

Cell membranes show great complexity. They contain not only cholesterol and these two different kinds of lipid chemicals, but also proteins. These proteins perform many important functions. Some act to prevent or allow passage of substances through the cell membranes. Other proteins, the receptor molecules, will signal to the cell that special hormones or other chemicals are in its environment. Finally, just like all the other factors such as temperature, acidity, water, and electrical effects between molecules, these proteins can affect the stability and phases of the cell membrane lipids.

All of this is background. What Quinn suggests is that after cooling of cell membranes, the normal structural relations of protein, lipid chemicals, and water in the cell membranes become deranged. The cell wall proteins, together with all the other constituents, will aggregate. On rewarming, they won't tend to spontaneously separate back into their original form.

However, these reactions are complex. Among other things, cryoprotectant drugs like glycerol will greatly improve survival of almost all kinds of cell after freezing. Furthermore, even without protection cells do have some ability to repair the damage that occurs to their membranes upon freezing.

Glycerol and other cryoprotectants act to hold water molecules to themselves. This means that when frozen with glycerol, cell membranes will form combinations with water which behave differently from the normal cell membranes. Most importantly, glycerol will tend to reduce the normal tendency of membrane chemicals to separate out into aggregations. Experimental evidence taken from studies of simple mixtures of cell wall lipids supports this theory of how glycerol may act (P. J. Quinn, A. Sen, et al, BIOCHIM BIOPHYS ACTA, 686, 215-224 (1982)).

Quinn points out that cell membranes aren't usually passive mechanical systems like the experimental preparations. Cells contain biochemical processes which will try to correct for any disturbance in cell membrane structure. In fact, we must assume such processes since many cell membranes would not remain stable for as long as they do without stabilization by the cell they surround.

These ideas suggest many speculations about methods of protection from freezing damage, methods not considered before. For example, Quinn himself points out that the biochemical processes which tend to stabilize membranes must involve enzymes. If we could discover these enzymes and enhance their action, we would have a totally new method of protection. Furthermore, much work

discussed by Quinn employs relatively simple mixtures of cell wall lipids. These are a MODEL. We can test many chemicals for their effects on this model. We might well find quite new classes of chemicals which protect against freezing damage. Furthermore, still other classes of chemicals may exist which tend to break up these aggregations after they occur. Such chemicals might restore a damaged membrane to its former state.

Finally, I will say specifically that the scale on which these changes of structure occur is molecular rather than microscopic. At worst, it's very unclear that such molecular rearrangements can affect the actual information content of frozen cells. Rearrangements of molecular structure in cell walls can drastically affect their function while not obviously destroying their information content. This question deserves far more attention than scientists, either cryonicists or otherwise, have yet given it.

INCIDENCE OF SEVERE DEMENTIA

Among our problems as cryonicists, the question of how we can preserve our finances intact until suspension ranks high. One event putting our finances at risk would be catastrophic illness, specifically an illness which left us alive, but unable to care for ourselves.

How serious is this problem? A recent article by B.S. Schonberg and others in ARCHIVES OF NEUROLOGY (42, 740 (1985)) publishes some interesting statistics on the incidence of severe dementia among different ages, races, classes, and sexes in a Mississippi county. Although there are published estimates of the rate of dementia, apparently documented statistical studies on this problem are rare.

These authors studied people of Copiah County, Mississippi, of age 40 or more. They used a well-defined method for deciding whether or not a person was demented. To count as demented, a person had to need constant supervision, had to be unable to perform normal household duties, and one of the neurologists making the study had to have diagnosed dementia or agreed with the diagnosis of another neurologist. Finally, the dementia had to have persisted more than four months.

At the time of the study, Copiah County had a population of 23,842 people, with about 49% blacks and 50% whites. Age distributions differed: Among the population 40 years or older, 39% were black and 60% were white.

The authors found 80 people in the county with severe dementia. Thirty-five of these were institutionalized (they comment that the noninstitutionalized population is much harder to count than the institutionalized. It's easy to

underestimate the size of the problem). Rates of dementia did vary markedly with age. The authors found a rate of dementia in the 40 to 59 age group of 45 per 100,000 up to a rate in the 80+ age group of 6,807 per 100,000.

Women were about 20% more likely to develop dementia than men. For instance, among whites the rate in the 80+ age group was 5,882 per 100,000 men versus 7,246 per 100,000 women. Blacks showed a slightly higher rate than whites, but this may not mean anything statistically. (Blacks, however, may be institutionalized less, so that censuses of dementia which count only institutional patients might be badly biased.)

These figures were for severely demented patients. We don't have to be severely demented in order for us to be unable to care for our financial affairs. This study therefore underestimates the seriousness of the problem from our standpoint. Less severe dementia, of course, is much harder to quantify.

The main point of this study is that as we grow older we can expect increased risk of dementia. It underscores the need for cryonicists to devise binding legal arrangements so that our provisions for suspension will not evaporate when we lose the ability to care for ourselves. Since Durable Powers of Attorney are possible in California, they provide one means for us to make such arrangements.

CLOCK GENES COMMON TO MICE AND FRUIT FLIES

By now the idea that animals and plants have at least one (and probably many) biological clocks capable of measuring time independently of any external periodicities is a commonplace of biology. I feel this is an important phenomenon for aging research too. It is a commonplace not just of biology but of everyday life that developmental events such as puberty occur at well defined times. (For some odd reason, few people pass through puberty at age 50!). Our bodies must contain clocks which time these events. These clocks may well also relate to aging, probably because they turn off repair at given times. Understanding this clock of aging ought to let us literally rewind it.

An interesting paper in NATURE (317, 445 (1985)) by H. Shin, Michael Young, and others at Rockefeller University and the Sloan-Kettering Cancer Center presents evidence that some genes controlling body clocks are COMMON between both fruit flies and mice. By implication, we also may have such genes.

These researchers used modern techniques of cloning and gene mapping to isolate a gene in Drosophila (the fruit fly) which controls several periodic behaviors, among which are the times of breaking out of the pupae and the rhythm of the fly's song. Once they had a copy of the relevant gene, they could search for closely similar sequences of DNA in cells from other species, including mice and human beings. Sequences were not identical between mice and fruit flies. However these authors did find long sequences of nucleic acids in mice identical to those of the fruit fly, within which were other shorter regions of difference. Of course we would not expect identical DNA sequences between mice and fruit flies. The sequences may involve code segments showing common factors (the existence of a rhythm, for instance) with others specifying the differences.

The authors also point out that we can now study these sequences in mutant fruit flies to work out their function. This knowledge in turn will

tell us how mouse and even human clocking genes work. Emergence from the pupae is a developmental event in fruit flies which may correspond to puberty.

One big obstacle to studying biological clocks and aging consists of the fact that we don't really understand clocks very well. This paper tells us nothing directly about aging. However a direct understanding of clocks ought to tell us enough to discover a good connection (or its absence) with aging.

MARCH-APRIL 1986 MEETING CALENDAR

ALCOR meetings are usually held on the first Sunday of the month. Guests are welcome. Unless otherwise noted, meetings start at 1:00 PM. For meeting directions, or if you get lost, call ALCOR at (714) 738-5569 and page the technician on call.

The MARCH meeting will be at the home of:

(SUN, 9 MAR 1986)
(SECOND SUNDAY)

Mike Darwin and Scott Greene
350 W. Imperial Highway, #21
Brea, CA

DIRECTIONS: Take the Orange Freeway (Hwy 57) to Imperial Highway (Hwy 90), and go west through Brea on Imperial Highway. 350 is about one mile from the freeway, and in the third block beyond Brea Blvd., on the south (left) side. If the gate is closed, park on the streets north of Imperial. Be careful crossing Imperial. There is a blind curve to the east and a blind hill to the west at this point.

The APRIL meeting will be at the home of:

(SUN, 6 APR 1986)

Sherry Cosgrove
3100 Palm Drive, #1
Fullerton, CA

DIRECTIONS: Take the Orange Freeway (Hwy 57) to Yorba Linda Blvd., just north of the CSU Fullerton campus. Go east on Yorba Linda to the second stop light (Placentia Ave.). Go north (left) on Placentia, around to Palm Drive. Turn right on Palm. 3100 is an apartment block immediately on the right, behind the K-Mart parking lot, and is not numbered. #1 is at the corner of the street and the parking lot.