

CRYONICS

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EDITORIAL MATTERS

In accord with our declared policy for this issue, all contributions have been printed AS IS, with no editing, except where noted. All authors take full responsibility for both the content and presentation of their articles, again except where noted.

The Editor of this edition of CRYONICS is I, Thomas Donaldson. I am responsible for selection of articles, layout of camera-ready copy supplied to me by the authors, numbering of pages, and provision of a table of contents.

We can recommend two other publications which any serious cryonicists should read: THE IMMORTALIST, monthly publication of the Cryonics Association, to which subscription is available through membership in CA for a minimum of \$15 a year Associate Membership (write to Mae Junod, 17534 Lamont, Fraser, MI 48026) and ANTI-AGING NEWS, available for \$27/year (write to 2835 Hollywood Blvd., Hollywood, FL 33020).

EDITOR'S COMMENTS

The theme of this issue of CRYONICS is "the past and future of cryonics," and it contains articles by CE Tandy on the past, and by Corey Noble, Fred Chamberlain, and myself on the future. I was quite surprised by the articles by Noble and Chamberlain, which have an underlying premise that for our own PERSONAL chance we need many more cryonicists than we presently have. However, all contributions agreed in a belief that the number of

cryonicists which we NEED (as distinct from the number of cryonicists which we might like to have) is an important question to any evaluation of our future. I believe it should receive much more attention within the cryonics movement than it has so far gotten; much more critical thought and analysis is called for than has yet come forth.

In terms of our answer to this question, we can then go on to formulate some policies. An examination of Trans Time's books suggest to me that its major losses now are taken in the Suspension and Standby part of its business. Art Quaife has argued cogently that Trans Time simply cannot depend for its revenue on the carrying out of suspensions, since these are too sporadic as sources of income. To me this situation suggests that suspension members should, directly or indirectly, pay an amount in their dues for Trans Time services which varies in proportion to the probability that they will need the suspension services of Trans Time. To have dues rise with age would raise problems; however, we can easily adopt the pattern of insurance companies, and have dues and Entry Fees increased with the age AT TIME OF JOINING.

Regardless of specific policies, it seems unwise for us to depend for our survival on any sweeping general changes in society at large or any rallying of noncryonicists to our cause. Our personal plans and the accounts of our societies should be founded on the premise that cryonics will remain small into the indefinite future.

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#### THE FUTURE OF CRYONICS

\*Corey Noble, PhD.

If we are to survive, the future of cryonics, and particularly the relatively near-term future extending from the present to, say, the year 2010, must be very different from its past and present. A key element in transforming the presently ailing cryonics program into a clearly viable operation is growth. Without more significant number of members, the cryonics community will continue to lack the necessary resources and stability needed to maintain bodies in storage for hundreds of years on a reliable basis. My consideration of the future of cryonics will therefore focus on the prospects of achieving growth in the next few decades. Some growth is possible through our traditional educational efforts in which we continue to define clearly our present positions. It is my contention, however, that significant growth will require a radical alteration of the entire operating basis of cryonics. In this event, the future of cryonics might indeed be very different from the present.

There are surely many reason for the failure of the cryonics community to grow. One of the most pressing ones currently is the CSC/CI disaster, which has established in the minds of most people the notion that cryonics in general is a fraudulent scheme to rip off the gullible. This idea will continue to handicap us in the future, but inasmuch as it is a simple falsehood which can be very easily refuted, it is not a fundamental barrier to growth as much as it is a temporary restraint on growth potential. The real problem is far more fundamental and serious than mere confusion over the difference between CSC/CI and cryonics in general. The fundamental problem with cryonics in its present form is that it has no credibility. Furthermore, cryonics in its present form will never have any credibility. Therefore, the only way to transform the success of the cryonics program is to transform the basis of cryonics itself.

The problem with cryonics is not the fact that nobody cares about

staying alive, seeing the future, reaching for the stars, etc. There are hundreds of pro-space groups, loads of anti-aging clinics and spas, reams of literature on dietary and other methods of extending lifespan, scads of aging millionaire sybarites who would love to continue their present frolics. Given a door to the future, plenty of people would gladly step through it, even at considerable cost, and it is therefore not necessary for us to try to sell cryonics by selling the future. The future has already sold itself. The problem is that the future is not considered available, the door into it being closed. If we were able to change the prevailing negative opinion about the feasibility of cryonics it is entirely possible that we could then bring into our ranks at least one person out of every 30,000, which would give us 10,000 active cryonicists in the US alone. This should be enough to ensure the continued existence of cryonics. Since we cannot hope to change individuals' perceptions about death and about the desirability of the future, the best strategy is to try to convince people who already have a positive outlook concerning the future and life extension that there is really something to cryonics and that cryonics really is worth looking into. Alan Harrington is one example of the type of person that is our best hope for the future. If we can overcome the reservations of individuals like Alan Harrington, Barbara Hubbard, and Madalyn O'Hair, it will be a sign that cryonics really has a future.

\*Corey Noble is a pseudonym. The PhD. is real.

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In my opinion, the perceived incredibility of cryonics is based primarily on two very strongly held beliefs. The first is that "dead is dead" and that cryonics will therefore fail for people who are dead. The second is that freezing cause so much damage that it will never be possible to reverse it, so that cryonics would be hopeless even for living people, let alone for dead ones. Although these strongly held beliefs may be based on limited knowledge, they are shared by the establishment of opinion makers, both scientific and extra-scientific, and are so deeply entrenched that we cannot hope to change them, at least not for significant numbers of people. I therefore propose that we ACCOMMODATE these beliefs by removing both death and freezing from the cryonics program, at least as the only options available. The key to larger scale acceptance of the cryonics program is to obtain the legal authority to begin cryonics procedures before death and to offer vitrification in an attractive way as an alternative to freezing. We could then offer people indefinite preservation without postmortem brain damage and without any freezing injury, and the number of "takers" should increase considerably.

Removing death and freezing from the cryonics program is a tall order, but the future of cryonics will be strongly affected by our ability to bring these changes about. These goals are not unattainable. If cryonics is going to have any future, we must be willing to "think big" and take the steps that are necessary to cause fundamental change.

What follows is a hypothetical scenario showing how the achievement of these goals might be accomplished in the coming years. Of course it should be understood that the future is more ours to change than it is ours to predict in any kind of detail, and the following is more of an illustration of possibilities than a serious effort at forecasting.

1981. Publication of this article results in discussion of what can be done to identify and circumvent barriers to the acceptance and growth of cryonics. A public opinion poll is considered. Attention is attracted again to the idea of obtaining a "mercy cryopreservation" (rather than "mercy killing") declaratory judgement. More thought is devoted to the

idea of storing whole vitreous bodies at -140 +5 or -5 degrees C. Public opinion continues to be negative.

1982-1985. Planning for a cryonics nursing home is completed. It becomes clear that it is possible to establish a cryonics terminal care facility in which a cryonicist could experience only momentary clinical death before being placed on an HLR and given stabilizing parenterals while being cooled. Much publicity is given to the fact that it will soon be possible to avoid prolonged clinical death before cooling proceeds, and this stimulates some public curiosity.

1986-1990. A cryonics terminal care facility becomes an established reality and several people are frozen (and a few vitrified) under nearly ideal conditions, with no or nearly no postmortem brain damage. It becomes clear even to new media personnel and cryobiologists and physicians that death is no longer the barrier to success it once was, although many people will continue to be frozen or vitrified under poor conditions. The facility continues to be supported mostly by non-cryonicist patients' funds. The positive results achieved continue to stimulate cryonics lawyers to push for legalization of suicide and exploitation of "right to die" and "death

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with dignity" rulings and sentiments to permit even momentary clinical death to be avoided when appropriate before cryonics procedures commence.

Great strides are made in vitrifying and freezing whole kidneys, brains, and other organs. At least one cryobiologist goes on record as being a cryonicist. A great deal of interest is stimulated concerning the possibility of vitrifying whole people to achieve a state very close to perfected suspended animation. Several individuals of considerable wealth consider backing the construction of a long-term storage facility. The facility, modeled after existing walk-in cold room establishments which have an unbroken 10 year long record of maintaining -85 degree C within close tolerances, would utilize a mechanical refrigeration system (plus one mechanical and one liquid nitrogen back up system) for maintaining a -85 degree C environment, within which the storage containers would be maintained at -140 degree C using state-of-the-art thermoelectric cooling devices, which are very reliable and are not subject to mechanical failures.

1990-2010. Construction of the proposed permanent storage facility is begun. The perpetual maintenance of the facility is ensured by the commitment of controlling shares in several business ventures to the account of the facility corporation, so that income from the business ventures will always equal or exceed the cost of maintenance, even without the availability of trust funds of suspended individuals. The availability of space in the facility together with lessened maintenance costs per patient and greater security stimulates considerable growth of the cryonics program. At least one celebrity is know publicly to be signed up to be cryopreserved. Several individuals uncertain about their ability to pay for reanimation services revive the centuries-old concept of indentured servitude, signing contracts which give any interested party in the future a guarantee of up to 100 years of service in exchange for paying the cost of reanimation. A few individuals, caught between old concepts and new, see cryonics as a possible means of avoiding Hell.

As the storage facility is completed, the cryonics terminal care facility is combined with in on the same premises, and revenues from non-cryonics patients continue to support part of the overall operations. Legal rulings favorable to cryonics are handed down, removing completely the need for a person to die before being preserved. Brain preservation becomes a well-defined technology and many more individuals, including

wealthy individuals, become involved. A laboratory is established for conducting further research in cryonics, and a journal of cryonics research is established. At this point cryonics becomes a firmly established part of society.

AS the year 2,000 approaches, more and more people become optimistic about the future, and continuing scientific and technological progress makes cryonics more and more plausible and socially acceptable. For the first time, the contemplation of space exploration and development starts to stimulate both government and private interest in suspended animation research. As the third millennium begins, problems such as inflation and hunger are well on the way to solution, allowing more and more attention to shift to life extension. Effective life extension drugs will be available, and people will be taking them. It is clearly becoming an immortalist's world. The fact that it may also be on the way to becoming a cryonicist's world will have been due, in no small part, to the steps taken since 1981 which resulted in a greater degree of plausibility for the cryonics movement in the minds of those who were ready to live.

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#### CRYONICS -- THE FUTURE

Those people who scoff at and discount the future of cryonics, and there are many of them, are walking on very thin ice. The future, at best, is only visible in the light of the past. Where cryonics is concerned, the past has almost nothing in the way of comparable developments to offer.

The future of the automobile rested on a history of oxcarts, chariots, and stagecoaches. Cryonics has no historic parallel other than the Egyptian cult of preserving the dead by mummification. The Egyptian culture was based on the divinity of royalty, supported by the fraud of an entrenched priesthood. Notwithstanding this, that culture persisted thousands of years, and demonstrated that humans can be strongly impelled by a system in which the objective bypassing of physical death is paramount.

There is no way to know what would have occurred if the Egyptians had possessed workable suspended animation rather than a mystical sham. With the prospect of lifespan extension and the expansion of human potential through engineering, parallels with the Egyptian culture fade further -- the centuries of pyramids become just another religious era, like that of the Aztecs. Perfected life extension will constitute a major break in the pattern of evolution of life on Earth -- as part of this development, cryonics has no parallels at all.

Most persons who "grasp" the potential significance of life extension hold their breaths, as if they were suspended by a thread above a chasm, waiting for an explosion of cryonics activity they imagine will take place at any moment. As years pass, they realize the time is not yet right. Some newcomers, dumbfounded, lose heart and wander away. Others see that there is no alternative, and their interests hold firm. The question they ask is, "How long will it take?"

The problem of "How long will it take?" stems from the onward rush of time and the aging process that continues to snuff out generation after generation without slackening pace. 100 years (if we should live so long) equates to 36,525 days -- in terms of pennies, \$365.00, quite a paltry "allowance." The jeopardy in just "waiting" incites us to "force" history -  
- not merely to content ourselves with the "inevitability" of life

extension.

A "trigger" mechanism is what most life extensionists really desire. On a mountainside heavy with snow, the steps of a hiker, or skis cutting through the snowcrust may release enormous quantities of sliding ice in an avalanche. Those who would like to cause a similar acceleration of interest and activity in life extension frequently speculate on what it will take to "get things going." Among the possibilities heard most often are a successful series of suspended animation experiments with animals, involvement of one or more famous personalities, a well capitalized promotional campaign, or some related event such as development of a potent anti-aging method.

An essay by Fred Chamberlain

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#### CRYONICS -- THE FUTURE

Most critics of cryonics point to the lack of a proven "round trip" technology. Irrespective of arguments about future scientists developing methods to deal with thawing damage, it may well be the case that a "round trip" demonstration in sizeable mammals will be a precondition of massive public enthusiasm for cryonics. Lack of a demonstration, to and from long term storage temperatures, may be likened to a sturdy dam behind which all major motivation for cryonics is stored.

"But why should such a dam exist?" many cryonicists object! "Why would anyone not do anything which might offer the slightest hope of success? Look at the treatments for many terminal illnesses which, while quite extensive, frequently have little chance of benefit! Why do people struggle so to live, and yet decline or fail to seek out a procedure which has any possibility at all of circumventing death entirely?"

A large part of the "dam" holding back life extension is pure mysticism -- promises of an effortless, risk free immortality to be purchased by blind adherence to the tenets of some faith. Most terminally ill patients, while not certain of being immediately transported to some heaven upon death, yet have a desperate, unfounded hope that they may somehow awake in another world. Few dying people view themselves as incredible colonies of some forty trillion living cells, all of which will die over various periods of time after the heart stops. Even fewer perceive the promises of effortless immortality as frauds, employed in many forms over thousands of years in dozens of cultures for such purposes as population control and the preservation of royal lines and priesthoods.

The "dam" holding back science-oriented pursuits of life extension is interwoven into so many institutions and practices, so deeply embedded in most individuals' self concepts, that it may for a time withstand even the most clearcut demonstrations of fully feasible life extension procedures. The dam will ultimately collapse, of course, and the transition period is almost certain to be chaotic!

When suspended animation can be demonstrated as a fully proven technology and methods for slowing/reversing aging are perfected, one can envision a total transition of mankind to a life extension culture. The crumbling away of many institutions, drastic changes to concepts of "personal destiny" and elimination of extension childbearing for species preservation, all will take place in a relatively short period of time. In

terms of the evolution of life on earth, this will be virtually a "discontinuity," and the long range results can scarcely be guessed. The point is that a transition of this magnitude will involve a considerable cultural "shakeup," something akin to going over Niagara Falls in a barrel. Even the details of this near term "shakeup" are guesswork, but important to be concerned with, since our survival as individuals may hang in the balance.

An essay by Fred Chamberlain

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#### CRYONICS -- THE FUTURE

Many of we cryonicists living today may be frozen by the time the peak of the "cultural shakeup" is reached. We will be sleeping, as the "barrel goes over the falls." With this in mind, we should be thinking not only of how to instigate the rush into life extension, but how also to survive it. Will various states and countries "outlaw" cryonics? Will there be secular wars over life extension in general? Will such conflicts take on nationalistic tones, i.e. a "life extensionist" United States being attacked by a culturally retarded and stagnant Middle East with "atheist" Russia coming in as our ally? We do not know, but we should consider all possibilities and attempt to concentrate on preparing for the most likely scenarios.

Nobody ever told us survival through life extension was going to be simple or easy. It will almost certainly be challenging, exciting, and risky. At least, we don't have to return to the dust in ordinary ways. While time permits, those of us who expect to make a maximum survival effort must begin to plan, to predict, to build defenses which will survive and protect us even when we may lie in a cold, deep sleep. Such defenses may depend on the efforts of people yet unborn, whom we may not identify and know for many years hence. They, in turn, may have to pass the torch to others -- we have no way of placing limits on the time that will be required.

If, despite all odds to the contrary, we make it -- we pass into a life extensionist future with our self identities intact, it will be no sham heaven. . . it will be for real! The rocks, the birth and death of stars, all attest to the continuity of time in the universe -- to the existence of the "future" we are seeking. Someday, hopefully, we may all be able to get together at some distant spectacular part of the solar system and celebrate the fact that we managed to escape, through time, from a place where death was considered as natural and acceptable as breathing -- where survival by spiritual deliverance was the only kind of survival most even considered seeking -- where a few of us were absolutely convinced our destinies lay elsewhere!

The paragraph above presents a satisfying view of the future -- positive and comfortable. Let's try to remember that at this time, we are stuck back at the starting point. We are not "immortal" because we can conceive of it. . . we are all dying of the sickness known as aging, and cryonics is currently like jumping out of the window with an untested parachute. Acting in desperate haste, without a fully worked out plan, may avail nothing -- this is what we have been doing up to now, and we have plenty of skinned knees to show for it.

A first step is to know what we are "up against" -- this paper is a

small contribution towards that -- a second step is to work out a strategy for success. A plan which takes into account such things as our personal goals, resources and limitations as individuals. . . includes the definition of the milestones we must achieve cooperatively through organizations. . . devises ways of dealing with developments we have been unable to predict. . . defines what we mean by such terms as "commitment" and how this affects the viability, the reliability, the probability of success of any plan we may jointly create.

An essay by Fred Chamberlain

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#### CRYONICS -- THE FUTURE

The usual view of "planning" is that a committee sits down and works out in its best judgement what will be done and tried in the interest of success -- this is the "plan," and it binds people who made no contribution to it. . . such plans do not incorporate broad, long range details concerning the people who are supposed to implement the plan. . . a few facts such as professional qualifications and physical health are all that are taken into account. Plans like this can be used to win wars where individuals are expendable, and even to create economic power blocks over short periods of time, but they have limited longevity and reliability -- they do not "fit" what is needed in a system where survival of individuals over great periods of time is the objective.

So what kind of "plan" is needed? How can it be implemented? How can such a thing possibly be worked out, and how can it be implemented without being unbearably unwieldy? How can a plan exist which is the composite of a myriad of individual plans underlying it? Yet, without this, how can any plan be trusted? How can we rely upon it? What does planning have to do with the future of cryonics anyway?

Planning has everything to do with the success of human endeavor, if you look at history, and cryonics is no exception. Many early tribes that survived tracked the north-south movement of the sun with the seasons so as to govern their planting/harvesting activities. . . No great structure ever rose without architectural planning. . . Man's recent trip to the moon was a masterpiece of planning and coordination. Nothing less will do for us, in fact, we need new dimensions in planning -- planning to do the planning. . . planning which incorporates our individual plans. . . planning which permits a fluid adjustment as time passes and we grow/change as individuals.

Planning can, and will, have a profound effect on the future of cryonics, and is a proper topic for a separate article at a future time. Meanwhile, consider the following questions: Do you have a personal plan which fully brings together, without conflict, your day to day lifestyle with your goals as to life extension? Do you feel as if your plans fit perfectly with those of other life extensionists, in an overall plan to see you safely into the future? If either answer is "no," do you feel you would be more satisfied with your life if you could change the answer to "yes"?

An essay by Fred Chamberlain

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## CRYONICS AND OUR FUTURE

by Thomas Donaldson

Many outsiders, and even many people actively involved in cryonics, feel that our chances of eventual revival are really not very good. The major fact leading many to believe this is something obvious to every cryonicist: cryonics is so SMALL. This fact has corollaries: very few people are actively working to improve suspension methods, very few biologists count themselves as cryonicists, the medical "establishment" is almost entirely indifferent or opposed to cryonics. . . and so forth. "However," we can imagine a newcomer questioning, "however can you believe that despite all these facts visible to everyone, your chances of revival are worth even 65 cents, let alone \$65,000?"

In order to predict the future, we use (either consciously or unconsciously) a THEORY about how historical events are related to one another. It's quite true that cryonics is small, cryonicists are few in number, and cryonicists who are qualified biological scientists, much less qualified cryobiologists, is even fewer. We can count the last group on the fingers of one mutilated hand. Nevertheless my own theory of what's happening with cryonics predicts that our chances are much larger than the proportion of cryonicists to the general population: indeed, I think they are VERY much larger. Just how much larger I can't really say, but the probability of our revival seems large enough that I cannot think of it as small.

The common idea in evaluating the future of cryonics seems to involve somehow counting up the number of cryonicists and dividing this number by the number of PEOPLE. Not surprisingly, we get a very small number. However even a little thought should convince us that the number we get by doing that is almost entirely IRRELEVANT to our chances of survival. Look here. WE ARE RUNNING A CRYONICS SOCIETY, NOT AN ELECTION!

A reasonable person might ask at this point if numbers of cryonicists play any role at all in our eventual survival. Yes, the number of cryonicists does play a role, and I will discuss that role. There are several other numbers which play very important roles, and we can look at them too.

Let's take an economic approach to the subject of our survival and our revival. In doing so, I will translate everything into money terms; it's quite true that money is not everything, but it is a convenient accounting device and should help to make the points I wish to explain very clear indeed. In the first place, in order for us to be successfully stored indefinitely and eventually revived, we must provide a certain amount of resources in the form of money or other things. To make an initial approximation, I'll suppose that this amount of money, \$X, is completely independent of the number of cryonicists in existence who are in storage already. That is, the cost of storage per person does not depend on the number of people stored. In order for us to remain stored indefinitely and eventually revived, one fundamental relation which has to hold true and to go on holding true is that there EXIST cryonicists. That is, there must continue to be people who will care for the patients in storage and for their money, devoting this money to their storage, and finally there must be people who will be motivated to revive us whenever that becomes both desirable and possible. In other words, one fundamental condition for successful storage is that the number of live cryonicists never goes to ZERO.

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This gives us already one very important NUMBER to play around with. The number of cryonicists will remain above zero so long as the RECRUITMENT RATE for new cryonicists EXCEEDS the ATTRITION RATE of cryonicists who undergo suspension (or perhaps lose interest, although I've never heard of that happening). We can now use this number to see just exactly what it means. Right now there are probably under 200 cryonicists in the entire world. We have an average lifespan of about 70 years; I will suppose that people on average become Suspension Members at age 30 and then for 40 years afterwards. To find the average attrition rate per year we divide 40 into 200, getting a figure of FIVE. This means that so long as we recruit FIVE OR MORE CRYONICISTS PER YEAR in the whole world, on average, we will continue to have cryonicists on into the indefinite future.

FIVE is not a large number. Unfortunately the various cryonics societies do not maintain and publicize demographic figures of their recruitment and attrition rates. I don't know what this number is currently; it is a far more more important number than the number of cryonicists itself, or the number of people in the world. Naturally as the number of cryonicists increases, the total number of people we recruit each year must also increase; but we only have to recruit about 1/40th of our number every year to keep going. When looked at coolly, FIVE seems very unimpressive matched against the population of the world; but then, converting or finding five cryonicists is a MUCH easier problem than converting the world, isn't it?

Now of course since the numbers are small, we must expect a lot of random variation. In some years, we may convert 10 or even 20 people to Suspension Members, while in others we might convert only 1 or perhaps even none at all. But we have a buffer, and it's very important. The period over which we have to maintain the average is a period on the order of 40 years. What happens in one year alone is not very important, since we can all expect to continue living and working on cryonics for at least (on average) 40 years after we join. We can therefore withstand a lot of random variation in recruitment rates.

In the above I have assumed that the sum of money we must provide for our continued storage does not depend on the number of cryonicists in storage. Clearly for very small numbers of cryonicists that's not so. Let's try to change our economic model so as to take account of that, and see what sorts of factors might increase or decrease storage costs depending on the number of patients in storage.

One perhaps surprising fact is that the cost of providing against catastrophes of various kinds is unlikely to bear much relation to the number of cryonicists in storage. For instance, wars or rebellions can be dealt with in several ways, but the most efficient is to MOVE patients out of harm's way. But the cost of moving suspended patients, per patient, is unlikely to vary much depending on the number of patients we have to move. The same is true of adverse governmental regulations: there are over 100 different sovereign states on the planet, and the optimal solution to adverse regulation is to move the patients somewhere else where regulations are not so adverse. The cost per patient of moving patients should be the same whether we are moving 10 patients or 10,000.

On the other hand, various forms of passive protection should have some relation to the number of cryonicists in storage, because of economies of scale. We need a place of storage, which must be either owned or rented;

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larger the number of cryonicists stored there, the smaller the cost per patient. We may wish to have this place of storage protected passively in several ways: thick and strong walls to protect against fires and earthquakes, for instance; a number of spare capsules to deal with the problem of capsule failure. If we hire a watchman who is a cryonicist to be responsible for care of the patients his salary is a fixed cost which (so long as the number of cryonicists is not TOO large) does not depend on the number of people in storage. That means that his cost per patient will go down the more patients he watches. Finally, perhaps the most important economy of scale is the ease of investing large sums of money rather than small.

It is usual in cases of economies of scale that at some point if the scale gets too large, we stop getting those economies of scale. For instance, if we store TOO many cryonicists in one capsule, then we have a terrible problem if that one capsule starts leaking. In general, there is an optimum size of storage installation such that if the number of people in storage EITHER INCREASES OR DECREASES, costs per patient will rise. Once we attain this optimum number, our own INDIVIDUAL costs and risks will stay the same no matter how many people are stored. It is this optimum number, and not the proportion of cryonicists to the population at large, on which we should focus when discussing our chances of successful longterm storage.

Unfortunately we don't yet really know just what the optimum size for a storage center might be. However we can make some observations. If we have 200 head in storage at a storage charge of \$900 a year, we have a yearly income from storage of \$180,000 a year, which seems entirely adequate to support a (small) facility and the parttime salary of someone to watch over the patients in storage. I think it quite likely that we are already coming close to the optimum size and if we have 200 patients in rather than 10 in storage (as on average cryonicists now living can expect at about the time they are suspended) we will probably have reached that figure. We will probably also have reached a figure for the total value of our suspension funds which takes account of economies of scale in INVESTMENT too: if after suspension every cryonicist leaves a trust fund of \$30,000, then that would amount to 6 million dollars. Yes, 6 million dollars is not GREAT WEALTH, but then it is not small either. Among other things, a sum of 6 million dollars allows considerable diversification of assets and the maintenance of a cash reserve for emergencies.

When looked at coolly, it seems unlikely to me that we will need even as many as 1000 cryonicists in storage to take advantage of whatever economies of scale or safety there may be in numbers. We must pay for our suspensions, including all contingencies and catastrophes, by our own suspension funds. Once we attain enough people for these economies of scale, we do not increase our suspension funds by increasing the number of cryonicists. We really don't need all those people out there. It is the other way around: it is their MISFORTUNE that they are not cryonicists.

Now everyone involved in cryonics sooner or later thinks about various paranoid political events. The type case of these would be that the ENTIRE WORLD unites against cryonics. I don't think that's reasonable, even on its own terms. Here's another way of thinking about it. Cryonicists are like a small island nation, say Samoa or Iceland, or for that matter Andorra or the Principality of the Knights of Malta (which consists of one

building in Rome, with a population of ONE). It's quite true that if the ENTIRE WORLD united against Iceland, Iceland would be destroyed. But that point forgets that nobody really care enough to destroy Iceland, while the Icelanders care

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a lot about continuing to exist. In order to exist, they ally with whomever suits them; they make themselves useful in any one of a number of ways. They play one side against the other. As a society and culture, with a language and literature of their own, Icelanders have existed for 1000 years, and show no signs of going away. There are about 100,000 Icelanders. Of course, they've had their ups and downs, but the point is: they still exist. For cryonicists, the best way to deal with political and social opposition at present is probably to leave the country where it exists for more favorable climes. There will ALWAYS be more favorable climes.

For cryonicists who are scientists, and particularly for cryonicists who are biological scientists, the worry about the small number of cryonicists takes another form. After all, there are very few cryobiologists who are cryonicists also. And for scientists it is very important that our peers "recognize" us: that they consider the problems on which we work at least worth the effort, and what we have to say worth listening to. In these terms particularly for a cryobiologist it may be even more important to convert other scientists than to convert the world at large, and the small numbers of cryonicists in existence becomes a painful fact. It is very easy to look at this situation and judge that cryonics can't possibly survive.

Yet look here. We're talking about SURVIVAL, we're not talking about scientific recognition. Hundreds of intellectual movements: homeopathy, osteopathy, naturopathy, psionics, ufology, dowsing, Atlantism, astrology, and may other movements have survived for hundreds of years in the teeth of opposition from the scientific community.

FOR SURVIVAL scientific recognition is quite unimportant. The material base of homeopathy, osteopathy, chiropractic, and iridology lies somewhere else than in the medical establishment. Doctors and scientists may fume, but their impotence is clear to all.

Furthermore we don't even need scientific recognition to do scientific studies aimed at improving our suspension methods. If such studies are worth doing, they are worth doing because they will improve our methods, not because they will make scientists or doctors change their opinions of us. Survival is its own reward. True, if the number of cryonicists is small, then only relatively small amounts of money can go into research. If all scientists became convinced of cryonics, then vast amounts of money MIGHT be forthcoming. However it's just as true that if wishes were horses, beggars would ride. Those biologists who wish to help with cryonics research can (and already do!) help out whether or not the community of self-proclaimed scientists recognizes their efforts; and their work remains just as scientific whether or not that community calls it so.

My own opinion is that cryonics, as distinct perhaps from the quite different proposition that people who are already alive can be successfully frozen and revived, has no chance whatever of attaining scientific

recognition whatever until someone frozen by present inadequate techniques after dying of old age is successfully thawed, revived, and rejuvenated. Nothing less will do. Quite possibly I am overly optimistic, too. In any case, I doubt that such an event will happen for at least 100 years AT MINIMUM, and I'd be surprised if it only took that long.

The fundamental problem with using scientific recognition as a touchstone for the survival of cryonics is that scientists suffer from the very same psychological problems about death as everyone else in the population. The

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proposition that someone dying of a terminal cancer, or horribly maimed in an auto accident, can EVER come back to life and health does not depend on any scientific beliefs in the strict sense. It is an unprovable proposition about the direction in which science and medicine are moving and how far they will go. Yet that premise is fundamental to cryonics; without it the whole endeavor makes no sense at all. We're not even likely to learn to freeze WELL people in any reasonably near future; the most we can expect is verifiable preservation of the nervous system. Is there any cryonicist who seriously believes that many cryobiologists, who by and large CHOKE on the idea that we might not bother to preserve the HEART, who have endless hangups about "viability" and moral doubts about freezing, are going to accept that freezing the BRAIN is a successful proof of CRYONICS? No way.

Perhaps the history of insurance will give us a good idea of just what the REAL sources of apathy towards cryonics are. Life insurance doesn't require any special TECHNOLOGY or SCIENCE at all. Indeed, the relation was all the other way: it was because life insurance companies were founded and people wished to insure their lives that the mathematical studies needed for life insurance were done. And even despite the fact that no TECHNOLOGICAL barrier to life insurance existed at all, it took over 60 years for more than a minute proportion of the population in the United States to accept the idea, and even after that only a small minority insured their life; that 80 years after the first attempts to found companies opposition to the idea was still rife. People thought it was FOOLISH to take out life insurance. They thought it was IMMORAL, and they thought the companies promoting it were FRAUDS. It will probably take at least as long for any significant number of people to adopt cryonics as it took for life insurance to catch on.

So we have an idea of what will happen to OUR future in cryonics. Cryonics and cryonicists will continue to exist; they will very gradually increase in numbers. Almost all scientists, doctors, and biologists will dismiss cryonics as a wild fantasy on the same plane as ufology, for at least 100 years. Almost every living cryobiologist will rot or burn; all those people out there waiting for "something to happen" before they make any arrangements will also rot and burn. The storage centers will move several times, probably out of the US. Wars and rumors of wars, crashes in the sharemarket followed by tremendous booms. Eventually many people will begin to notice the storage centers: rusted walls encrusted with moss, and many of the original patients STILL IN STORAGE. More people will begin to join, the longer it lasts ("For Chrissake, they've kept going for 100 years now!"). Research will pick up. About 200 years from now some large fraction of those frozen now will come out of storage. It will not be a dramatic event but a matter of routine. "What's surprising about that?" everyone will say. "After all, we've known it would someday happen for the last 100 years. . . ." We will be ALIVE.

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\*\*\* EXTRA PAGE INSERTED IN THE ISSUE'S CENTER \*\*\*

#### CRYONICS TRAGEDY

In February 1974, RM Sr. was placed in suspension due to the efforts of his son RM Jr. He was soon placed in long term liquid nitrogen storage at the new Trans Time facility. In November 1978, RM Jr.'s mother KM died and was placed in suspension by the Trans Time suspension team.

In June 1980, RM Jr. was killed in an automobile accident. In spite of numerous urgings, RM had not made long term funding arrangements for his parents, and had not become a BACS Suspension Member himself. Since he was not wearing one of the Medic Alert bracelets that our enrolled Suspension Members wear, we were not contacted at the time of his death, and he was soon buried.

We have since retained an attorney and filed a claim against RM's estate for the ongoing charges for maintenance of his parents in liquid nitrogen, plus charges for their disposition. The two attorneys for the estate representing the two sides of the family are not willing to seriously address or negotiate our claim.

Trans Time has unpaid invoices totalling \$6,600 for one and a half years maintenance of these two patients in liquid nitrogen. We can no longer afford to subsidize their maintenance. This continued cash outlay for liquid nitrogen and other maintenance costs, when Trans Time is losing money almost every year, endangers the continued maintenance of patients for whom storage bills are being paid.

We have received an offer from two fellow cryonicists to excise the heads of these patients and maintain them as neuropreservation patients. These and other proposals for continued maintenance of these two patients should be addressed to BACS President Jerry White, 1675 Oxford Street, Berkeley, CA 94709, (415) 841-7681. BACS has legal custody of the two patients. Trans Time states its intention to terminate their suspension on November 1, 1981, and dispose of them by cremation, unless alternative and funded proposals are forthcoming from other cryonics organizations or supporters. Including past bills owed, a minimum of \$110,600 would be needed for investment to provide a reasonable chance of indefinite maintenance of these two patients.

Art Quaife, President  
Trans Time, Inc.

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NICHOLAS FYODOROVICH FYODOROV

by Charles Edward Tandy

The article which follows is a slightly edited version of one written several years ago by Charles Edward Tandy. It has had an underground existence among cryonicists for all that time; I print it because I feel it deserves publicity. Cryonicists should know about what the past of cryonics has been, just as much as they should think about the future. So far as I know, Fyodorov was the very first person ever to conceive of resurrection as a specifically scientific task. THE idea of scientific

(i.e. technological) means to rejuvenation is much older, going back to the early Chinese Taoists; the idea of "suspended animation" seems at least as old as the 18th Century as a scientific task. Neither immortality nor suspended animation however, are quite the same as cryonics; Fyodorov seems the earliest mention of resurrection in these terms.

Everyone knows that myths of suspended animation (the Seven Sleepers), immortality (the Wandering Jew or Utnapishtim in the West, or the hsien in China), and resurrection (Lazarus) go back very far in history. The outsiders often reproach us with these myths; the only answer I know is that they are myths precisely because they embody very deep human desires, and by scientific means we propose to achieve these desires.

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Nicholas Fyodorovich Fyodorov. Although he was highly praised by such people as Fyodor Dostoyevsky and Leo Tolstoy (literature), Afanasi Fet (poetry), Vladimir Solovyov (philosophy), and Konstantin Tsiolkowsky (astronautics), he is virtually unknown to the Western world.

Nicholas Fyodorovich Fyodorov, a 19th century Russian, formulated an immortalist philosophy from a Christian perspective. Bastard born in 1828 of Prince P.I. Gagarin and a woman of non-nobility, Nicholas Fyodorov (with his mother and her other children) had to leave his paternal home at age four, due to the Prince's death. The family continued to be well taken care of, however. Fyodorov studied law for only 3 years, then began 14 years of wanderings in seven cities, teaching in elementary schools. In 1868, he began 25 years as a librarian with the Rumyantsev Museum. After retiring, and until his death in 1903, he worked in the Archives of the Ministry of Foreign Affairs.

Throughout much of his adult life he lived almost ascetically. He resided in a tiny room where he slept 4 or 5 hours daily on a hump-backed trunk. He often went for months without eating any hot food. He did not want to possess property and never owned even a winter overcoat. He considered fame immodest. He turned down proposed salary increases; nevertheless, he often assisted needy scholars with his own funds (which one might have supposed to be nonexistent).

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Fyodorov wrote much, but was not interested in publication, nor in writing to be easily understood. He was largely unknown to his contemporaries. His works, published posthumously, were (in proper spirit) available only free of charge from the publishers, who renounced all rights. Little on or by him seems available in English even today. He is not listed even in the indexes of Encyclopedia Britannica or Encyclopedia of Philosophy, to cite only two examples. Other examples are too numerous to mention, so see the bibliography at the end of this article for English-language references.

#### Fyodorov's Basic Idea

Fyodorov, due to his Christian perspective, found the widespread lack of love among people appalling. He divided these non-loving relations into two kinds. One is alienation among people: "nonkindred relations of people among themselves." The other is isolation of the living from the dead: "nature's nonkindred relation of men." "Man must live not for himself (egoism), nor for others (altruism), but with all men and for all men." Fyodorov is referring to all people of all time (past, present, future). He is speaking of a project to unite humankind, colonization ("spiritualization") of the universe, the quest for the Kingdom of God,

creation of cosmos from chaos, the death of death, even resurrection of the dead. Fyodorov believed, and passionately felt, that resignation in the face of death and separation of knowledge from action was false-Christianity. He cautioned against being fooled into worshiping the blind forces of Satan. Rather, one should actively participate in changing what is to what ought to be.

Let us now look at Fyodorov's views on various topics.

#### Fyodorov On History

"History is (in essence) a ravaging of nature and an annihilation of men by one another." Genuine loving relations or true human community would produce people interested in using science to overcome death and to populate, regulate, and transform "all of the worlds of the universe." "It was for this that man was created." "Our attitude toward history should not be 'objective,' i.e. nonparticipating, nor 'subjective,' i.e. inwardly sympathetic, but 'projective,' i.e. making knowledge 'a project for a better world.'" "In Man, nature itself has become aware of the evil of death, aware of its own imperfection." In history "mankind is summoned to be God's instrument" in the salvation of the world.

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#### The Two Classes

The division between the learned and the unlearned was, in Fyodorov's view, worse than the separation of the rich and the poor. The unlearned are more concerned with work than thought. The learned (philosophers and scientists) are less concerned with work than thought. The learned seem unaware that ideas "are not subjective, nor are they objective; they are projective." Philosophers and scientists, because they have separated ideas from moral action, are simply slaves to the imperfect present order. It is a root dogma of the learned that paradise is not possible. The unlearned should demand that the learned (because only they have the necessary knowledge) become a temporary task force for the Kingdom of God. The learned, however, will attempt to persuade us that problems like crop failures, disease, and death are not general questions but matters for a narrow discipline, questions for only a very small (or non-existent) minority of the learned. Separation of the learned from the mass turns them into a seemingly permanent class, producing non-lovers of humankind. The "transformation of the blind course of nature into one that is rational. . . is bound to appear to the learned as a disruption of order, although this order of theirs brings only disorder among men, striking them down with famine, plague, and death.

#### Birth And Resurrection

Parents give their life to the raising of their children. Children should devote their life to the raising of the dead. "Death is a triumph of blind, nonmoral power"; "a man who would not return life to those from whom he relieved it is not worthy of life or freedom." Fyodorov thought of "replacing childbirth by the raising of the dead." In redirecting the "unconscious process of birth into a universal resurrection," "mankind can make all worlds support life." No doubt (Woody Allen would be pleased to know) "the actualization of this project would demonstrate that life is not an accidental or useless gift." According to Fyodorov, science will mean "control over all the molecules and atoms of the world, in order to collect what is dispersed, to unite what is disintegrated, i.e. to create our forefathers in the body."



## Patriotism To One's Roots

A citizen, a comrade, or a team-member can be replaced by another. However, a person loved, one's kin, is irreplaceable. Moreover, memory

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of one's dead kin is not the same as the real person. Pride in one's forefathers is a vice, a form of egoism. On the other hand, love of one's forefathers means sadness in their death, requiring the literal raising of the dead. Politics must be replaced by physics. The politics of egoism and altruism must be replaced by Christianity which "knows only all men." Pride is a Tower of Babel which separates us from one another. Love is "a fusion as opposed to a confusion."

## A Good Death

The "desire for repose in old age . . . is not humility before the Divine" but Satan-worship. "Regardless of wars, our real enemy remains (for the time being) the blind, death-dealing power legalized by" social Darwinism (only the fit ought to survive). "The true relation of a rational creature to the irrational power" of nature "is that of the regulation of a natural process." "No matter how deep the causes of mortality may be, mortality is not primordial; it is not an unconditional necessity. The blind power in whose dependence a rational creature finds himself can itself be controlled by reason."

## Salvation

For Fyodorov, "complete and universal salvation" is preferable to "incomplete or nonuniversal salvation in which some men -- the sinners -- are condemned to eternal torments and others -- the righteous -- to an eternal contemplation of these torments." That is to say, Fyodorov's bold science project, "the common task," is not the only route to salvation. "Salvation may also occur without the participation of men . . . if they do not unite in the common task"; "if we do not unite to accomplish our salvation, if we do not accept the Gospel message," then a "purely transcendent resurrection will save only the elect; for the rest it will be an expression of God's wrath," "eternal punishment." "I believe this literally." "Christianity has not fully saved the world, because it has not been fully assimilated." "Christianity is not simply a doctrine of redemption, but the very task of redemption."

## An Epilogue

Many of the few philosophers familiar with Fyodorov admit his originality, his independence, his human concern, perhaps even his logic -- up to a point. But at some point (there is disagreement as to at what point), there same philosophers state matter-of-factly that Fyodorov has slipped into fantasy or magic.

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Too, Fyodorov's thoughts have been variously described as bold, culminating, curious, easily-misunderstood, extreme, hazy, idealist, naive, of-value, scientifico-magical, special, unexpected, unique, and utopian.

Perhaps all would agree, however, on his single-mindedness. Looked at positively, this is simply another term for purity-of-heart, a quality of saintliness.

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(This article has been shortened by the removal of several paragraphs. In accord with the wishes of Mr. Tandy, we have NOT copyrighted it.)

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#### SCIENCE REPORTS

##### RNA FROM POSTMORTEM BRAINS WILL FUNCTION

The case for cryonics does not rest upon any simple notion of survival. Those, either scientists or laymen, who are not cryonicists believe that

there is an event which occurs at some identifiable time after which either people or cells are irreversibly irrecoverable: not, take note, "irreversibly irrecoverable" in the sense of what any PRESENT technology can do, but irreversibly irrecoverable IN PRINCIPLE. Yet anyone can see the tremendous difference between these two kinds of events, and even without any specifically biological argument at all the most we can say about what is irrecoverable in principle (and therefore about "death") is that NOBODY KNOWS what is irrecoverable in principle or when the time of "death" occurs.

This point holds both for individual cells and for a whole person. Outsiders use the word "destroyed" or "killed" to describe cells far too loosely. Usually when someone uses this term he or she does not mean that the cell or person has ceased to exist, they mean that the cell or person is not functioning: in fact a very different condition from that of being "destroyed." It is the difference between having one's house burnt down and accidentally locking oneself out of the house.

In itself this would be a relatively minor philosophical point. However when we consider the extent to which the biochemistry of cells and tissues, and even whole functioning organelles and parts, all survive the so-called "death," the point becomes much more philosophical. The case for cryonics, in brief, rests upon the observation that on a subcellular level, even in brain cells, virtually all the cell structure continues to exist even after ischemic and freezing injury. A person is not "destroyed" at the time of "death," but rather locked away into their own cells. If not frozen, they will be destroyed quite literally, but if frozen they will stay locked away but not destroyed for as long as they remain frozen.

These thoughts bear upon a recent experiment, which provides yet again another instance of survival of subcellular structure even long after "death" of the brain. J. M. Gilbert, C. A. Marotta, and others from several medical schools and hospitals in Boston report experiments in JOURNAL OF NEUROCHEMISTRY (36(3) (1981) 976-984) in which they extracted messenger RNA from postmortem human brains up to 6 hours after "death." They then tested this RNA to see if it would serve as a template for the formation of new protein molecules in the same way as it does in functioning cells. It did so easily; the messenger RNA would stimulate the formation of human brain proteins in a cell-free system in which only the original messenger RNA had come from the postmortem brains. This shows that the synthesis products could not be mere impurities coming from the original brains. In a parallel experiment the same scientists compared this messenger RNA from to messenger RNA isolated from the postmortem brains was less than that from the rats, but these researchers report that they could find no evidence at all for selective breakdown of some kinds of RNA compared to others. The postmortem RNA successfully directed the synthesis of over 250 different proteins with some even of very high molecular weight, such as 250,000. In particular, the proteins produced were identical to the corresponding proteins synthesized

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by RNA taken immediately after death from rat brains (rats and human beings have a great biochemical similarity, less of course than the similarity between humans and chimpanzees, but still great compared to say trees and human beings).

By now many studies of survival of functioning cell parts and biochemicals taken from brains after "death" exist. Many critical enzymes for metabolism and brain function remain active up to 72 hours after "death"; some scientists have isolated synaptic complexes from human brains as long as 20 hours after "death" with no signs of postmortem degeneration during that period. Appreciable protein breakdown will not occur up to 8 hours postmortem and perhaps for very much longer.

In cryonics terms this information is also interesting for the indications of treatments and conditions which will destroy or minimize survival of m-RNA. The authors of this study mention, in particular, that they could not isolate any messenger RNA at all from the brains of patients who had been kept on a respirator for more than 24 hours prior to death. Such a treatment, of course, may keep ischemic brain tissue at a high temperature for a prolonged period and therefore make the damage of ischemia far worse than it was initially. The authors report that they cannot account for the differences in yield of RNA as a single function of the interval between death and collection. In particular, yield in one brain may have been lower than that of another not because of differences in time between death and collection, but rather because of a hypoxic episode which happened previous to death.

Because the question asked is really quite complex, and involves great experimental problems too, even hundreds of years from now we will probably lack a theory of exactly when real patients have become "irreversibly destroyed" so that their revival is impossible in principle. Of course we will know much more about what treatments can destroy a person, but that is not the same.

## AGING AND CLOCKS IN DROSOPHILA

Many gerontologists have put around the notion that aging may depend somehow on an aging "clock," and therefore that if we found some way to rewind this clock we could modify aging. Unfortunately this idea receives more mention and discussion than it does actual experimentation: to study it experimental, of course, we would have to study all the various clocks which affect our behavior and, modifying each with drugs and surgery, look for effects on aging. A related approach, of course, would be to study aged animals looking for signs that their clocks may be malfunctioning or functioning differently from those of younger animals. Yes, studying clocks in gerontology would be a large program.

An interesting paper in EXPERIMENTAL GERONTOLOGY (16(2) (1981) 109-117) falls rather far short of giving us a complete theory of the "aging clock" but for its discussion of clocks in aging, and the fact that up to now chronobiology and gerontology have made few connections, deserves some mention in this journal.

As readers probably know, all animals have one or more different clocks "built-in" to their design. These clocks will make them eat, sleep, or hibernate according to an internal rhythm quite independently of whether or not their environment shows similar rhythm. Often more than one clock controls their behavior, so that they have a "master clock" which in turn sends signals to lesser "slave" clocks which then in their turn affect the rhythm of some particular activity. Surgical or drug manipulations can make these clocks run by different rhythms even when they will always coincide in nature. Usually also these clocks will align themselves to stay in step with each other.

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Relatively recently some biologists studying this phenomenon have noticed that changes in clock rhythm produced changes in lifespan. For instance, fruit flies will live shorter lifespans if put into an environment with constant light and temperature, so that they never experience the normal day-night cycle (CS Pettendrigh and DH Minis, PROC NAT ACAD SCI US 69 (1972) 1537). From an immortalist standpoint an even more interesting effect is that at least in codling moths a shift in the phase of day-night rhythm by 90 degrees every 6 days will actually prolong lifespan. The other side of this coin consists of attempts to discover whether or not aged fruit flies might have a different temporal rhythm from that of the younger fruit flies: that problem is the main one approached in the recent paper by HV Samis et al in EXPERIMENTAL GERONTOLOGY.

These scientists studied two different rhythms in aged fruit flies, the rhythm in attraction to light and the rhythmic variation in the levels of a common enzyme catalase, in their cells. Levels of attraction to light and catalase vary with time of day in fruitflies; but as the fruitflies grew older they became less attracted to light and moreover showed less variation depending on the time of day. Levels of catalase showed large variations with time of day in both the old and the young fruitflies, but at middle age varied much less.

We need to know a lot more about clocking and age in fruitflies before we will come anywhere near understanding their age clock. In itself the information presented by this paper means little; we would hope for a good deal more work on the problem, aimed in particular at discovering how clocks might affect aging (rather than how aging affects clocks).

Nevertheless the paper is a beginning to a conversation between chronobiologists and gerontologists which we have needed for a long time.

#### BIOCHEMICAL FACTORS AFFECTING RECOVERY FROM BRAIN ISCHEMIA

By now all cryonicists will know of the experimental work on reviving brains from ischemia, and its demonstration that the old idea of a fixed and definite period of warm ischemia after which brains suffer total destruction lacks any experimental foundation. Some doctors have even begun to apply this experimental work clinically, successfully reviving people after periods of warm ischemia far in excess of those formerly thought irreversible (cf CRYONICS May 1981). However experimental work on this problem continues: ultimately of course we want to find ways to revive people after many hours of warm ischemia, but even within present capabilities significant problems remain. For instance, a wide variation exists in the ability of the brains to withstand ischemia, and we would like to learn how to bring the worst cases up to the level of the best.

A recent review by S. Rehncrona in ACTA NEUROL SCAND (Suppl 78, 62(1980) 167) presents some information on the different biochemical states and the mechanisms causing damage during ischemia, together with a compendium of recent discoveries on the subject. Some hypotheses about ischemic damage so far lack experimental support, of which the leading one is the notion that free radicals play a critical role. However two different events do seem to affect the ability of the brain to recover. Ischemia causes an increase in the free fatty acid level (FFA level) of the brain cells, particularly the levels of arachidonic acid. The increase in FFAs may underlie the brain swelling which occurs in ischemia, both directly and by causing an increased synthesis of prostaglandins which in turn cause swelling. Treatment after ischemia with indomethacin and prostacyclin seems to help prevent this problem (JM Hallenbeck, TW Fulton STROKE 10(1979) 629-637). A second biochemical factor affecting recovery of the brain is the production of

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lactic acid. If the ischemia is complete then none of the chemicals needed for metabolism can reach the brain; however if it is incomplete then some but not all will reach the brain. The brain cells, starved of oxygen but still receiving glucose, respond by producing lactic acid in the same way as muscle cells produce lactic acid during a burst of effort when all their oxygen stores are exhausted. This lactic acid then damages the brain cells, severely affecting their ability to recover. Rehncrona presents several new experiments suggesting that this production of lactic acid in poorly perfused brains is responsible for much of the variability in recovery of brains after ischemia. Unfortunately as yet no therapy for this problem exists.

Besides its interest for cryonics in reemphasizing the danger of inadequate brain perfusion compared to none at all, and the suggestion that indomethacin may help improve recovery, the paper is interesting for its illustration of a common phenomenon in medicine and science. Before we can cure a condition or disease, it seems a simple and single entity, but as we understand it more deeply we see many different subproblems and conditions within it. Each condition then acquires its own separate name as a new and different disease. "Death," too, will only be curable after it has turned into a hundred different conditions and diseases, each with their own name and different treatment.

## EFFECTS OF CYSTEINE ON FOOD ABSORPTION

One of the possible drugs against aging is the amino acid cysteine. As a common constituent of foods cysteine is easily available, and may substitute for the drug thiazolidine, which is only available in the United States from biochemical supply companies as a biochemical rather than a drug. Thiazolidine, as many immortalists know, has had some success in increasing the lifespan of mice (cf S Oeriu and MA Dimitriu, EXPERIMENTAL GERONTOLOGY 1(1965) 223). A recent paper in AMERICAN JOUR CLINICAL NUTRITION (34(1981) 322-327) may therefore interest any immortalists or cryonicists who are taking this drug. Miguel Layrisse and two other doctors and scientists from Venezuela report the observation that cysteine will significantly increase (in fact double) the absorption of iron from our foods when it is taken at the same time as a meal. If put into food before its final cooking, cysteine will lose its effect on iron absorption. These authors used the same chemical as that taken by immortalists, cysteine hydrochloride for their experiments.

Several other food substances will increase the absorption of iron, among which are animal proteins both from fish and from meat, and Vitamin C. The reasons for this property of cysteine remain unknown, although the authors speculate that cysteine, like the proteins from animal meat, may somehow prevent the heme group which contains iron from polymerizing (which could make it hard to absorb). Cooking, which destroys the ability of cysteine to increase iron absorption, may do so by oxidizing the cysteine to the related amino acid cystine.

This information is in itself neither negative nor positive new about taking cysteine or about any general effect of cysteine on lifespans. It suggests that cysteine may have some positive effect in anemia or suspected anemia, though of course anyone with this problem would still have to eat adequate iron supplies. Readers who may be taking cysteine may however like to know of this new physiological effect