AN EXPLORATORY SURVEY EXAMINING THE FAMILIARITY WITH AND ATTITUDES TOWARD CRYONIC PRESERVATION

W. Scott Badger, Ph.D.

ABSTRACT

A consumer survey designed to measure familiarity with and attitudes toward the idea of cryonics was conducted over the internet. A total of 517 responses were examined in an effort to clarify the relationships between (1) the reported level of familiarity vs. the accuracy of responses, and (2) demographic variables vs. attitudes and dispositions toward cryonics. Results indicate that (1) those claiming superior familiarity do not have superior knowledge, (2) a number of those surveyed have significant misconceptions regarding cryonics, and (3) important attitudinal differences exist between demographically diverse groups.

INTRODUCTION

Cryonics has been defined as "the technology for freezing a person after a terminal illness or a fatal accident, in the hope that medical science will be able to revive that person in the future, when life extension and anti−aging have become a reality".[1] Cryonic suspension is an emergency medical procedure designed to save lives (much like Cardio−Pulmonary Resuscitation), a last−ditch effort to forestall irreversible brain damage. Since the first individual was cryonically preserved in 1967, a handful of firms have sprung up offering cryopreservation and/or storage services to the general public.

It is often argued on the Cryonet[2] (an internet newsgroup for cryonics related issues) that the cryonics industry has experienced a relatively slow rate of growth over the years although some firms have grown faster than others. Between the several firms involved, it is estimated that only about 100 individuals have been frozen to date, with another 700−800 signed up for cryopreservation once they are pronounced legally dead.[3] These figures cannot be considered to be highly reliable since some firms do not divulge membership information. These are disappointing figures for many leading cryonicists who have struggled financially and worked incessantly to convince the public that cryonics is a rational and affordable alternative for those who wish to extend their lives and the lives of those they love.

The successful reanimation of those who have been frozen will depend on a number of factors. First and foremost, the technology required to repair the damaged bodies will have to be developed. The successful operation and long−term growth of the organization responsible for one's eventual reanimation will also be of significant importance.

It has been stated that despite three decades of massive publicity, the growth of the cryonics industry has been abysmal.[3] Cryonicists have appeared on talk shows, television magazines have taken tours of cryonics facilities, a number of magazine and newspaper articles have been published, marketing professionals have tried to sell cryonic services as they have successfully done with other services, and individual members have tried to persuade their friends and family. Even so, these approaches appear to have had little effect on the growth rate of the industry. The lackluster response of the market has consequently been the focus of many spirited debates among cryonicists. A number of hypotheses have been generated regarding why the American public has been so slow to embrace the central tenets of cryonics.

One of the most clearly articulated hypotheses is that presented by one of the pioneers in cryonics, Saul Kent. Mr. Kent is currently the Director of 21st Century Medicine. This research firm is currently involved in several lines of research, one of which is investigating the viability of vitrification as an effective suspension

protocol. His recent essay titled, "The Failure of Cryonics"[3] concludes that consumers are not attracted to cryonic services for the simple reason that there is no convincing evidence that cryonics will work. He characterized cryonics as "a bad product", insisting that emphasis needs to be placed on research aimed at better suspension techniques. Only when it can be demonstrated that humans can be revived will we see a significant increase in the number of people interested in signing up for cryonics, according to his essay.

Some contributors to the Cryonet newsgroup suggest that resistance among consumers is strongly related to the difficulty they experience dealing with the idea of their own death. Some say that many people object to the notion of cryonics on religious or ethical grounds. Others suggest that the general populace is not attracted to cryonics because they do not fully understand the concepts which underlie it. Some argue that the concept of cryonics is marketable, but the correct marketing strategy has yet to be discovered. In fact, some suggest that a sophisticated marketing strategy has yet to be undertaken. Others insist that the only way to sell someone on cryonics is through persistent and patient persuasion over a long period of time. This paper will examine the survey participants' familiarity with and attitudes toward cryonics, and in so doing will attempt to address some of the controversy discussed.

METHOD

Procedure

This was an exploratory, correlational study designed to examine relationships between factors relevant to the issues discussed above. For this purpose, a consumer survey was designed to measure the familiarity with and the attitudes toward the ideas of cryonics. The survey was reviewed by a number of cryonicists before the final version was completed and placed on the internet. The survey included four sections; (1) a Demographics Section, (2) a Quiz Section measuring familiarity, (3) an Attitudes Section, and (4) an Answers Section providing the correct answers to the items presented in the Quiz Section. Respondents were unable to proceed from one section to the next until all the items for that section had been answered. The majority of the items were in a 5 point Likert−type, multiple−choice format.

Participants

Participants in the study were subscribers to a weekly internet magazine/newsletter known as "The Tourbus" (http://www.tourbus.com). Information on various web sites and internet−related issues is e−mailed to approximately 80,000 subscribers according to the editor on a bi−weekly basis. The following paragraph appeared on the front page in the September 1, 1998 edition of The Tourbus:

> Is It Cold In Here?
>
> If a person's body is frozen just after clinical death, could they perhaps be revived at some future time when medical technology permits? That question is the essence of Cryonics. I recently found a really interesting and educational web site which deals with Cryonics, and all the questions that surround the issue. The Associated Cryonicists Consumer Survey is a fun way to explore this fascinating subject, and learn whether cryonics is just wild−eyed idealism or serious science. You can find it here:
>
> Cryonics Survey − http://homepages.waymark.net/cgi−bin/cgiwrap/wbadger/demoinfo.cgi

Approximately 250 completed surveys were collected over the next two weeks. The survey was mentioned once again on September 23rd as follows:

> WHO LEFT THE REFRIGERATOR DOOR OPEN?

Before we begin our tour for the day, I wanted to remind you about the Cryonics survey we mentioned in a previous issue. It's really quite fascinating, and you'll be surprised at some of the answers. Is Walt Disney's body frozen? Find out soon, because the survey is closing in a few days.

Cryonics Survey − http://homepages.waymark.net/cgi−bin/cgiwrap/wbadger/demoinfo.cgi

As of October 1, 1998, a total of 517 responses were collected after 32 accidentally repetitious and clearly disingenuous replies were deleted. Table 1 outlines the demographic profile of the sample:

Table 1. Demographic Variables' Frequency Distributions for Survey Respondents

Variable	Percent	Variable	Percent	Variable	Perce
Gender		Marital Status		Income	
Males	57.1	Married	58.6	< 25K	1
Females	42.9	Single	41.4	25−49K	4
				50−74K	2
				75−99K	
				> 100K	
Age		Ethnicity		Occupation	
< 25	8.7	African American	6.8	Agricultural Field	
25−34	24.8	Asian American	2.3	Engineering	
35−44	26.9	Caucasian	80.5	Computer Field	2
45−54	25.1	Hispanic	0.8	Health Care	
55−64	9.9	Native American	1.9	Legal Field	
> 64	4.6	Other	7.7	Research Scientist	
				Sales	
				Service Industry	
				Social Services	
				Teacher/Instructor	
				Other	3
Children		Education		Religion	
0	42.2	Elementary	1.7	Agnostic	1
1	14.3	High School	25.5	Atheist	
2	24.4	Associate's Degree	12.6	Buddhist	
3	12.2	Bachelor's Degree	27.5	Christian	5
4	4.1	Master's Degree	21.5	Hindu	
5	1.9	Doctoral Degree	2.7	Jewish	
6	1.0	Medical Doctor	0.4	Moslem	
		Jurisprudence	1.0	Taoist	1
		Other	7.2		

Limitations of the Study

It is important to point to some of the limitations of the current study. First, the sample of participants used for this study was not randomly selected. Participants were solicited through the internet. Therefore, they may not be (and probably are not) representative of the larger population. Consequently, findings may have limited generalizability. Also, the sample population appears to be disproportionately Caucasian and Christian. The small size of a number of subgroups (e.g. Hispanics, Hindus) may have suppressed significant results related to their responses. It should also be noted that a large percentage (25%) of the participants marked "Computer Field" for their occupation. In addition, the overall response rate was less than one percent. A larger and more representative sample, and possibly a different sampling source may address some of these problems in future studies.

RESULTS

Familiarity Questions

The first question examined in this study addresses the assertion among some cryonicists that increased publicity designed to educate the public on cryonics will be ineffective since the public is already sufficiently familiar with the essential elements of cryonics. Question #2 examines self−reported levels of familiarity and appears below. The frequency distribution in percentages lies to the right of each group.

2.

How familiar would you say you are with Cryonics compared to the average person?

Group 1 = Much less than the average person. 5.2%
Group 2 = About as much as the average person. 64.4%
Group 3 = Somewhat more than the average person. 27.3%
Group 4 = Quite a bit more than the average person. 3.1%

Self−reports may now be compared to other quiz items to determine how accurate respondents' self−evaluations are. In addition, we can compare responses between the four groups created in Question #2 using one−way Analysis of Variance (ANOVA) and Tukey HSD post−hoc strategies. ANOVA is a statistical procedure used to determine whether there are any group differences overall on a variable. Tukey HSD is a follow−up procedure used to detect specific group differences. Unless otherwise specified, the parameter for statistical significance will be set at $p < .05$. This means that if one group is said to be "different" from another (e.g. males and females) on a particular variable (e.g. Q23), then there is less than a 5% chance that there is, in fact, no difference between the groups.

There were a total of 16 questions in the Quiz section of the survey. In the interests of limiting the scope of this article, only three variables considered to have particular relevance to the study (Q5, Q6, and Q7) were investigated. Upon examination, the responses to these three questions ranged widely, and the frequency distributions appeared to be highly skewed. The reader will note that the mean values are almost 10 times the median values, and that the median values are considerably closer to the estimated true values. This degree of skewness threatens the validity of the ANOVA procedure which requires a relatively normal distribution as one of its assumptions. Consequently, the three variables were transformed using a log function which resulted in a lognormal frequency distribution for each variable. The means of these transformed distributions

(log means) were then used for the ANOVA procedures to look for group differences. The log means were then transformed back (exponentiated) into figures which may be more easily compared by the reader to the original means.

Questions #5 and #6 were designed to determine how popular or successful participants perceived the cryonics industry to be.

Q5.

What is your estimate of the number of people that have already been cryonically suspended?

Groups	Normal Means	Exponentiated Means of Logs
1	842	86
2	1296	190
3	1327	207
4	896	158

The mean and median values of the non−transformed distribution was 1,271 and 100 respectively. The correct answer, as previously asserted, is approximately 100 suggesting that the log means of all four groups were fairly accurate. In addition, there is no statistically significant difference between the four groups at the .05 level, suggesting that those who claim to have much greater familiarity than the average person are no more accurate in their estimates than those who claim to have much less familiarity. It should be noted, however, that 144 individuals (27.9% of the total sample) estimated there were 1,000 or more people already cryonically frozen, overestimating by a factor of 10.

Q6.

What is your estimate of the number of people that have made arrangements to be cryonically suspended upon their death?

Groups	Normal Means	Exponentiated Means of Logs
1	4571	400
2	10,030	1026
3	10,864	1229
4	8,813	849

The overall normal mean and median values of the non−transformed distribution was 9,969 and 1,000 respectively (once again a 10:1 ratio). The log means in this instance are again relatively accurate given the estimated "true" value of 700−800 described earlier. No statistically significant differences were found between the groups at the .05 level even though it appears that Group 4 (those claiming superior familiarity) are closer to the true estimate. It may be worth noting that 106 individuals (20.5% of the total sample) estimated there were 10,000 or more people already signed up to be cryonically frozen, overestimating by at least a factor of 10.

Question #7 was designed to assess participants' familiarity with the costs of being cryonically preserved.

Q7.

How much do you believe it costs to have your body cryonically preserved?

Groups	Normal Means	Exponentiated Means of Logs
1	626,288	42,480
2	588,343	58,489
3	303,606	58,402
4	150,937	65,303

The overall normal mean and median values of the non−transformed distribution was $499,545 and $50,000 respectively. Log means for the four groups are fairly accurate estimates of the previously asserted range of $28,000 to $165,000. Although no statistically significant group differences were detected at the .05 level, one can see that the estimates appear to decrease as the level of alleged familiarity increases on the non−transformed figures, while the opposite seems to be the case with the lognormal means. Since there are no statistically significant differences between the means, these trends should be disregarded. It is noted once more, however, that 91 individuals (17.6% of the total sample) estimated the cost of cryonic preservation to be $300,000 or more, overestimating by at least a factor of 10 based on the least expensive suspension service available.

At this point, one might ask, "Are the gross overestimates across variables Q5, Q6, and Q7 being consistently made by the same group of people from the sample?". A bi−variate correlation analysis measures the degree of association between two variables. The results of correlation analysis indicates that the responses to Q5 correlate significantly with the responses to Q6 ($r = .31$, $p < .000$), but there are no other statistically significant correlations among these three variables at the .05 level. For the most part, it appears that the answer to the question posed is, "Most of the responses appear to be independent of each other".

Attitude Questions

Participants were asked to respond to six positive statements and ten negative statements about their attitudes toward various aspects of cryonics. All of the items in this section were in the form of a Likert scale as shown below. The numbers of the Likert scale are treated as interval values rather than as categorical or ordinal values. This means there are equal differences between measures (e.g. temperature, IQ, etc.).

1	2	3	4	5
Strongly Agree	Agree	Not sure	Disagree	Strongly D

Mean (arithmetic average) Likert scores and standard deviations for the positive statements appear in Table 2.

It can be seen that the mean response to Questions 18 and 19 fell about midpoint between "Strongly Agree" and "Agree" indicating a moderately positive attitude towards extended lives and towards cryonics as representing a chance for achieving that end. Questions 20 through 23 fell about midway between "Agree" and "Unsure" suggesting a mildly positive view towards those statements. Though all means fell on the left (favorable) side of the Likert scale, respondents were least positive overall about the statement made in Question 23.

Table 2. Means and standards deviations of positive attitude statements

Positive Statements	Mean	Std. Dev.
Q18. I love being alive and I want to remain alive and healthy for as long as I can.	1.46	0.78
Q19 . Being frozen is no guarantee that I will be revived someday, but I know my chances are zero if I am buried or cremated.	1.57	0.88
Q20. I could accomplish much more with my life if it were significantly extended.	2.49	1.03
Q21. I'm very optimistic about humankind's future and want to be there to see and participate in the amazing advances that will be made.	2.40	1.09
Q22. I look forward to a time when we won't have to suffer the loss of our friends and family because of aging and disease.	2.50	1.20
Q23. I'm excited about the prospect of waking up in a body made young again through bio−technological advances.	2.77	1.25

Mean values and standard deviations for the negative statements appear in Table 3. The values in Table 3 suggest that people perceive cryonics as unaffordable, and they have mildly negative feelings about what the impact of being frozen would be on their friends and relatives as well as not having those friends or relatives around when they are revived in some future time. There was mild to moderate disagreement with the idea that considering one's own death is so difficult that cryonics is hard to think about. There was also mild to moderate disagreement with the idea that people do not care about cryonics because they are young and healthy. There is also mild disagreement with the negative statement regarding all the paperwork involved in signing up for cryonics.

Table 3. Means and standards deviations of negative attitude statements

Negative Statements	Mean	Std. Dev.
Q24. Cryonics doesn't interest me because I just don't think it will work.	3.11	1.12

Q25. The cost of having my body frozen is far too expensive for me.	2.21	0.95
Q26. Dealing with wills, insurance policies, and other legal matters is too much trouble to make Cryonics worthwhile.	3.22	1.00
Q27. Extending one's life span through Cryonics is unnatural, selfish, and immoral.	3.20	1.16
Q28. Cryonics is a bad idea because it would lead to an overpopulation problem.	2.90	1.11
Q29. I don't think about Cryonics because I don't like thinking about death.	3.69	1.02
Q30. Cryonically preserving me would be too hard/weird for my family/friends to handle.	2.83	1.06
Q31. I'm too young and healthy to even care about it at this point.	3.52	1.03
Q32. I would not want to wake up in a future time without my family or friends around.	2.73	1.19
Q33. I don't think that people in the future will have any interest in reviving frozen bodies.	3.36	1.09

Disposition Questions

Finally, a series of statements were presented which required participants to consider different conditions under which they might become favorably disposed toward the idea of cryonics. The purpose was to identify variables which may or may not be helpful in motivating individuals to give favorable consideration to being cryonically preserved. The stem for each statement is, "I would feel more favorably toward the idea of cryonics if . ." Table 4 summarizes the means and standard deviations for this group of questions.

Table 4. Means and standards deviations of motivation statements

Motivation Statements	Mean	Std Dev
Q34. Thousands of other people were signing up.	3.58	0.95
Q35. Millions of other people were signing up.	3.48	1.08
Q36. My physician approved of and recommended the idea.	3.26	1.06
Q37. Celebrities I admired were signing up.	4.09	0.88
Q38. Someone in my family were signing up.	3.15	1.06
Q39. a mouse were completely revived after cryonic storage.	3.30	1.02
Q40. a dog were completely revived after cryonic storage.	3.20	1.07
Q41. a human were revived.	2.52	1.19
Q42. if it were cheaper.	2.85	1.12
Q43. Under no circumstances.	3.47	1.12

A simple examination of the descriptive statistics in Table 4 indicates that the participants are less likely as a whole to be motivated to sign up for cryonics because celebrities sign up or even if large numbers of others sign up. It also appears that successfully reviving mice or dogs (and presumably any other non−human animals) will be mildly ineffective motivators. The two variables which appear to have some mild motivational potential was Q41 (the revival of a human being) and Q42 (if it were cheaper).

The final item in the survey was:

Q44.

I believe that Cryonics is an exciting idea and intend on looking into it further.

Using the same Likert scale as before the overall mean was determined to be 2.09 suggesting that there is fairly solid agreement with this statement among those surveyed.

Group Differences

Descriptive statistics such as the majority of those discussed above can be useful in developing a general profile of the sample population. They can also act as indicators that point to productive areas of inquiry. The second section of this report will examine differences between groups formed by demographic dissimilarities within the sample. In other words, the groups created by the participants' responses to the questions in the Demographic Section will be compared to see if they differ with respect to their responses to various questions in the survey. Examination of the distribution frequencies of the Q18 through Q44 indicates they are relatively unskewed, and lognormal transformations will not be necessary.

Table 5. Gender

Group #	Gender	# Participants
1	Male	295
2	Female	222

Gender differences appeared early on in the survey with several differences uncovered on a number of items. On item Q2, males perceived themselves as more familiar with cryonics than females ($p < .00001$). Responses to Q20 indicate that males feel they could be more productive if their lives were significantly extended while women were less prone to agree ($p < .0015$). Women had a higher degree of agreement with item Q22 suggesting than men were less concerned with the loss of family and friends ($p < .083$). Males were more agreeable than females to the idea in Q23 of waking up in a young and healthy body in the future ($p < .022$). Women perceived cryonics as less affordable than men ($p < .009$). Item Q27 results indicated that men disagreed more strongly than women with regard cryonics being immoral, selfish, or unnatural ($p < .036$). Women were more agreeable than men with the idea (Q32) that it would be unpleasant to awake in the future without one's family and friends ($p < .00001$) Women also appeared less confident than men that people in the future would have any interest in reviving frozen bodies (Q33) ($p < .032$). Finally, men were found to agree more strongly than women with item Q44 which stated, "I believe that cryonics is an exciting idea and intend on looking into it further" ($p < .0002$).

Table 6. Occupation

Group #	Occupation	# Participants
1	Agricultural Field	18
2	Engineering	31
3	Computer Field	119
4	Health Care	36
5	Legal Field	10
6	Research Scientist	11
7	Sales	30
8	Service Industry	33
9	Social Services	5
10	Teacher/Instructor	47
11	Other	177

Few differences were found between the occupational groups. Individuals in the Service Industry expressed a greater willingness to feel favorably toward cryonics if thousands of others signed up as compared to Research Scientists and those in the Computer Field. When that number was raised to millions instead of thousands, Research Scientists were still more reluctant to think favorably of cryonics than either those in the Service Industry or Engineers. When asked whether cryonics was unnatural, selfish, and immoral, those in Health Care replied more affirmatively than did Engineers. It is worth noting that 177 participants fell into Group 11 while many other Groups had quite small numbers suggesting that a different set of occupational fields may be advisable in future surveys.

Table 7. Age

Group #	Age Range	# Participants

1	< 24	45
2	25 – 34	128
3	35 – 44	139
4	45 – 54	130
5	55 – 64	51
6	> 64	24

There were a relatively large number of group differences found on the basis of age range. Group 2 appeared to be more concerned with population problems arising as a result of cryonics than either groups 3 or 4. In responding to items Q34 and Q35 (I would feel more favorably toward cryonics if thousands (millions) were signing up), Groups 2 and 3 disagreed most strongly, both having significantly higher scores than Group 1 who was the most agreeable group. The same group differences were found for Q36 (if my physician approved of and recommended the idea). Group 2 also disagreed more strongly with item Q44 (I believe that Cryonics is an exciting idea and intend on looking into it further) than Group 1. Group 2 appears to be the Group least disposed toward the idea of cryonics. There may be a cohort effect for those in this age range due to cultural events in their lives, or it may be that people at this stage of life are more skeptical in general than other age groups.

Table 8. Ethnicity

Group #	Ethnicity	# Participants
1	African American	35
2	Asian American	12
3	Caucasian	416
4	Hispanic	4
5	Native American	10
6	Other	40

Although there were a number of statistically significant mean differences between ethnic groups, it was felt that little value could be placed in any interpretations drawn from the analysis due to the relatively small group memberships for all except Caucasians.

Table 9. Religion

Group #	Religion	# Participants
1	Agnostic	85
2	Atheist	34
3	Buddhist	13
4	Christian	295
5	Hindu	8
6	Jewish	23
7	Moslem	6

8	Taoist	53

Several group differences were found to exist as a function of this demographic. The reported level of familiarity with cryonics was significantly higher for Agnostics and Atheists as compared to Christians. Even so, no group differences were found with respect to the answers given on the Quiz Section. Agnostics and Atheists also agreed more strongly than Christians with Q20 (I could accomplish much more with my life if it were significantly extended). Agnostics had a significantly lower (more agreeable) mean score than Christians on Q21 as well, suggesting they are more optimistic about the future of humans. The same was true for Q23 indicating that Agnostics look forward to waking up in a young body in the future more so than do Christians. Christians were found to agree more strongly with Q24 (Cryonics doesn't interest me because I just don't think it will work.) than did Agnostics. Christians also viewed cryonics to be less affordable than did Agnostics (Q25). Christians perceived the paperwork and legal work associated with cryonics as more troublesome than Agnostics (Q26). Christians were more disposed to perceive cryonics as unnatural, selfish, and immoral than either Agnostics or Atheists (Q27). Agnostics and Atheists had fewer concerns with the negative perceptions of family and friends toward cryonics than Christians (Q30). They were also less concerned about waking up in a future time without family and friends around (Q32) than either Christians or Jews.

Questions 34 through 43 all began with the same sentence stem; "I would feel more favorably toward cryonics if . . ." and were designed to assess the relative value of various social, financial, and technological motivators. No group difference were found among social motivators. Differences first appear with Q39 "if . . . a mouse were completely revived after cryonics storage" with Agnostics more favorable disposed than Christians. Atheists join Agnostics in being more favorably disposed than Christians toward cryonics if and when a dog is completely revived. The same was true for Q41 ("if . . . a human were revived."). Finally, Christians agreed more strongly than Agnostics or Atheists with Q43 (. . . under no circumstances.").

The last question of the survey (Q44) addressed overall interest in the idea of cryonics. Among all the religious groups, Christians had the highest (least interested) mean score and these scores were significantly different from Agnostics and Atheists who appear to be among the most interested. It may be helpful for the reader to know for comparison's sake that the mean scores on Q44 were: Christians = 3.12; Agnostics = 2.57; Atheists = 2.41. It is interesting to note that out of 295 Christians participating in the survey, 20 marked "Strongly Agree" for Q44 and 57 marked "Agree". This suggests that about 26% of those from the Christian faith seem to be approachable on the subject of cryonics.

Table 10. Marital Status

Group #	Marital Status	# Participants
1	Married	303
2	Single	214

Married individuals expressed significantly greater reluctance toward cryonics due to family−related issues (Q30, Q32) than did single respondents.

Table 11. Education

Group #	Education	# Participants
1	Elementary	9

2	High School	132
3	Associate’s Degree	65
4	Bachelor’s Degree	142
5	Master’s Degree	111
6	Doctoral Degree	14
7	Medical Doctor	2
8	Jurisprudence	5
9	Other	37

High school graduates agreed more strongly with Q29 ("I don’t think about cryonics because I don’t like thinking about death."). than did individuals with Associates, Bachelors, or Masters degrees. They also expressed greater concern about waking up in the future without family and friends being there as compared to individuals with Master’s degrees.

Table 12. Income

Group #	Income	# Participants
1	< 25K	101
2	25 − 49K	212
3	50 − 74K	136
4	75 − 99K	39
5	> 100K	29

It was found that individuals in Group #5 believed themselves to more familiar with cryonics than those in Groups # 2 or #3. Even so, individuals in Group #5 fared no better on the items in the Quiz Section than any of the other groups. Although all groups were in at least moderate agreement with Q18 ("I love being alive and I want to remain alive and healthy for as long as I can."), Group #4 most strongly agreed with this item. Similarly, all groups generally agreed with Q19 ("Being frozen is no guarantee that I will be revived someday, but I know my chances are zero if I am buried or cremated."), but Group #5 agreed most strongly. As would be expected, group #5 was least concerned with the affordability of cryonics while Group #2 was the most concerned. Group #5 was also the least concerned group when the issue of overpopulation was brought up while Group #3 was found to be the most concerned. When presented with factors which might favorably dispose them to cryonics, Group #1 appeared to be the group most motivated by the idea of large numbers of other people signing up and to the idea of cryonics being recommended by their physician, while Group #2 disagreed most strongly with these items.

Group differences based on Income approached statistical significance ($n = 516$, $p = .07$) on Item Q44 ("I believe that cryonics is an exciting idea and intend on looking into it further."). Group #5 most strongly agreed with this item (mean = 2.69) while Group #2 most strongly disagreed (mean = 3.05).

Factorial Analysis

The factorial analysis of variance is a statistical procedure designed to examine the effect of two or more independent or classification variables (e.g. gender) on a set of dependent variables (e.g. Q23) (Stevens, 1995). One of the purposes of this procedure is to determine whether there are any interaction effects between demographic variables (e.g. "Do male agnostics differ from female agnostics?", "Do older married people differ from younger married people?", etc.). No significant interaction effects were found to exist between these variables indicating that only main effects have any statistical or practical significance in this study.

Multiple Linear Regression Analysis

In multiple regression we are interested in predicting a value for a dependent variable from a set of predictor (independent) variables. The final question addressed in this study asks, "To what degree does each demographic variable contribute to the variance observed in the responses to Q44." ("I believe that cryonics is an exciting idea and intend on looking into it further."). A step−wise linear regression analysis was performed to identify which demographic variables significantly contributed to explaining fluctuations in Q44. The results indicate that Gender alone reached the .05 level of significance required to be entered into the regression equation. Some may ask why other demographic variables such as Religion, where important group differences were previously discovered, failed to enter into the equation. It must be remembered that although Christians differed from Agnostics and Atheists, there were no other statistically significant group differences found. In other words, there was relatively little overall variance observed for the Religion variable so it was unable to explain a significant amount of variance in Q44. The equation derived from the multiple linear regression procedure follows:

Q44 = 2.40 + .35 (Gender) + noise

R^2 = .0259

(standard error of the regression coefficient = .09)

Noise is a term used to represent error. R^2 is a value that reflects the degree to which the regression equation explains the variance in Q44. In this case, R^2 = .0259, so only about 2 1/2 % of the variance in Q44 is explained by Gender. Four other variables achieving significance levels of $p < .10$ but not $p < .05$ are included in Table 13. These variables may be considered to be approaching significance. Nevertheless, regression analysis suggests that demographic factors have limited usefulness in predicting dispositions toward cryonics.

Table 13. Regression Analysis #1

Demographic Variable	Significance of T
Gender	.0002
Age	.0843
Marital Status	.0750
Occupation	.0689
Ethnicity	.0797

A similar analysis was performed using the items from the Attitude Section (Q18−Q33) as the independent variables and regressing them on to Q44, the dependent variable. The following regression equation was derived:

Q44 = 3.35 + .08 (Q21) + .30 (Q23) − .25 (Q24) − .14 (Q27) − .08 (Q30) + noise

$R^2 = .49$

Using the same parameters, a relatively impressive R^2 value of .49 was obtained indicating that almost half of the variance in Q44 can be explained by the five variables in the equation. This equation suggests that those who find Cryonics to be an exciting idea and intend on looking into it further are also those who (1) are optimistic about humankind's future; (2) are excited about the prospect of waking up in a body made young again; (3) tend to believe that cryonics will work; (4) disagree that cryonics is unnatural, selfish, and immoral; and (5) disagree that cryonic preservation would be too hard/weird for their family/friends to handle.

Precise coefficient values and associated standard errors are presented in Table 14.

Table 14. Regression Analysis #2

Variable	B Value (Coefficient)	Standard Error of the Coefficient	Significance Level o
Q21	.081577	.038534	.0347
Q23	.299711	.034873	.0000
Q24	−.253954	.035224	.0000
Q27	−.142850	.037327	.0001
Q30	−.083530	.036120	.0211
Constant	3.355794	.223347	.0000

SUMMARY

In the Quiz Section, survey participants expressed a considerable amount of variability in their responses to "fill−in−the−blank" questions. After being transformed into lognormal distributions to compensate for their overly skewed distributions, Q5, Q6, and Q7 provided log means that were relatively accurate. ANOVA procedures indicated that there were no statistically significant differences between those who claimed to be familiar with cryonics and those who claimed they weren't. Even so, a portion (17.6 − 27.9%) of the sample over−estimated in their responses to Q5, Q6, and Q7 by a factor of 10. This suggests that a sizable segment of the population greatly over−estimates the number of people frozen and those signed up for cryonics. Further, a sizable portion may also greatly over−estimate the cost of cryonics. This result indicates that the affordability of cryonics through life insurance policies is a message that may be failing to reach the general public.

In the Attitudes Section, the average participant was moderately positive toward life extension and toward cryonics as a means to that end. They were mildly agreeable with the remaining statements associated with positive and optimistic attitudes toward the promise of future developments in anti−aging and other technological advances. When given a chance to respond to statements representing negative attitudes, results indicated that participants were most negative about the perceived cost of cryonics. They also had mildly negative attitudes toward the idea of becoming alienated from their family and friends as a result of signing up for and being frozen. Though it is often cited as an important reason why people resist considering cryonics, participants most strongly disagreed with the idea that they are uncomfortable thinking about their own mortality.

Survey participants indicated overall that the successful revival of a cryonically frozen human being would be the most persuasive factor of those considered. The next most persuasive factor was lowered costs. Although many have suggested that membership rates would likely increase if more celebrities would sign up for cryonics, results demonstrate that this statement was more strongly disagreed with than any other.

In terms of differences along demographic variables, a number of statistically significant results were uncovered. Men perceived themselves as more familiar with cryonics and had, for the most part, more positive attitudes toward cryonics than women. With respect to age, it appears that individuals between the ages of 25 and 34 and those older than 65 are most strongly opposed to the idea of cryonics while those younger than 24 express the greatest amount of interest. This finding fails to support those who hypothesize that the young lack interest in cryonics for one reason or another.

It became clear when examining group differences between religious groups that Agnostics and Atheists were consistently more favorably disposed toward cryonics than were Christians. No other group differences were found based on religion. Married individuals were more concerned about family issues related to cryonics than were single individuals, but there was no difference in overall interest in cryonics between married and single individuals. Those with no more than a high school education were more uncomfortable thinking about death in general and more concerned with family issues than those with more education. Individuals making more than $100K were generally more favorably disposed toward cryonics while those making from $25K − $49K appeared to be the least favorably disposed income group.

CONCLUSIONS

Keeping the aforementioned limitations in mind, the data gathered points to a number of tentative conclusions. It suggests that, for the most part, people are able to make reasonably good estimates of the current memberships and costs associated with cryonics, although about one−fifth over−estimate these values by a factor of 10. Some will maintain that this tends to support those who have contended that the cryonics industry has received sufficient publicity and thus, more publicity will not significantly increase membership. Others might argue, by way of analogy, that there would be great concern in the computer industry if one−fifth of the public believed that the average computer was priced at $10,000.

The data also suggests, however, that publicity aimed at the general public may not be the most effective approach. A more effective marketing effort might be one targeted at male agnostics and atheists. There may also be some value in targeting individuals who are single, fairly well−educated, or younger than 25 or between 35 and 64 years of age. It is reasonable to assume that individuals who meet more than one of these criteria are likely to have an increasingly favorable disposition toward cryonics.

The results also suggest that the content of marketing efforts focus on certain issues. Emphasis should be placed on (1) the affordability of cryonics, (2) promoting optimism with regard to the future, and (3) the idea of receiving a young and healthy body in the future. Results also suggest that the most important negative attitudes which need to be overcome include; (1) beliefs that cryonics will not work, (2) beliefs that cryonics is unnatural, selfish, and immoral, and (3) the belief that cryonic preservation would be too hard/weird for their family/friends to handle.

A number of cryonicists express strong opinions in their subjective assessments of the public’s perception and attitude toward the idea of cryonics. Although the results of the current survey assist in clarifying some aspects of the debate on this issue, several questions remain unresolved. Additional surveys designed to replicate and extend the scope of the current study may provide the beginnings of an empirical foundation for guiding the efforts of firms offering cryonic services.

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REFERENCES

1. Alcor Foundation, (1993). *Cryonics: Reaching For Tomorrow*, 4th Ed., p.5.
2. http:\\www.cryonet.org
3. Kent, S. (1998). *The Failure of Cryonics*, Cryonics, 19:3, p.8.
4. Stevens, J. (1992). Applied Multivariate Statistics for the Social Sciences, 2nd Ed.

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