



A Descriptive Study of An Elite Sample of Science  
Oriented Adolescents and Their Career Choices Over Time

by

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## Abstract

There is a shortage of some health care professionals in parts of Ontario. One means of circumventing this problem is to attract more adolescents into the science educational pathway. Previous research has focused on large samples of general populations of students in relation to their occupational aspirations. This study examined 243 elite students of a summer science program to determine the range of influences on their occupational aspirations over time. Descriptive results revealed that the aspirations of these adolescents tended to remain within a "zone of acceptable alternatives" of career aspirations, particularly, in terms of gender.

Forty-nine percent of the students considered an occupation from within the same category of science career pathway from Time 1 to Time 2. Males interested in other science careers such as engineering were the most consistent respondents. Furthermore, there appeared to be considerable movement both within and between science and nonscience career pathways.

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## Introduction

In many parts of Ontario, particularly the rural regions in the north and south, the shortage of various types of health care professionals has been an important political, economic, health, and social issue. One long-term solution for overcoming the potential shortage is to attract more adolescents into the science educational pathways that would lead to the health sciences. The limited research in this area reveals a concern that most students are not interested in pursuing health care professions as careers. For example, Thomson, Miller, Shargey, Smith & Denk (1991) found that even in their elite sample of graduates from a specialized high school designed for adolescents interested in health professional careers, just slightly over one-half (57%) indicated an interest in health or science-related careers. From this sample, 22% (n=230) reported that they would pursue a career in medicine, 16% (n=159) aspired to a career in nursing, 8% (n=82) indicated a career choice related to allied health occupations (e.g., physiotherapy, audiology, occupational therapy, and speech therapy), and 13% (n=135) aspired to careers in business. Although these numbers might look promising, the authors were concerned that if only 57% of these elite students chose health professions as careers,

it would stand to reason that very few individuals from non-health specialty high schools would be entering these same professions.

While it may be argued that increasingly the science pathway is not the only route towards careers in health, it still remains primary. For example, entry into medicine at McMaster University in Hamilton is possible with degrees in areas outside of science (e.g., law). Similarly, the majority of the entrants into the midwifery program at Laurentian, McMaster and Ryerson Polytechnic Universities had liberal arts backgrounds as opposed to previous education in science. However, the majority of universities in Canada still require applicants to have a strong science background for most health science educational programs.

Adolescence, as a critical period for career choice decisions (Gottfredson, 1981), may be an optimal point at which to promote adolescent participation in science educational pathways which lead to careers in the health care professions. Furthermore, the strong, positive relationship between the educational attainment of high school students and their occupational aspirations has been consistently demonstrated in the sociological research on career choice (Sewell, Haller & Portes, 1969; Breton, 1972; Porter, Porter & Blishen, 1982).

Failure to take certain high school courses may result in the elimination of many future career options. For example, in general, advanced science courses are required for post secondary health majors including medicine, nursing, occupational therapy, physiotherapy, and audiology. Lee (1987) found that a failure to take advanced mathematics and science courses in high school resulted directly in the exclusion of health science career options in later life.

Most previous research in this field has considered the sciences as a single group of studies and has all but neglected the career decision making process of the health sciences in particular (Houser & Garvey, 1985; Lee, 1987; Wilson & Boldizer, 1990). Not only does this current study examine differences between students choosing health science versus other science programs but also examines specific variables which influence students' decisions to pursue particular health care educational and occupational pathways over others. However, in order to be able to intervene and increase the quantity and quality of students committed to a health care professional career choice, we must first extend our understanding of the career development process.

### Career Development Theory

Existing theories of career development, although dated are still relevant to understanding career development in adolescence. A great deal of research has been conducted more recently which explores these many facets of career development. Most relevant to the current study is Gottfredson's (1981) attempt to formulate a theory about career development that reflects the transitional nature of adolescence.

A review of the literature on career development reveals that an increasing emphasis has been placed on viewing vocational choice behaviour as a developmental process. The theories of Super (1957), Ginzberg, Ginsburg, Axelrad, and Herma (1951) and more recently Gottfredson (1981) provide a developmental framework for viewing career development as a continuous lifelong process that incorporates both social and psychological factors. On the other hand, Holland (1973) has provided a purely psychological theory for occupational choices that addresses the question: 'why do people pursue certain careers over others?', emphasizing the importance of personal attributes in this process. However, a broader understanding of these choices calls for some attention to the social and psychological variables that influence this personal decision.

According to Ginzberg et al. (1951), occupational choice should not be considered as a single decision but rather as a series of decisions made over a period of time. Furthermore, each of these decisions made is dependent on the chronological age and developmental level of the individual. More specifically, because the occupational choice process is related so closely to the general maturation of the individual, consideration must be given to the sequential changes (physical, intellectual, emotional, and social) that occur during these crucial years.

Ginzberg et al. (1951) propose that the career decision making process can be divided into three distinct periods. The first period occurs around the ages of six to eleven years, during which the child makes what is described as a fantasy choice by playing or imagining oneself as engaging in adult activities. The second period coincides with early and late adolescence where an individual makes a tentative choice. The choices are considered 'tentative' because Ginzberg et al. (1951) believe that adolescents realize that they do not understand enough about themselves, society, and future roles in order to make a definitive commitment. The third period involves making a realistic choice by early adulthood. It is during this time that young adults

realize that they can no longer remain undecided and therefore must consider their alternatives and choose one. Finally, in this theory, the concept of compromise is an essential aspect of every choice (Ginzberg et al., 1951). Throughout the developmental years, an individual attempts to gain sufficient knowledge about interests, capacities and values, and about the opportunities and limitations in the working world in order to be able to make an occupational choice that will yield maximum satisfaction. Most often, individuals are unable to base this choice on one element such as interest. Usually, concerns about the labour market, and the income and prestige attached to different occupations enter into this decision. Thus, compromise (or balance) among the major internal and external factors must be made (Ginzberg et al., 1951).

Similar to Ginzberg et al. (1951), Super (1957) also supported a developmental view and defined occupations as a sequence of positions occupied by individuals during the course of a lifetime. Super (1957) also proposed stages of vocational development which included the stages of growth (birth to 14 years), exploration (15-25 years), establishment (25-45 years), maintenance (46-65 years) and decline (65+ years). For the purposes of this study, the first two stages are most important for consideration. According to Super, (1957), the individual's attitudes,

interests and needs are developed during the growth stage. While in the exploratory stage, one's choice of occupation becomes clearer but is not finalized. Central to Super's (1957) theory is the role of the development of a person's vocational self-concept on the career patterns eventually pursued. Therefore, as individuals pass through the stages of career development, they choose occupations that are most compatible with the self-concept. In this context, the concept of self refers to the kind of person one is or would like to be.

Compared to Ginzberg et al. (1951) and Super (1957), Holland (1973) asserted that an individual's personality type determines the primary direction of occupational choice. Holland's (1973) work focused on an explanation of why people choose certain occupations over others (occupational choices). The importance of occupational choices was more recently advanced by Dorr & Lesser (1980) who asserted that one's occupation determined many aspects of a person's life including standard of living, status, hours of leisure, sets of friends, place of residence and the nature of family. Holland (1973) described occupational choices as specific decisions that pertain to career development. More specifically, he believed that an interplay of children's heredity and experience led to preferences for some activities and an aversion to others.

These preferences often then become well-defined interests from which the individual gains self-satisfaction and external rewards from others. As time progresses, the pursuit of these interests leads to the development of more specialized skills and to the exclusion of interest in developing skills.

At the same time as interests are developing, values are formed which are representative of the limits or opportunities available to an individual. These aspects create a personality type that is predisposed to exhibit characteristic behaviours including a preference for certain occupations. These personality traits include self concepts, perceptions of the environment, values, achievements and performances, differential reactions to environmental rewards, stressors, preferences for occupations and occupational roles, coping styles and personal traits (Holland, 1973).

Noeth, Engen & Noeth (1984) also found that interest was the single most important factor influencing the educational and occupational choice among their sample of college-bound high school students. Bateman (1990) also found that the most salient variable which distinguished between adolescents pursuing science and nonscience pathways was the significantly higher interest in science

among the groups of students who were indicating an intention to pursue a career in science.

Gottfredson (1981) attempted to incorporate the major positions on career development into a theoretical framework describing how occupational aspirations develop continuously from the preschool years through to the college years. Gottfredson (1981) felt that this was necessary because all previous research had examined career development either through a psychological or sociological perspective. She felt that a more comprehensive explanation of the development of vocational aspirations would be attained through the integration of these perspectives.

Gottfredson's (1981) developmental theory of occupational aspirations contains two central concepts which are circumscription and compromise. The notion of circumscription suggests that "as the person's cognitive map of occupations develops, new criteria are used to eliminate particular occupations as potential alternatives" (Gottfredson, 1981: 575). In other words, with increasing age, a child may mention more titles as potential choices but these choices become successively more homogeneous and more closely related in terms of nonpsychological factors such as socioeconomic status, gender stereotypes and/or skill level. Furthermore, the process for circumscription

is similar for all adolescents, such that each individual determines the boundaries for a "zone of acceptable alternatives" for an occupation based on prestige, gender, and field of work. Within this zone however, occupational choices will vary according to psychological and social factors such as judgements of personal abilities, internal motivation, the definition of success within the home and community, and the external expectations that are interpreted as being for 'someone like him/her'.

Occupational alternatives are described by Gottfredson (1981) as preferences that have been balanced by the individual's sense of how realistic those occupational choices are. The "zone of acceptable alternatives" directly reflects the person's desire to fit into a particular social space which include family, peers and a broader society. Gottfredson (1981) states that although specific occupational choices may change, the zone of acceptable choices will remain stable. Therefore, an adolescent who is interested in becoming a physician may also consider a career in dentistry as an alternative choice that is within the same zone in terms of prestige level and the amount of effort required to achieve it. To summarize, the circumscription component of the theory can be said to address the successive narrowing of the range of

occupational alternatives during early childhood and adolescent career development.

The concept of compromise, however, is more speculative than the concept of circumscription since little research has been done in this area. This is surprising since in times of increasing unemployment, the decline in the availability of jobs must inevitably result in more people having to make more compromises in their career decision making. Furthermore, the importance of compromise was addressed in the theories of Ginzberg et al. (1951) and Super (1953) but neither of these theories discussed the compromises that individuals face in their careers and how they cope with them. Compromise, in Gottfredson's (1981) theory, relates to the fact that as people progress through their occupational lives, they have to compromise between factors such as sex type of a job, prestige level, and field of work in order to obtain a job. Gottfredson (1981) predicts, however, that factors internalized at an earlier age (i.e. sex type) will be more resistant to change than factors internalized later in development (i.e. vocational interests) and that when compromising, individuals are most likely to sacrifice field of work and least likely to sacrifice sex type.

The process of compromise is closely related to the constraints imposed by social and economic structures which

are reflected as the interaction between socially constructed roles and the realities of the labour market. Compromise can be said to represent the necessary adjustments to the realities of the labour market because in verity, the jobs that people actually aspire to may be very different from the jobs that are available to them. As a result, accessibility factors play a large role in this process including job availability in the local geographic area.

According to Gottfredson (1981), adolescents assess their preferences for different occupations in relation to their perceptions of the accessibility of these jobs and will attempt to execute the better option. This compromise process begins to be evident toward the end of high school, at which time adolescents begin to implement their occupational choices by entering educational training deemed necessary for the chosen occupation. Barriers to obtaining and completing education or training are obstacles to fulfilling one's adolescent aspirations. To reiterate, the compromise component of the theory can be summarized as outlining the relative importance of various factors when a person is faced with the realities of implementing a career.

Although there has been much interest in the career development of adolescents, little research has been done

in the area of youth who choose to pursue health related careers. The little research that does exist reveals that a wide range of factors influence students' aspirations. For example, Wagoner & Bridwell (1989), in their American study of high school students' motivations for aspiring to medical careers, found that students appeared to be motivated by personal and monetary rewards when considering career options. More specifically, the most frequent responses included the 'chance to make a difference in people's lives' and that the 'profession is always changing and provides a constant challenge'.

Brown-West (1991) studied influences on career choice among 153 upper year allied health science students (e.g., physiotherapists, dieticians and medical laboratory science students) at the University of Connecticut. Results revealed that the need to help others, prestige, professional autonomy, opportunities for advancement, income potential and the effect of the specialty on family and personal life were the six major factors of career choice among the allied health science students.

Bross & Smugar (1986) investigated a sample of grade twelve students who had aspirations to enter educational pathways for nursing and other allied health sciences. Using a mail questionnaire, they found that the five highest ranking factors which influenced a student's

decision for a career in nursing or allied health were employment opportunities, quality of academic programs, educational opportunities after graduation, teaching reputation, and cost. The results from these studies would suggest that a wide range of factors come into play when individuals select certain occupations over others.

When examining students pursuing the health sciences, it is important to remember that health sciences are one component of science careers. In order to best understand adolescents' entry into science careers, and in particular health professions, it would be appropriate to examine those students with highly focused interests and abilities in science. Previous research has also indicated that it is important to study students in their final years of high school who are making educational choices which will lead them to their aspired careers and examine changes in career aspirations after high school.

Every high school in Canada has a group of 'elite' students who can be identified by their current commitment to science. High achieving high school students who excel in science have the necessary grades and prerequisite courses to be successful in entering health care educational pathways. Therefore, it becomes imperative to examine the educational choices of those who have

aspirations for health careers and the factors which are affecting these choices.

In order to reach this goal, the current study will use Gottfredson's developmental theory of occupational aspirations for direction. This theory was selected as a guideline because it best captures the 'big picture' of career development theory. More specifically, it integrates variables from a social systems perspective with the more psychological approaches. However, because Gottfredson (1981) does not refer to all variables relevant to the career decision making process, the work of other researchers will also be discussed in order to add pertinent information to the 'big picture' of the adolescent decision making process.

### Key Variables in Career Development

Gender. According to Gottfredson (1981), the formation of career choices is initially based on gender. In fact Gottfredson (1985) argued that people are more concerned about protecting their gender identities than they are about defending their identities associated with social class, ability or personality. Therefore, occupations that are perceived to be inappropriate for one's sex are eliminated first in the career decision process. This may help to explain the fact that fewer females than males enter science careers which have traditionally been considered as more appropriate for males (Nevitte, Gibbins, & Coddling, 1990). Furthermore, females who do enter science careers tend to choose the health sciences over mathematics, engineering and physical sciences (Bateman, 1990; Nevitte et al., 1990). This is supported by Mishoe, Valeri & Beveridge (1993) who reported significant gender differences in their study of the career choices of 393 high-achieving American high school students. Survey responses revealed that females chose health careers first (19%), business second (10%) and engineering third (4%) while males chose engineering first (9%), business second (7%) and health careers third (6%).

Research has shown that there are some significant gender differences in the pursuit and seepage (exit) rates

of health science careers. In their study of Canadian final-year university graduates, Nevitte, Gibbins and Coddling (1990) found that female science students were approximately four times more likely than their male colleagues to enter such "nurturing" careers as social work or missionary work. On the other hand, male science students were about seven times more likely than their female counterparts to use their science degree as a means to "do something in the business world". Results also revealed that even though there was approximate gender parity within the field of medical sciences, the seepage rates for this area of science were high with 40% of the males and 46% of the females 'seeping out'. The seepage rate was defined in this study as the percentage of the sample that planned to pursue neither further education nor research in the field. One finding of particular interest for the present investigation was that the very best female science students (43%) were more likely than the 'average' performing female students (24%) to leave science. Therefore, it was the top academic performing female science students who reported the highest seepage rate of all students (Nevitte et al., 1990). Furthermore, the best female science students were five times more likely than the average female students to seek "nurturing" careers and it was the average performers who were three times more

likely than their higher-achieving counterparts to plan on pursuing further post-graduate education (Nevitte et al., 1990).

Lee & Ware (1986), in their study of the High School and Beyond data from the United States, found that females had a greater tendency to "leak out" of science educational pathways after earlier high school courses in mathematics and science compared to their male counterparts. As a result, at the point of high school graduation, female students had fewer credits in college preparatory mathematics courses which would have enabled them to pursue more advanced science and health science educational pathways. Gender is clearly implicated in the career decision process in both initial choice and later exit rates.

Support and Encouragement. Parental support and encouragement are mentioned indirectly by Gottfredson (1981) as factors which affect career development through their role in creating a "zone of acceptable alternatives" of occupations. Among the factors associated with the boundaries of this "zone of acceptable alternatives" is success within one's own community and the expectations of others. Obviously, the expectations of other people can be measured by the amount of support and encouragement received from parents. Turritin, Anisef and Mackinnon

(1983) identified parental support as the key variable in the decision of grade 12 students to pursue higher education in their longitudinal study of Ontario youth. It was also found that parental support played a more significant role for young females to achieve higher levels of education compared to young males. This trend is supported by Lewko, Hein, Garg & Tesson (1993) who found that more than 78% of their elite high school students perceived both parents to be supportive of their occupational choices. Furthermore, a study of Canada Wide Science Fair participants revealed that 88% of the sample came from an authoritative family or from a family type that combined authoritative parenting with other styles (Hein & Lewko, 1993). This would suggest that parents who engage in more open communication with responsiveness and encouragement, in combination with the establishment and enforcement of rules, produce an environment which encourages adolescents to excel in science.

More specifically, support and encouragement from family members have been found to be important factors related to the pursuit of health science careers. Kutner & Brogan (1980) found that 85% of women and 70% of men entering medical school said that a particular person or event had especially encouraged or supported their decision to become a physician. One or both parents were the

sources of support most frequently cited by both women and men. Men more often than women specified that their father had encouraged them. Similarly, Houser and Garvey (1983) found that young females (average age=20 years) who were pursuing nontraditional career goals (a program in which at least 80% of the students enrolled in California during 1977-1978 were males) received more support and encouragement from their mothers and fathers than did those who were pursuing career goals deemed to be more traditional (a program in which at least 80% of the students enrolled in California during 1977-1978 were females). Furthermore, parental support and encouragement was the single variable which differentiated traditionally goal-oriented females from those who had nontraditional goals. Nontraditional females receive more support from parents than females pursuing traditional careers (Houser & Garvey, 1983).

According to a second study by Houser & Garvey (1985), not only did female students aspiring to nontraditional careers believe that they received more support and encouragement from parents but they also believed that they had received more encouragement from female and male friends and other family members, as well as from teachers and counsellors. This study supported the findings of Turritin et al. (1983) who reported that the one dimension

that most significantly differentiated the nontraditionals from the traditionals was the amount of support and encouragement they received from significant others in their lives. In fact, the one variable indicating the amount of encouragement the respondents received from female friends and family members alone accounted for 18% of the variance between the traditional and nontraditional subgroups.

Smith (1991) also found a relationship between parental support and encouragement and adolescents' intentions to pursue careers in the physical sciences. It should be remembered, for the purposes of the current study, that some education in the physical and biological sciences is usually a prerequisite for entry into health care educational pathways. Results of Smith's (1991) analysis revealed significant variables as influencing career choice in a physical or quantitative science. First, students perceived that they had received "a lot" of influence from both parents in their educational decisions in general. Second, students perceived their father as being very supportive of their career choice.

Socioeconomic Status. Numerous studies have found that socioeconomic status (SES) is an important influence on adolescents' occupational aspirations (Haller, Otto, Meier & Ohlendorf, 1974; Porter, Porter & Blishen, 1982). Socioeconomic status is also a primary factor discussed within Gottfredson's theory because of its close relationship to levels of prestige and social class self-concept within the processes of circumscription and compromise. According to Porter et al. (1982), the relationship between educational and occupational aspirations and social class was consistent for 2,571 grade twelve and thirteen males and females at all levels of social class. More specifically, the brighter lower-class males and females were less likely than the brighter middle or upper-middle class males and females to aspire to the highest educational or occupational levels. This held true for all levels of mental ability. Furthermore, not only did lower social class adolescents aspire to lower educational and occupational levels, but they were also underrepresented in the academic levels of study (Porter et al. 1982). Therefore, many university programs, particularly those in the health sciences, which require advanced level courses for admission, are not accessible to lower SES students who tend to take more 'general' level

courses compared to 'advanced' level courses in high school.

Gottfredson (1985) reasons that if nothing else, an occupation represents "a place in society" (p.160). Furthermore, an individual's "place" is often measured in terms of socioeconomic status. As a result, many highly competent students of lower socioeconomic status do not seek their highest available educational and/or occupational level because they do not find it necessary to obtain a higher-level occupation in order to be considered successful within their own social surroundings. On the other hand, students from high socioeconomic backgrounds often feel pressured to obtain high-level jobs in order to maintain a social standing compatible with the status of their family and friends (Gottfredson, 1985).

In a 1988 Canadian study, of 317 female students in grades 8, 10, and 12, Holms and Esses found that females from higher socioeconomic backgrounds aspired to higher levels of education, were more highly committed to a career and aspired to more highly prestigious occupations. Conversely, female students from lower socioeconomic backgrounds had lower educational and occupational goals. The authors of this study reasoned that perhaps girls from lower socioeconomic backgrounds acknowledged the high

financial requirements necessary for higher education and realized that funding might not be available to them.

In 1987, Green examined the annual freshmen surveys of the Cooperative Institutional Research Program sponsored by the American Council on Education and the University of California at Los Angeles, with particular attention to female freshmen who entered college to pursue nursing careers. Green (1987) found that the proportion of prospective nurses from families with incomes under \$10,000 was more than 50% greater than the non-nurses (10.6% compared to 6.9%). In families whose income was under \$25,000, prospective nurses accounted for 35% of the respondents compared to only 25% of the non-nurses. Furthermore, 65% of the nurses came from families with incomes less than \$40,000, compared to 53% of the non-nurses. These data provide evidence that nurses tend to come from lower income families.

Parental Educational and Occupational Background. The major components of SES include the occupation and education of the parents. These factors are important within Gottfredson's (1981) theory, and specifically in terms of circumscription because in order for adolescents to aspire to becoming health care professionals, they must first have a sense of what is available to them. It stands

to reason that adolescents who have parents in the health care professions are more aware of these specific occupations and as a result would be more able to appreciate the options of becoming health care professionals themselves. As a result, many researchers have examined these components in detail.

Cuneo & Curtis (1975), examined the influence of maternal and paternal educational factors on the educational and occupational attainment of an adult sample of both English-speaking and French-speaking Canadian men and women aged 25 to 34 years. The levels of education for both father and mother were significant for explaining the educational and occupational attainments of all subjects. However, father's education had the greatest independent influence on educational attainment among the francophones and females while father's occupation had the greatest independent effects among the anglophones and males. Furthermore, although mother's education also had a more direct influence on the educational attainment among francophones than anglophones, it was stronger among men than women.

Mother's occupation has also been noted as a factor related to entry into medical school, particularly for women. Kutner & Brogan (1980) found that 57% (n=97) of the female medical students as compared to 43% (n=73) of the

male students had mothers who were employed outside the home in various occupations, most of which were unrelated to medicine or health care. Only three female students and one male student of the 170 female and 170 male students who participated in this study reported having a mother who was a physician.

Father's occupation has also been found to be related to career choice. Fitzpatrick & Silverman (1989) found in their study of high ability female college students that females majoring in engineering were most likely to have fathers employed in science or engineering (39.6%), compared to females in traditional studies including the social sciences and humanities (6.5%). In terms of the health sciences, research has shown that 18-27% of male medical students and 6-21% of female medical students had fathers who were physicians (Kutner & Brogan, 1980).

In researching the role of parental education on occupational choice, Sandberg, Ehrhardt, Mellins, Ince & Meyer-Bahlberg (1987) found that young women who came from high socioeconomic backgrounds and had highly educated fathers and employed mothers were more likely to enter and maintain interest in non-traditional occupations. A non-traditional occupation was defined as one that was predominantly filled by men, (i.e., by 40% of women or less). Traditional referred to all remaining choices.

Bateman (1990) similarly found that adolescent girls who had expressed a desire to pursue science careers had mothers who had achieved higher levels of education than adolescent girls choosing nonscience careers.

O'Connell, Betz & Kurth (1989) reported similar findings in their study of 173 female college students. Nontraditional students (i.e., females pursuing engineering and veterinary medicine careers) were significantly more likely to have highly educated fathers compared to the traditional students (e.g., females pursuing nursing careers).

Furthermore, Nevitte et al. (1990) reported that Canadian female university students enrolled in science undergraduate programs were more likely than male students to have a father who worked in a scientific or technological occupation. It is interesting to note that in this study, father's occupation was a stronger correlate for female's educational pathway than was father's education. Students were divided into three categories including bio-medical sciences, mathematics-natural sciences and engineering. The authors calculated what they referred to as the "seepage rate" or the percentage of the sample that intended to pursue neither further education nor careers in science or technology. After they had determined that gender differences existed in the student

seepage rates, the authors investigated whether or not an array of twenty social, cultural, economic and demographic variables differentially affected the seepage rate for males and females. The most significant result obtained was that female science undergraduates were more likely to have fathers employed in the sciences. Furthermore, additional analyses using only the data for females revealed that father's occupation decisively (ps.01) distinguished female students in the hard sciences (mathematics, natural science, engineering) from those in bio-medical sciences. The authors conjectured that familial role models are relevant at career decision points, as well as during earlier decision points that are related to selecting the academic field of study.

Francophone Culture. In her theory, Gottfredson (1981) discusses the perceived accessibility of occupations. This perception reflects the probability of attaining a specific occupation and as a result, influences how ardently an adolescent may consider this occupation as a career. Northern Ontario has a large francophone population and, as a result, needs to be examined within this context. Churchill, Frenette & Quazi (1986) reported that francophone students appeared to be at a greater disadvantage in realizing careers in science compared to

their anglophone peers. More specifically, Churchill et al. (1986) found that francophones were consistently less well represented in mathematics and science courses compared to non-francophones. Since educational and occupational aspirations are closely linked (Breton 1972, Porter et al., 1982), it is reasonable to conclude that if francophone students are unable to acquire science and mathematics credits in high school they will not be able to enrol in science and math at the post-secondary level which will restrict their career aspirations in science and health science occupations.

#### The Measurement of Occupational Aspirations

Gottfredson (1981) describes aspirations as the central concept or independent variable studied in all research relating to career development and occupational choice. The concept of aspirations is operationalized as the type of job or career that the individual would most like to obtain or desire at a particular point in time. Therefore, a fundamental issue to examine when utilizing measures of occupational aspirations in career development is whether individuals maintain stable patterns of vocational interest over time.

Gottfredson (1981) argued that although a person's assessment of which alternative is best at any particular

time may change, the social space of their aspirations will remain stable (an individual's social space refers to one's acceptable range of choices based primarily on identity within gender and prestige scales). Furthermore, with only a few exceptions found at the high school level, adolescents are more likely to shift between occupational fields at the same level rather than moving up or down levels within a field (Gottfredson, 1981). For example, adolescents would be more likely to shift from aspiring to becoming a physician to becoming a judge (similar sextype and prestige levels) than to shift from aspiring to becoming a dental hygienist to becoming a physician (different sextype and prestige levels).

Subsequent research by Swanson & Hansen (1988) supports the view that career interests will be relatively stable between the ages of 18 and 30 years. When measuring the stability of vocational interests over a twelve-year period, median stability coefficients were .81, .83, and .72 for 4 year, 8 year, and 12 year intervals respectively. Furthermore, a study by Hansen & Stocco (1980) of 14 and 18 year old individuals concluded that the overall trend was toward interest stability rather than change of career aspirations. Wilson & Boldizar (1990) also supported this view by concluding in their examination of 1983 college graduates in the United States (n=974,309) that college

specialization was determined prior to high school graduation.

In a study which examined differences in response to blocked career pathways in medicine, the mean age of unaccepted applicants was 25.1 years for males and 25.4 years for females. Of the unaccepted applicants who were pursuing careers in medicine, the mean age declared at which a decision was made to become a physician was 16.6 years for males and 16.1 years for females (Weisman et al., 1976). Furthermore, Wyrick & Stern (1987) found in their survey of 1,337 occupational therapy (OT) students that the majority (55.5%) of the students had decided on occupational therapy as a career by the time they were 19 years old and that most of the OT students (58.7%) had applied to programs by age 20. The results from these studies suggest that the aspirations of those individuals pursuing health educations and occupations are made relatively early in the academic career and that these aspirations are stable as demonstrated by the actual behaviour of applying to medical and occupational therapy schools (Weisman et al., 1976; Wyrick & Stern, 1987).

Another essential area to examine in the career development process is the actual persistence of individuals within the educational pathways leading to their desired careers. Research on the pursuit of science

education by Hilton & Lee (1988) showed that the greatest loss from the science educational 'pipeline' occurred between high school and university. Of their sample, 32% switched from science to nonscience majors. A further 26% dropped out of school completely.

Tilleczek (1993) also discovered a loss in her sample of Canadian high school students. In her 1989 follow-up study of 836 young people, which covered four years following the initial 1985 study, science career pathways lost 7% of the potential students while nonscience gained 1% and the percentage of undecided students grew by 6%. An interesting gender difference was found in this study in terms of the field of science for the persisters. More specifically, within the group of female science persisters, those interested in medicine and health sciences (83%) were more likely to persist compared to those female science persisters who were in natural science, engineering and mathematics (17%). This can be compared to the male science persisters where 78% aspired to occupations in natural science, engineering and mathematics compared to only 22% who were interested in medicine and health professions.

In a similar fashion, Hilton & Lee (1988) found that only half of both male and female mathematically-able students remained in the field that they had indicated as

an interest from their high school to college years. Finally, Lee (1987) found that students who left a particular field of science were significantly more likely to leave science entirely than to change to another educational field within the sciences. This has serious ramifications for researchers interested in studying health science directed adolescents because if such a large number of students are leaving the science educational pipeline, it is logical that these students will not be able to enter health care educational pipelines. On the other hand, Taylor & Pryor (1985) explored the process of compromise in the career decision making process and found that only 54% of the sample responded when asked what course or occupation they would attempt to enter if they failed to matriculate. This would suggest that almost half of the sample had not even considered the possibility that they might not attain their educational or occupational goal. Nonetheless, in this study, medicine aspirants, compared to other career aspirants, were most likely to persist in their original career choice as revealed by the fact that 63% chose to reapply to medical school rather than to consider another alternative.

Finally, in order to understand persistence within a specific educational pathway, it is also necessary to examine the seepage rate. For example, Lee (1987) found

that the movement into and out of science educational pathways was more typical than persistence within the sciences. It is even more important to examine seepage out of science and the health care educational pathway because once individuals leave this specialized area, it is very difficult to return since education in the sciences is cumulative in nature and the ability to understand advanced science depends upon earlier foundations in science. As a result, seepage away from science at an early stage in education results in a substantial permanent loss to the potential pool of young scientific talent (Nevitte et al., 1990).

#### Summary

Among the current conceptual frameworks in the field of career development, Gottfredson's developmental framework is key. The main variables incorporated into this framework include gender and socioeconomic status, which also encompasses both parental employment and education. The introduction to this study also examines specific variables that have been found to influence career decisions in general and health science career pathways in particular. These variables included gender, (Gottfredson, 1981; Bateman, 1990, Nevitte et al., 1990; Lee & Ware, 1986; Turritin et al., 1983; Lewko et al., 1993;), parental support and encouragement (Kutner & Brogan, 1980; Houser &

Garvey, 1983; 1985; Smith, 1991), socioeconomic status (Porter et al., 1982; Gottfredson, 1985; Holms & Esses, 1988; Green, 1987), parental employment and education (Cuneo & Curtis, 1975; Kutner & Brogan, 1980; Fitzpatrick & Silverman, 1989; Sandberg et al., 1987; O'Connell et al., 1989;), and the francophone culture (Churchill et al., 1986; Breton, 1972; Porter et al., 1982).

When considering consistency of remaining within specific career pathways, a number of studies prove insightful. Previous works on the stability of adolescent responses (Gottfredson, 1981), persistence of individuals within educational pathways leading to their desired careers (Hilton & Lee, 1988) and the movement into and out of career pathways (Lee, 1987) help to form the context for the analysis of consistency over time.

### Purpose of the Study

The present study sets out to:

1. Provide a comprehensive description of career pathways of elite science students.
2. Describe the extent to which students are consistent with their initial choice of these three career pathways over a one- or two-year period.
3. Identify a set of factors that discriminate between students choosing health science (HS) and those choosing other sciences (OS) or nonsciences (NS).

## Method

### Sample

Each summer from 1987 to 1992, Laurentian University hosted the Northern Summer School for Science and Technology (NSSST). Participants in this program were high school students who had high academic achievement in science. More specifically, in the present study, 86% of the 243 students were enrolled in high school at the advanced level while the remainder were in combined courses of advanced, enriched and gifted programs. Academically, 84% stated that they had mainly A's during the previous school year. Ninety-six percent of these subjects expected to graduate from university. Evidently, these students represented a highly selected sub-group of youth who had the academic grades which would enable them to successfully enter educational pathways leading to health care careers.

In order to attend the NSSST, a student was first nominated by his/her school principal and science teacher. The nominations were based on the criteria of keenness and ability in mathematics and science and a positive attitude towards learning. Every high school in northeastern Ontario was guaranteed at least one place in the program regardless of the size of the institution. On the basis of

enrolment, some schools were allowed to select two students to attend the programme.

Subjects in this study were the 243 students who attended the NSSST in the summers of 1989 and 1990. Thirty-seven percent of the students were from the 1989 NSSST (n=89) and sixty-three percent participated in the 1990 NSSST (n=154). These students completed questionnaires at the NSSST and were successfully contacted during a follow-up in the summer of 1991 by means of telephone interviews.

The follow-up sample is representative of the total group of NSSST participants in terms of gender and language of study. Females outnumbered males among respondents with 42% of the sample being males and 58% being females. Furthermore, the respondents were fairly equally divided in terms of language of study (51% responded in English and 49% responded in French).

#### Procedure

The initial surveys took place in the summers of 1989 and 1990. All participants at the NSSST completed a questionnaire as part of a larger study of science students. In each year, the students assembled in a single session to complete the questionnaires. Research assistants were present to answer any questions concerning the survey posed by the students.

In the summer of 1991, a three-step procedure was used to contact all students who had attended the NSSST program previously. In the first step, attempts were made to contact the students by telephone. Students who agreed to participate were interviewed on the telephone. The second step involved NSSST students who could not be contacted by telephone and who were sent a mail questionnaire. A third step then followed whereby the parents of unavailable students were asked to complete a shorter version of the questionnaire containing objective questions regarding the student's background and educational status and plans. Only two of the students declined to participate in the study. As a result of this procedure, 243 subjects from 1989 and 1990 were included in the current study.

#### The Questionnaires

A subset of variables from the 1989 and 1990 questionnaire was used in the current study. These variables include the following: personal and family demographics and educational and occupational aspirations. In the 1991 follow-up questionnaire, participants were questioned about their current educational status, their future plans and aspirations and their reasons for choosing specific educational pathways over others.

## Measures

Independent variables included in this study are gender, first language spoken at home, support and encouragement from parents, parental education and occupation, and socioeconomic status. The dependent variables are career aspirations at Time 1 and Time 2.

### Defining the Variables

Occupational Aspirations. Student occupational aspirations at Time 1 (1989 or 1990) and Time 2 (1991) were coded according to the Canadian Classification and Dictionary of Occupations (CCDO) (1989) which is the classification system that is standard for both Canadian education and industry. The occupational aspirations were recoded into 'health science' (HS), 'other science' (OS) and 'nonscience' (NS) categories. The CCDO classifies occupations according to the tasks and responsibilities of each job. According to the CCDO classification system, health sciences include occupations involved with "preventing and diagnosing human and animal ailments, and prescribing and giving surgical and medical treatment for diseases and illnesses; giving professional and non-professional nursing care and providing special therapeutic services; and providing pharmaceutical, dietary, optical and medical support services" (Statistics Canada, 1980: 81). Within this classification system, health science

occupations are then further subdivided into 3 groups including health diagnosis and treatment, nursing and related occupations and other health occupations. Thus, the main occupations that were considered under this category included physicians and specialists, psychologists, nurses, pharmacists, physical therapists, occupational therapists, speech pathologists, audiologists, dieticians, veterinarians and dentists (for a more detailed list see Table 1).

Occupations were also classified as being traditional versus non-traditional. The criteria used to arrive at this classification was defined by Sandberg et al. (1987). A non-traditional choice for women was defined as an occupation that was predominantly filled by men, (i.e., with 40% of women or less). Conversely, traditional choices for women were defined as occupations that had 60% of women or more. The same criteria was applied to the male definition whereby traditional occupations for males were defined as occupations that had 60% of males or more and non-traditional male occupations as occupations with 40% of males or fewer. Blishen, Carrol & Moore's (1987) socioeconomic index was used to determine the percentage of females and males found within each occupation.

Socioeconomic status. Parental occupations and students' occupational aspirations were recoded using the socioeconomic index developed by Blishen et al. (1987), which rank-orders occupations on the basis of prestige, education and income. For descriptive purposes, the measure of SES was divided into high, middle and low using the mean of the scale (42.74) and the standard deviation of the scale (13.28). The minimum value of this scale is 17.81 and the maximum value is 101.74.

Parental Education. From Time 1, parents' education was measured by the highest level of education attained. Students were asked to circle a response to the question, "how far did each of your parents go in school?" Responses were in the range of having had some elementary schooling to having completed a doctorate at the university level.

Support and Encouragement. At Time 1, support and encouragement from family members and significant others was measured by a self report about how these people had influenced the subjects' educational decisions. More specifically, the question asked students to rate (on a 5-point likert scale) the extent to which specific individuals including mothers and fathers had encouraged or supported them in relation to their desired job or career.

Interest and Motivation in Science. At Time 1, students were questioned about their interest and motivation in science. More specifically, students were asked: "how strong is your interest in science?" and "how strong is your motivation to do well in science?" Students responded using a 5-point likert scale which ranged from "not strong at all" to "very strong".

### Data Analysis

The first step in the analysis of data was to determine if any differences existed between the 1989 and 1990 cohorts on all variables. Analysis of variance (ANOVA) and chi square tests revealed that there were no significant differences between the two groups on any of the variables, including persistence. Hence, the 1989 and 1990 groups were combined to form one cohort. It is also worth noting at this point that there were no significant language differences. As a result, language differences were not pursued any further.

Since the focus of this study was a descriptive examination of students' career choices and the stability of these choices over time, the analysis was based primarily on descriptive statistics including frequency distributions and cross-tabulations.

Table 1: Classification of Health Professions<sup>a</sup>

<b>Health Diagnosing and Treating Occupations</b>	<b>Nursing, Therapy and Related Assisting Occupations</b>	<b>Other Occupations in Medicine and Health</b>
physicians	registered nurses	pharmacists
surgeons	registered nurses assistants	dieticians
dentists	orderlies	optometrists
veterinarians	audiologists	radiology technicians
chiropractors	speech therapists	medical laboratory technicians
psychologist	physiotherapists	denturists
	occupational therapists	dental hygienists
		respiratory technicians

<sup>a</sup>Based on the Canadian Classification and Dictionary of Occupations (CCDO) 1980.

## Results

### Overview

The results section was divided into 5 sections. The first section deals with a background description of the students at Time 1. This section is further divided into subsections focusing on the family background of the students, science-related characteristics, initial career aspirations, gender differences in career choices and students' career choices within the health science career pathway specifically. The second section examines the extent of consistency in terms of the students' career choices at Time 2 compared to those at Time 1. The third section examines in more detail the seepage into and out of the three career pathways and is subdivided into each of the three pathways including health science (HS), other science careers (OS) and nonscience careers (NS). In the fourth section, a discriminant analysis was conducted in an attempt to determine a set of factors which would differentiate between the groups of students choosing health science (HS), other science (OS) or nonscience (NS) careers and to attempt to identify a model which would distinguish between subjects with consistent and inconsistent career aspirations. The final section summarizes the key findings from the study.

It is important to note that gender was the primary focus of this study due to the homogeneity of many of the other variables.

#### Background Description at Time One

The first two subsections describe the nature of the sample in an attempt to gain insight into how these students may have become initially interested in science and science careers, and more specifically in health science careers.

The family. Most parents of the study participants were employed and a large percentage of the mothers worked part-time (31%) or full-time (54%). Nearly all of the fathers worked full-time (92%).

These parents were also highly educated as 42% of the mothers and 47% of the fathers had some form of post-secondary education. This can be compared to 35% of the 1988 adult members of the Canadian labour force who had college diplomas or university degrees (Statistics Canada, Labour Force National Averages, 1988). When examining the specific fields in which parents were employed, only 5% (n=13) of the fathers worked in health science careers and 17% (n=41) worked in other science careers. In comparison, 9% (n=21) of employed mothers worked in health occupations and only 5% (n=12) worked in other science-related occupations. When looking at the health-related

occupations held by mothers and fathers, it is apparent that the fathers held higher status jobs compared to the mothers. Fathers held jobs in medicine (n=5), health administration (n=4), optometry (n=1), and medical technology (n=2), while mothers held jobs in nursing (n=17), or medical technology (n=2), pharmacy (n=1) or psychology (n=1).

In terms of parental socioeconomic status, the majority of students (77%) came from high (44%) or middle (33%) socioeconomic status families. Moreover, the majority of students (84%) reported that they had received a great deal of support and encouragement from their parents in terms of their career choice.

Science-related characteristics. The majority of the study participants became interested in science relatively early in life. In fact, the average year in which these subjects became interested in science was grade 7. In terms of how these students became interested in science, 40% (n=93) stated that it was through a teacher and 26% (n=61) stated that it was through the school curriculum. Other factors outside of school included: natural curiosity (18%,n=41), parental influence (14%,n=32) and interest in a specific future occupation (14%,n=32).

When questioned about their interest and motivation to do well in science, 89% stated that their interest in

science was strong or very strong. Nearly all of the students (92%) stated that they were highly motivated towards high achievements in science.

Initial Choice of Career Pathways. One of the main foci of this study was to examine the careers to which these students initially aspired at Time 1. Of the 243 participants, 30% (n=73) aspired to careers in the health sciences (HS), 34% (n=83) aspired to careers in other sciences (OS) and 13% (n=30) aspired to nonscience (NS) careers (see Table 2). The remaining 23% (n=57) were indecisive about their chosen career pathway. The most popular HS occupation chosen by these students was medicine (n=33), the most popular OS career was engineering (n=25) and the most popular NS career was management (n=5).

In an attempt to distinguish between the three groups, chi square tests revealed that those students who were interested in HS and OS careers were more likely than those students interested in NS careers to be very interested in science ( $X^2=26.6$ ; d.f.=15;  $p \leq .05$ ) and also to be very strongly motivated in science ( $X^2=40.2$ ; d.f.=12;  $p \leq .001$ ). Furthermore, students aspiring to careers in both science pathways (HS and OS) were significantly more likely than those students who were not (NS) to believe that science would very likely

be important to their future careers ( $X^2=50.7$ ;d.f.=12; $p\leq.00$ ).

Chi square tests did not show significant differences between the three career pathways in terms of language, the grade level of the participants, support and encouragement received from mothers and from fathers, parents' socioeconomic status (SES), parental occupation or parental education, or participants' involvement in employment or volunteer work.

Table 2  
Specific Occupations Chosen by Students at Time 1 (1989 and 1990)

Occupation	Health	Science	Nonscience
Management Position			5
Politician			2
Accountant			1
Chemist			
Geologist		2	
Physicist		1	
Meteorologist		1	
Biologist		8	
Architect		3	
Engineer		25	
Mathematician			
Computer Analyst		6	
Psychologist	2		
Social Worker			3
Lawyer			2
University Teacher		4	
Elementary Teacher			1
Secondary Teacher		17	
Physician	33		
Dentist	2		
Veterinarian	4		
Chiropractor	2		
Nurse	4		
Physiotherapist	6		
Occupational Therapist	2		
Pharmacist	10	1	
Optometrist	5		
Medical/Dental Technician	3		
TV Announcer/Actor			2
Translator			1
Coach			1
Something in Science		15	
Other Nonscience Careers			12
<b>TOTAL</b>	<b>73</b>	<b>83</b>	<b>30</b>

Gender Differences in Career Choices. Table 3 shows the significant gender differences between students aspiring to three groups of occupations whereby females (77%) were more likely than males (23%) to aspire to HS careers and males (59%) were more likely than females (41%) to aspire to OS careers. Furthermore, more females (57%) compared to males (43%) aspired to NS careers ( $X^2=21.7$ ;  $df=6$ ;  $p \leq .05$ ).

Table 3  
Career Aspirations by Gender

Career Pathway	Gender			
	Females (n=141)		Males (n=102)	
	Number	Percent	Number	Percent
Health Sciences	56	40%	17	17%
Other Sciences	34	24%	49	48%
Nonsciences	17	12%	13	13%
Undecided	34	24%	23	22%

When examining gender differences within the HS pathway more closely, a major trend was apparent (see Table 4). Results revealed that females were much more diverse than males when aspiring to become health professionals. More specifically, males' aspirations were **mainly limited** to those health careers where the title of 'doctor' was the result. In other words, males tended to only choose those health careers that offered high status and high income. More specifically, 71% of the males who were interested in health careers chose 'physician' as their career choice within the HS pathway. On

the other hand, while only 38% of the females within the HS career pathway aspired to becoming a 'physician', another 20% aspired to other careers which also hold the title of "doctor. Furthermore, **only females** aspired to become psychologists, veterinarians, nurses, physiotherapists, occupational therapists, technicians, dental hygienists, etc. It should also be noted that females largely outnumber males in Table 4 which puts a different perspective on the percentages presented.

Table 4  
Health Science Career Aspirations by Gender

Health Occupations	Gender			
	Females		Males	
	n	%	n	%
Psychologist	2	4%	0	0
Physician	21	37%	12	71%
Dentist	1	2%	1	6%
Vet	4	7%	0	0
Chiropractor	1	2%	1	6%
Nurse	4	7%	0	0
Physiotherapist	6	10%	0	0
Occupational Therapist	2	4%	0	0
Pharmacist	9	16%	1	6%
Optometrist	3	5%	2	11%
Technician	2	4%	0	0
Dental Hygienist	1	2%	0	0
<b>TOTAL</b>	<b>56</b>	<b>100%</b>	<b>17</b>	<b>100%</b>

Table 5 shows the gender breakdown for students aspiring to OS careers. This table reveals that there were also gender differences within this pathway. Results show that among students choosing OS as a career pathway, a larger percentage of females (29%) compared to males (8%) were undecided about which **specific** occupation they wished to pursue. Males were most likely to choose engineering (n=18), while females within this pathway were most likely to aspire to high school science teaching (n=9).

Table 5  
Other Science Career Aspirations by Gender

Other Science Occupations	Gender			
	Females		Males	
	n	%	#n	%
Geologist	1	3%	1	2%
Physicist	1	3%	0	--
Biologist	3	9%	5	11%
Meteorologist	0	--	1	2%
Architect	1	3%	2	4%
Engineer	7	21%	18	37%
Computer Analyst	0	--	6	13%
University Science Professor	2	6%	2	4%
High School Science Teacher	9	26%	8	17%
Technician	0	--	2	4%
Something in Science	10	29%	4	8%
<b>TOTAL</b>	<b>34</b>	<b>100%</b>	<b>49</b>	<b>100%</b>

Table 6 shows the gender breakdown of those students aspiring to NS careers. Results revealed that there is a trend similar to students in the science career pathways in that females aspiring to NS careers were more likely (47%) to be undecided as compared with their male counterparts (31%). Caution must be taken when examining this trend, however, due to the small number of cases found within this pathway.

Table 6  
Nonscience Career Aspirations by Gender

Nonscience Occupations	Gender			
	Females		Males	
	n	%	n	%
Management Occupations	3	18%	2	15%
Members of Parliament	0	--	2	15%
Accountants	0	--	1	8%
Social Worker	4	23%	0	--
Lawyer	1	6%	1	8%
Kindergarten Teacher	0	--	1	8%
Radio Announcer	1	6%	0	--
Translator	0	--	1	8%
Coach	0	--	1	8%
Nonspecified Nonscience Career	8	47%	4	30%
<b>TOTAL</b>	<b>17</b>	<b>100%</b>	<b>13</b>	<b>100%</b>

Table 7  
Traditional<sup>a</sup> and Nontraditional Career Aspirations by Gender

Career Pathway	Traditional Careers		Nontraditional Careers	
	Males	Females	Males	Females
HS	16 (26%)	15 (22%)	0	30 (43%)
OS	37 (62%)	0	0	15 (22%)
NS	6 (10%)	4 (6%)	1 (2%)	5 (7%)
<b>Total<sup>b</sup></b>	<b>59</b>	<b>19</b>	<b>1</b>	<b>50</b>

<sup>a</sup>Traditional and nontraditional careers were determined using Blishen, Carroll, & Moore's (1981) socioeconomic index.

<sup>b</sup>Total numbers found within this table may not total the entire sample as a result of several occupations being neither traditionally female or male (see Appendix A).

Table 7 demonstrates 'traditional' and 'nontraditional' occupations in terms of sextype chosen by students in each of the three career pathways as defined by Blishen et al. (1987) (see Appendix A for specific occupations found within each category). The most obvious distinction in this table is that while 72% of the females (n=50) were aspiring to more nontraditional careers, only 2% of males (n=1) were doing the same.

Students' Career Choices Within the Health Science Career Pathway. As previously stated, there were obvious gender differences within the group of students choosing HS careers. In order to examine students in the HS group more closely, and because there is such a widely accepted status and income division between specific HS professions, physician and dentist were grouped together and all other HS professions formed another category.

Further gender differences were found between the first group (those who intended to pursue medicine or dentistry) and the second group (other health science professions) (see Table 8). Males were more likely to aspire to becoming doctors and dentists compared to the females. In fact, 76% of the males (n=13) aspired to these professions compared to only 39% of the females (n=22). This compares to the second group whereby 24% of the males (n=4) and 61% of the females (n=34) aspired to nonmedicine and nondentistry professions ( $X^2=6.1$ ; d.f.=1;  $p \leq .05$ ). Furthermore, students who aspired to occupations in medicine and dentistry were more likely to have fathers who had completed postsecondary education (n=20) compared to the fathers of those students who aspired to other health occupations (n=7) ( $X^2=24.9$  d.f.=11  $p \leq .05$ ). This was true for both male and female students. There was no significant difference between the two HS groups in terms of mothers'

education, although 49% (n=18) of the mothers of the students who aspired to becoming physicians and dentists had completed postsecondary education compared to only 31% (n=11) of the mothers of students who aspired to becoming other health professionals. Again, this was true for both male and female students.

Finally, 84% of the students who aspired to become physicians and dentists compared to only 50% of the other health science groups stated that they had a strong interest in science ( $X^2=10.4$ ; d.f.=2;  $p \leq .01$ ). There was not a significant difference between the two health science groups in relation to their motivation to do well in science.

There were no significant statistical differences between these two groups (physicians and dentists versus other health professions) when considering language, specific parental occupations, parental socioeconomic status, or support and encouragement received from parents.

Table 8  
Gender by Specific Health Science Career Aspirations

	Males	Females	Total
Students Aspiring to Becoming Physicians and Dentists	13 (76%)	22 (39%)	35
Students Aspiring to Other Health Careers	4 (24%)	34 (61%)	38
Total	17 (100%)	56 (100%)	73

Extent of Student Persistence in Choice of Career Pathways

As mentioned previously, this study consisted of cohorts from the 1989 and 1990 NSSST. As a result, the 1991 follow-up examined the consistency of aspirations after a one-year period for the 1990 cohort and a two-year period for the 1989 cohort.

Persistence was examined in terms of consistency of aspirations and rates of seepage out of and into each of the three pathways over time. The extent of persistence was examined by comparing consistency rates of students' aspirations from Time 1 to Time 2. Chi square analysis was performed to determine if there were differences in the consistency rates between the two cohorts. There were no significant differences in terms of overall consistency rates nor for consistency rates between the three occupational

pathways (see Appendix B). As a result, the 1989 and 1990 student cohorts were combined to form one single group. Upon inspection of Table 9, it **appears** that the numbers within each pathway are almost identical at Time 2 compared to those at Time 1.

Table 9  
Career Aspirations at Time 1 and Time 2 by Gender

CAREER PATHWAY	Males		Females	
	Time 1	Time 2	Time 1	Time 2
Health Science	17 (17%)	19 (19%)	56 (40%)	58 (41%)
Other Science	49 (48%)	47 (46%)	34 (24%)	35 (25%)
Nonscience	13 (13%)	6 (6%)	17 (12%)	21 (15%)
Undecided	23 (22%)	30 (29%)	34 (24%)	27 (19%)
<b>TOTAL</b>	102	102	141	141

When examined more closely, however, the results revealed in Table 9 are deceiving. The more detailed results present a strong case for the necessity of descriptive analysis in this study despite seemingly similar numbers at the two study times. Descriptive results revealed that from this cohort of 243 students, only 119 students were categorized to be consistent at Time 2. In other words, at Time 2, only 49% of the students were still considering an occupation within the same category of career pathways (i.e., health or other

science or nonscience or undecided) as stated in Time 1 (see Table 10).

Table 10  
The Number of Consistent<sup>a</sup> Students in Relation to Career Pathways

		TIME 1			
		Undecided	Health	Other Science	Nonscience
T I M E  2	Undecided	<b>14</b> (25%)	11 (15%)	19 (23%)	13 (43%)
	Health	15 (26%)	<b>49</b> (67%)	9 (11%)	4 (13%)
	Other Science	18 (32%)	7 (10%)	<b>50</b> (60%)	7 (23%)
	Nonscience	10 (17%)	6 (8%)	5 (6%)	<b>6</b> (20%)
	TOTAL	57 (100%)	73 (100%)	83 (100%)	30 (100%)

<sup>a</sup>Bold numbers indicate consistent responses .

Table 10 illustrates that there were significant differences between the three occupational pathways and the number of consistent respondents within each ( $\chi^2=89$  d.f.=9  $p \leq .00$ ). Those students who aspired to NS careers and those students who were undecided were the least consistent. More specifically, Table 10 reveals that 20% (n=6) of the students who aspired to a NS profession at Time 1 also aspired to the same NS career pathway at Time 2, while 60% (n=50) of those in

OS career pathways and 67% (n=49) of those in the HS career pathways were consistent. Twenty-five percent (n=14) remained undecided over time.

Chi square tests were also performed to determine whether there were any statistically significant differences between the three categories of occupational aspirations (HS, OS and NS) in relation to consistency rates. The trend of gender differences continued in that males were more consistent than females in relation to their specific occupational aspirations at Time 2, compared to those at Time 1. In other words, males were significantly more likely than females to aspire to the same occupational category at Time 2 ( $X^2=24$ ;d.f.=2; $p<.001$ ) (see Table 11). Furthermore, the males who were the most consistent were those aspiring to careers in science whereby 76% of the males in the HS category (n=13) and 73% of the males in the OS category (n=37) were consistent. This compares to only 8% of the males in the NS category (n=1) ( $X^2=11.2$ ;d.f.=1; $p<.00$ ). This was somewhat different for the females in that there was less variation between the science and nonscience categories. For example, only 64% of the females in the HS category (n=36) were consistent compared to 38% of the females in the OS category (n=13) and 29% of the females in the NS category (n=5). Obviously, these results

should be viewed with caution due to the small number of subjects in each category and the nature of this elite sample.

Table 11

The Number of Consistent Respondents in Each Occupational Aspiration Category by Gender

	Health Science		Other Science		Nonscience	
	n	%	n	%	n	%
Males	13	27%	37	74%	1	17%
Females	36	73%	13	26%	5	83%
<b>TOTAL</b>	49	100%	50	100%	6	100%

Cross-tabulation of the independent variables with the variables representing the persistent respondents revealed several significant group differences based on interest and motivation in science, the importance of science for a future career and specific occupational pathways. More specifically, it was found that interest in science and motivation in science were significantly related to consistency among respondents. Although the majority of this sample had high levels of interest in science, those students who were consistent in their career aspirations (92%) were significantly more likely to have higher levels of interest in science compared to those who were not consistent (87%) ( $X^2=13.0$ ; d.f.=5;  $p \leq .05$ ). Those students who were consistent respondents (97%) were also significantly more likely to be highly motivated in science compared to those students who

were inconsistent (89%) ( $X^2=14.0$ ;d.f.=4; $p\leq.05$ ). Similarly, consistent respondents (92%) were significantly more likely to feel that science would be important to their future careers compared to those who were inconsistent respondents (74%) ( $X^2=13.3$ ;d.f.=4; $p\leq.05$ ).

There were no statistically significant differences between the consistent respondents for the three groups based on language, parental occupation, education or socioeconomic status.

#### Seepage Into and Out of the Three Career Pathways

Descriptive analysis was also performed in an attempt to determine consistency within each of the three categories and also to ascertain to which new occupational category the inconsistent respondents aspired at Time 2. While it was already determined that the overall rate of consistency for the sample of 243 students was 49 % (n=119), consistency rates for those students in HS were somewhat higher at 67% (n=49) and 60% for OS (n=50). However, consistency was much lower for students in the NS career pathway with a 20% (n=6) consistency rate. When examining the **specific** occupations chosen by consistent respondents within the three categories, a similar trend emerged in that consistent respondents within the HS pathway were the most likely to aspire to the same

specific occupation at Time 2 (65% of the persisters within HS).

Health Sciences (HS). Table 12 shows the occupations aspired to at Time 2 by those students who at Time 1 had aspired to careers in the HS occupations. Of the 24 students who left the HS career pathway, only 25% (n=6) continued to aspire to any type of science career at Time 2. The remaining 75% (n=18) were either undecided or aspired to NS career pathways at Time 2.

Table 12  
New Occupational Choices For Those Students Who Left The HS Career Pathway

Occupations	n of Students	% of Students
Service Manager	1	4%
Physical Scientist	1	4%
Biologist	1	4%
Architect	1	4%
Industrial Engineer	1	4%
Lawyer	1	4%
Elementary School Teacher	1	4%
Secondary School Teacher	4	18%
Writer	1	4%
Don't Know/No Response	12	50%
<b>TOTAL</b>	<b>24</b>	<b>100%</b>

In terms of **specific** occupations within the HS pathway, Table 13 reveals the number of consistent respondents, the number who left HS altogether and the number who seeped into these **specific** occupations from other HS professions and from other career pathways. Upon examination of Table 13, it is clear that there was a significant amount of change in occupational choice both within and between these **specific** HS careers. This is demonstrated by the result that from the original 73 students who aspired to HS professions, only 32 (44%) had specific occupationally consistent responses at Time 2. Furthermore, 23 students (n=31%) left the HS career pathway altogether while a further 18 students (n=25%) aspired to different HS professions at Time 2 compared to Time 1. Additionally, 27 new students aspired to health care professions at Time 2 who had originally aspired to OS and NS careers or had been undecided at Time 1. Only 5 (19%) of the new students to these specific HS careers came from the NS occupational pathway. Thirteen (n=48%) of these new students came from the OS career pathway and the remaining 9 (33%) students had originally been undecided before aspiring to these **specific** careers within the HS career pathway.

Table 14 shows consistent responses for each of the specific HS professions. This table also reveals to which specific HS careers inconsistent respondents aspired at Time

2. Obviously, medicine is the most popular profession to which these students aspired at both Time 1 and Time 2.

Table 13  
The Number of Consistent Respondents Within the HS Career Pathway in Specific Occupations and The Seepage Into and Out of Each

Occupations	Time 1	Time 2	Number of Consistent Respondents	Number Who Left Health	Number New From Health	Number New From Other Pathways
Psychologist	2	1	0	2	1	0
Physician	33	40	18	9	4	18
Dentist	2	3	1	1	1	1
Veterinarian	4	4	3	1	0	1
Chiropractor	2	1	0	1	1	0
Nurse	4	6	3	1	2	1
Physiotherapist	6	8	1	3	4	3
Occupational Therapist	2	4	2	0	2	0
Pharmacist	10	7	2	5	2	3
Optometrist	5	2	1	0	1	0
Medical Technician	3	1	1	2	0	0
<b>TOTAL</b>	<b>73</b>	<b>77</b>	<b>32</b>	<b>23</b>	<b>18</b>	<b>27</b>

Table 14  
Specific Occupations<sup>a</sup> Chosen at Time 2 by Consistent Respondents in the HS Career Pathway

Number of Respondents Who Aspired to Specific Occupations <sup>b</sup> Time 1											
Time 2 Responses	3111	3113	3115	3117	3131	3137	3138	3139	3151	3153	3156
Psychologist	1										
Physician	<b>18<sup>c</sup></b>					1		1		2	
Dentist	1	1									
Veterinarian			3								
Chiropractor										1	
Nurse	2				3						
Physiotherapist				1		1			2	1	
Occupational Therapist						1	2		1		
Pharmacist	1								2		
Optometrist	1									1	
Medical Technician											1

<sup>a</sup>This table displays only those occupations chosen by consistent respondents.

<sup>b</sup>Legend for Specific Occupations

2315-Psychologist; 3111-Physician; 3113-Dentist; 3115-Veterinarian; 3117-Chiropractor; 3131-Nurse; 3137-Physiotherapist; 3138-Occupational Therapist; 3139-Nursing Therapy; 3151-Pharmacist 3153-Optometrist; 3156-Medical Technician

<sup>c</sup>**Bold Numbers Indicate Consistent Responses**

Other Sciences (OS). Table 15 reveals the occupations aspired to by those students who at Time 1 aspired to OS careers but who had left this career pathway by Time 2. Of the 33 students from this group, 39% (n=13) of the students had changed from OS to HS career pathways. The remainder of the students from this group were either undecided or switched to NS career pathways.

Table 15  
New Occupations Aspired To By Those Students Who Left The OS  
 Career Pathway

Occupations	# of Students	% of Students
Accountant	2	6%
Elementary School Teacher	1	3%
Secondary School Teacher	2	6%
Physician	6	18%
Veterinarian	1	3%
Physiotherapist	2	6%
Pharmacist	3	9%
Dental Hygienist	1	3%
Bookkeeper	1	3%
Salesperson	1	3%
Electrician	1	3%
Don't Know/No Response	12	37%
<b>TOTAL</b>	<b>33</b>	<b>100%</b>

In terms of trends towards **specific** occupations within the OS career pathway, this category appeared to have a greater amount of seepage both into and out of it, compared to the HS career pathway. In fact, 39 students (47%) left the OS career pathway altogether, while 28 students (34%) changed their aspirations to new OS occupations (see Table 16). Thirty-two new students chose these specific OS careers. Only

four of these new students (13%) came from the HS career pathway while five of the new students (16%) came from the NS career pathway. The remaining 23 students (72%) who newly aspired to these specific OS careers at Time 2 had been previously undecided.

Table 17 reveals the number of consistent respondents for each specific OS occupation. It would appear from this table that the profession of engineering had the largest number of OS consistent respondents.

Table 16  
The Number of Consistent Respondents Within the OS Career Pathway in Specific Occupations and The Seepage Into and Out of Each

Occupations	Time 1	Time 2	Number of Consistent Respondents	Number Who Left Other Science	Number New From Other Science	Number New From Other Pathways
Geologist	2	0	0	2	0	0
Physicist	1	2	0	0	2	0
Meteorologist	1	0	0	1	0	0
Biologist	8	7	2	6	2	3
Architect	3	4	1	1	2	1
Engineer	25	23	6	7	12	5
Computer Analyst	6	11	4	0	5	2
Mathematician	0	1	0	0	0	1
University Science Professor	4	1	0	3	0	1
Secondary School Science Teacher	17	25	8	8	3	14
Something in Science	14	8	1	9	2	5
Other	2	0	0	2	0	0
<b>TOTAL</b>	<b>83</b>	<b>82</b>	<b>22</b>	<b>39</b>	<b>28</b>	<b>32</b>

Table 17  
Specific Occupations<sup>a</sup> Chosen at Time 2 by Consistent Respondents in the OS Career Pathway

Number of Respondents Who Aspired to Specific Occupations <sup>b</sup>										
Time 2 Responses	2112	2113	2114	2133	2141	2159	2183	2711	2733	9912
Physicist						1				1
Biologist				2 <sup>c</sup>				1		
Architect	1				1					
Engineer		1			1	<b>14</b>	2			2
Systems Analyst	1					2	<b>4</b>		1	
High School Science Teacher									<b>8</b>	1
Something in Science			1			1				1

<sup>a</sup>This table displays only those occupations chosen by consistent respondents.

<sup>b</sup>Legend for Specific Occupations

2112-Geologist; 2113-Physicist; 2114-Meteorologist; 2133-Biologist; 2141-Architect; 2159-Engineer; 2183-Systems Analyst; 2711-University Science Professor; 2733-High School Science Teacher; 9912-Something in Science

<sup>c</sup>**Bold Numbers Indicate Consistent Responses**

Nonsciences (NS). When examining trends within the NS category, caution must be taken due to the small number of cases. More specifically, 46% (n=11) of those students who had originally aspired to NS occupations at Time 1 but not to the same group of occupations at Time 2 changed their aspired occupations to OS careers. Table 18 reveals the specific occupations to which these inconsistent respondents aspired at Time 2.

Table 18  
New Occupations Aspired To By Students Who Left The NS Career Pathway

Occupations	# of Students	% of Students
Biologist	1	4%
Civil Engineer	1	4%
Professional Engineer	3	13%
Physician	3	13%
High School Science Teacher	6	25%
Physiotherapist	1	4%
Dental Hygienist	1	4%
Don't Know/No Response	8	33%
<b>TOTAL</b>	<b>24</b>	<b>100%</b>

Table 19 shows the consistency rates and seepage into and out of specific NS careers from Time 1 to Time 2. The only professions within the NS pathway to have consistent

respondents included accounting, social work and law. In terms of seepage, it is evident that the majority of students who aspired to NS careers at Time 1 did not continue to do so at Time 2 (see Table 20). In fact, 80% (n=24) of the NS students left this career pathway while 21 new students chose these specific NS careers. Of these 21 new students, 8 students (38%) came from the OS career pathway, while 5 students (24%) came from the HS career pathway. The remaining 8 students (38%) who entered the NS career pathway had previously been undecided at Time 1.

**Table 19**  
Specific Occupations<sup>a</sup> Chosen at Time 2 by Consistent Respondents in the NS Career Pathway

Number of Respondents Who Aspired to Specific Occupations <sup>b</sup> at Time 1					
Time 2 Responses	1171	1179	2319	2331	2343
Accountant	<b>1<sup>c</sup></b>				
Social Worker				<b>1</b>	
Lawyer		<b>1</b>	<b>1</b>		<b>1</b>
Other				<b>1</b>	

<sup>a</sup>This table displays only those occupations chosen by consistent respondents.

<sup>b</sup>Legend for Specific Occupations

1171-Accountant; 1179-Management Position; 2319-Occupation Related to Social Work; 2331-Social Worker; 2343-Lawyer; 9911-Other

<sup>c</sup>**Bold Numbers Indicate Consistent Responses**

Table 20  
The Number of Consistent Respondents Within the NS Career Pathway in Specific Occupations and The Seepage Into and Out of Each

Occupations	Time 1	Time 2	Number of Consistent Respondents	Number Who Left NonScience	Number New From Nonscience	Number New From Other Pathways
Management Position	5	1	0	5	0	1
Accountant	1	3	1	0	0	2
Social Worker	3	1	1	1	0	0
Lawyer	2	4	1	1	2	1
Elementary School Teacher	1	2	0	1	0	2
Actor/Writer	1	1	0	1	0	1
Other	17	15	0	15	1	14
<b>TOTAL</b>	<b>30</b>	<b>27</b>	<b>3</b>	<b>24</b>	<b>3</b>	<b>21</b>

### Differences Between Groups

Discriminant analyses were performed for two reasons. The first reason was to attempt to determine a set of factors which would differentiate between the groups of students choosing HS, OS and NS careers. Variables included in this model were: gender, language, parents' socioeconomic status, interest in science, and parental support and encouragement. This analysis did not produce a model which would differentiate between the three pathways. A second discriminant analysis excluding the NS groups also did not produce a model.

The second reason that discriminant analysis was performed was to attempt to arrive at a model which would distinguish between consistent and inconsistent respondents. Variables included in this model were: gender, language, parents' socioeconomic status, interest in science, and parental support and encouragement. This analysis also did not produce a model.

### Key Findings of the Study

Student Pursuit of Career Pathways. Overall, the elite nature of this sample was revealed by the family backgrounds from which the students came. The majority of students came from upper or middle class families and received a great deal of support and encouragement from both of their parents with respect to their career choices. Overall, these students were highly interested in science and strongly motivated to do well in science.

Not surprisingly then, the majority of the students (64%) aspired to science careers, while 13% aspired to nonscience careers and the remainder were undecided. Gender differences emerged whereby females were more likely to aspire to HS careers, compared to males who were more likely to aspire to OS careers. Females were also more likely to be undecided about specific occupations within the OS and NS pathways, compared to males. Furthermore, although 78% of the females aspired to nontraditionally sextyped careers, only 2% of the males aspired to nontraditional careers for males.

Those students interested in HS and OS careers were significantly more likely to be interested in science, to be strongly motivated in science and to feel that science would be important to their future careers, compared to those students interested in NS careers.

Student Pursuit Within the Health Care Professions. Thirty percent of the sample aspired to health science careers at Time 1. The most popular HS career chosen by these students was medicine. Gender differences emerged within the HS pathway whereby males aspired to only those careers that offered high status and high income levels.

Those who aspired to be physicians and dentists were also more likely to have fathers who had completed postsecondary education and to have a stronger interest in science compared to other HS aspirants. Mothers' educational level did not have an effect.

Consistency of Students' Aspirations. In terms of overall consistency rates, 49% of the sample aspired to the same occupational pathway between Time 1 and Time 2. HS aspirants were the most consistent (67%), followed by OS aspirants (60%) and then NS aspirants (20%).

Males were significantly more consistent than females and specifically those males aspiring to science careers. Consistent respondents were also significantly more likely to have higher levels of interest in science, to be more motivated to do well in science and to feel that science would be important to their future careers.

Overall, there was a great deal of movement into and out of the three career pathways. On the one hand, HS and OS aspirants left the science career pathways while on the other

hand NS aspirants also moved into the science career pathways. The majority of students who left a specific career pathway became undecided rather than entered a new career pathway.

Differences Between Groups. Discriminant function analysis did not produce models that differentiate between the groups of students choosing HS, OS or NS nor between the groups of students who were consistent compared to those who were inconsistent between Time 2 and Time 1.

## Discussion

### Student Pursuit of Career Pathways

Since this sample consisted of a group of elite summer science students, it was not surprising that the majority of the students aspired to careers in science. Furthermore, consistent with Lee (1987), the largest proportion of students who aspired to careers in the sciences, had chosen health science careers. Although the actual number of students aspiring to careers in the health sciences was only 30% of the sample, it must be remembered that health jobs represent a small number of potential jobs in the "science" field. From this perspective, the number of students aspiring to health-related occupations is actually very large.

Although this sample represented a group of elite students, these findings must also be discussed in terms of general adolescent development. For example, fully 23% of these students were undecided at Time 1. Conceivably, being an adolescent may play a larger role in one's career decisions compared to being an elite science student. Although these students have been identified as having a high level of knowledge and interest in science, the characteristic indecisiveness of adolescence also has an influence on the educational and occupational pathways chosen by these students. This is consistent with Gottfredson's (1981) research on career development in that specific occupational

choices have been shown to be unstable during adolescence, but general propensities (i.e., one's zone of acceptable alternatives) are more fixed. In Gottfredson's framework, an individuals' zone of acceptable alternatives most closely relates to one's gender, job prestige level and field of work.

In support of Gottfredson's theory, the most significant trend that emerged from this study was that **gender** largely differentiated between the career aspirations of these students. Specifically, females were much more likely to aspire to careers in health sciences and males were much more likely to aspire to careers in other sciences. These findings are consistent with those reported in earlier studies (Tilleczek, 1993; Smith, 1991; Bateman, 1990; Nevitte et al, 1990; Lee, 1987; Wilson & Boldizar, 1990). Furthermore, this study also supports Gottfredson's theory because a large majority of the students aspired only to those occupations which held high prestige and income levels. This remained constant from Time 1 to Time 2.

Not only did males and females differ in relation to their initial aspirations of specific science career pathways, but more generally, males adhered much more closely to their zone of acceptable alternatives in terms of sex stereotype within all three career pathways. This was supported by the fact that while the majority of females aspired to nontraditional careers, only one male from this sample did

likewise. This may be explained in several ways. Firstly, when examining historical patterns, most occupational positions, particularly those in the sciences, have traditionally been held by males. As a result, it is much easier for females to step outside of these limitations in the sense that most science fields may be considered to be 'nontraditional' for females. Secondly, perhaps the current socialization of children provides a broader range of choices for females than for males. In other words, perhaps we have opened new occupational pathways for females, but have kept the options available to "males" quite restricted. Finally, males are not attracted to the more traditionally-female occupations because these occupations have previously offered much less in terms of income and prestige. Maybe we need to make these traditionally-female occupations more desirable in order for males to aspire to these careers in the future.

Lee (1987) found that although there is close to gender parity in the life sciences, women are seriously underrepresented in other science career pathways. Despite the previous discussion of females breaking traditional career barriers, it was also found in this study that within the categories of "other science" and "nonscience", females were more likely than males to choose more traditional types of careers within these pathways such as teaching and social work. These findings are supported by Nevitte et al. (1990)

who also found that the very best female science students were five times more likely than their average female counterparts to seek "nurturing careers". Whether or not the females from this study would be more likely to seek nurturing careers compared to females who did not attend the NSSST is not known; however, it is an interesting result that the high-achieving female science students in this study were more likely than males to aspire to nurturing careers. In fact, no males in this study aspired to careers generally considered to be 'nurturing' including social workers or nurses.

Further gender differences were found within the health science career pathway. Aside from one male who aspired to becoming a pharmacist, males aspired only to those occupations which would lead them to careers holding the title of "doctor". On the other hand, females chose a greater variety of occupations in the health sciences. While 57% of the females aspired to careers holding the title of "doctor", they also aspired to such careers as psychologist, veterinarian, nurse, physiotherapist, occupational therapist, technician and dental hygienist. It would appear then, that although females have made inroads into the world of 'medicine', a large number of females still aspire to more traditional health care professions (as defined by Sandberg et al., 1987) such as the rehabilitation professions. This is also consistent with Gottfredson's (1981) finding that lower-level jobs are more

sex stereotyped than are higher-level ones. In other words it may be considered acceptable for females to enter the higher status jobs of physician and dentistry, but it may not be considered acceptable for males to enter lower status jobs including nursing, dental hygiene, and physiotherapy. This finding is also consistent with those of Wilson & Boldizar (1990) who found that somewhere prior to high school, boys and girls begin to aspire to gender segregated specialities, and for girls, those are specialties that require low mathematics achievement and have low income potential. In fact, Gottfredson (1981) stressed that youngsters first eliminated occupations perceived to be inappropriate for one's sex followed by those considered to be inconsistent in terms of social class self-concept.

Aside from gender, the only other variable which significantly differentiated between career aspirations in the three pathways was that students in both science career pathways (HS and OS) were more likely to have a strong interest and motivation in science and to feel that science would be important to their future careers compared to those in nonscience and those who were undecided. This finding is supported by Noeth, Engen & Noeth (1984) who found that interest was the most important factor which influenced the occupational choice of high school students. It seems obvious that those students aspiring to careers in the sciences would

most likely be interested and motivated in science and to also feel that science would be important to their future careers.

In terms of differences within the HS pathway, it was found that fathers' educational level distinguished between specific health care professions for both males and females. Fathers' educational level significantly differentiated between male and female aspirations to become a physician or dentist but not other health care professionals. Nevitte et al. (1990) found that having a father with a science career could help children to "demystify" the area of science, particularly for daughters. However, in this study, fathers' careers in science had the most significant influence on males aspiring to careers in medical science. In other words, males who were aspiring to become physicians and dentists were significantly more likely than female physician aspirants and other males to have fathers who had careers in science. It would appear from this study that males aspiring to medical careers were greatly influenced by their fathers' educational and occupational backgrounds.

Mothers' educational and occupational level had no significant influence on career aspirations. This differs from other research which suggests that mothers' education and occupation has a significant influence on an individual's career aspiration and specifically for women entering medicine (Kutner & Brogan, 1980).

Discriminant analysis did not differentiate between the three groups of career aspirations. The elite nature of this sample, (that is the homogeneity of the sample on numerous variables) may be a key explanation as to why the discriminant analysis did not produce a significant model. Lee (1987) was also unable to satisfactorily develop a model differentiating between those students choosing science and nonscience career pathways. Perhaps in seeking the range of influences of career choices we are avoiding the obviously pervasive influence of gender as Gottfredson (1981) proposes. It would appear from this study of elite science students that gender is key in differentiating and explaining choices between health science, other science and nonscience.

Although numerous other variables have been taken into consideration in this study, including socioeconomic status, parental influences, grade level, and language affiliation, it would appear that gender is still the most salient factor influencing this group of students while these other influences help to further describe these choices. In fact, such description has not previously been attempted for such an elite sample.

#### Consistency of Students' Aspirations

Overall the findings from this study revealed that students were as likely to be consistent as inconsistent in terms of their occupational aspirations over time.

Consistency, in this study, was measured over a one or two year period which is not a long period of time. This may account for the relatively high rate of consistency. These conclusions correspond almost identically to Hilton and Lee's (1988) study in which they found that half of the mathematically-able students remained in the field they had indicated as an interest from their high school to college years. Despite this finding, however, almost equal numbers of students were found within each of the occupational pathways at Time 2 compared to Time 1 indicating a large amount of movement between career pathways. This does not correspond with the findings of other researchers who have found that science loses more students than it gains over the course of time (Lee, 1987; Tilleczek, 1993). Perhaps again because of the elite nature of the sample in comparison to more general samples of adolescents.

In this study, all areas of aspirations, including health science and other science remained almost equal in terms of overall numbers. Therefore, when looking at these results, Nevitte et al.'s (1990) fears that seepage away from science at an early stage in education results in a substantial permanent loss to the potential pool of young scientific talent are not entirely supported by the findings since many previously nonscience and undecided students seeped in. However, caution must be taken with this assumption since the

sample in this study consisted of highly motivated, highly interested and highly able science students. This finding cannot be generalized to the general student population.

In terms of consistent respondents for specific occupations within each of the career pathways (i.e. physician, engineer and lawyer), the health sciences had the most consistent respondents followed by the other science career pathway. This corresponds with the findings of Taylor & Pryor (1985) who also found that medical students compared to other aspirants were most likely to persist in their career goals.

When examining gender differences between consistent respondents and the three occupational pathways, several trends emerged. Within the other science career pathway, males were significantly more likely than females to be consistent respondents. Males in the health science and other science career pathways were much more likely to be consistent respondents compared to males in the nonscience career pathway. Females had less variation in terms of consistency rates for the three occupational pathways and females in the health science pathway were the most consistent respondents. Overall, the most consistent respondents were those males aspiring to careers in the health sciences, followed by males aspiring to other science careers and then by females aspiring to health science careers. These findings are somewhat

similar to Nevitte et al. (1990) who found that the highest rate of persistence for any group was for males in the natural science, followed by males in all sciences, followed by females in medicine and health science.

Finally, the only significant variables which differentiated between overall consistency rates were higher levels of interest in science, higher motivation levels to do well in science and feelings that science would more likely be important to their future careers. While this seems an obvious result given the nature of the sample, it must be remembered that these variables differentiated between consistent and inconsistent respondents for all occupational categories including health science, other science, nonscience and undecided. This would suggest that those students who are the most interested and motivated in science were also the most decided about their occupational goals regardless of their specific occupational choice. It is also interesting to note that the most decided students within the nonscience career pathway still felt that science would be important to their future job. This would suggest that although these students have chosen a nonscience career pathway science still remains to be very important to them. Perhaps they see themselves as using their love and knowledge of science in these nonscience careers. Further exploratory analysis could prove useful in determining such underlying explanations.

### Limitations and Implications of the Study

The findings from this study have raised several concerns. Of particular concern is the fact that despite inclusion of several variables in statistical analysis including parental employment, education and support, socioeconomic status and language, gender is still the primary distinguishing factor when examining the pursuit of all careers within this study. Once again this may be due to the nature of the other variables which were entered into the analysis and also to the homogeneity of these variables.

Similar to Nevitte et al. (1990) this study also found that females do not persist as well as males within the "other science" occupational pathway. As a result, we must also intervene with female adolescents once they enter the science pipeline in order to ensure that they are supported in the pursuit of these career pathways.

One strength of this study was that it was able to look at career aspirations over time for this group of elite science students. As such, these results revealed a moderate degree of decisiveness and consistency in regards to students' occupational aspirations. However, only one or two years transpired between the initial data collection and the follow-up study which is not a long period of time. Clearly, much has transpired in the academic and personal lives of these students since 1991. It would be informative to perform

another follow-up study to determine the career pathways that were actually followed by these students in relation to their initial occupational aspirations in order to measure consistency rates at this time. In terms of methodological implications, a longer follow-up time frame is necessary in order to feel more comfortable with the trends that were discovered.

While the ability to describe and better understand such an elite sample of young people has been an asset, so too has the homogeneous sample been a limitation. As a result, the ability to generalize the results to other lower-achieving or even to other high-achieving science students is uncertain. The high degree of homogeneity (e.g., 84% of the students had high levels of parental support, 77% of the students came from high or middle SES families, etc.) between the variables may account for the inability to differentiate between the three occupational pathways. Finally, the number of students (n=243) in this study was modest given the nature of the analysis and as a result, caution must be used when interpreting the results of the more detailed descriptive analysis.

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Appendix A

Specific Traditional and Nontraditional Occupations

## Appendix A

Specific Traditional and Nontraditional Occupations

Occupation	% of Women	Category
Management Position	9.41	Male
Politician	22.36	Male
Accountant	31.10	Male
Chemist	19.68	Male
Geologist	10.13	Male
Physicist	5.34	Male
Meteorologist	7.49	Male
Biologist	31.04	Male
Architect	15.29	Male
Engineer	4.55	Male
Mathematician	31.77	Male
Computer Analyst	28.54	Male
Psychologist	51.90	Neither
Social Worker	62.54	Female
Lawyer	15.13	Male
University Teacher	24.38	Male
Elementary Teacher	80.37	Female
Secondary Teacher	42.12	Neither
Physician	17.15	Male
Dentist	7.94	Male
Veterinarian	16.47	Male
Chiropractor	13.67	Male
Nurse	95.39	Female
Physiotherapist	83.55	Female
Occupational Therapist	87.10	Female
Pharmacist	41.85	Neither
Optometrist	17.54	Male
Medical/Dental Technician	77.79	Female
TV Announcer/Actor	18.42	Male
Translator	59.97	Neither
Coach	55.64	Neither
Something in Science	uncodeable	N/A
Other Nonscience Careers	uncodeable	N/A

## Appendix B

Chi-Square Results of the Number of Consistent Respondents from  
Year 1 and Year 2

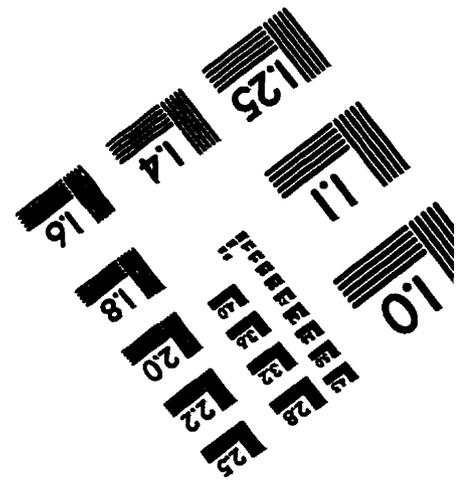
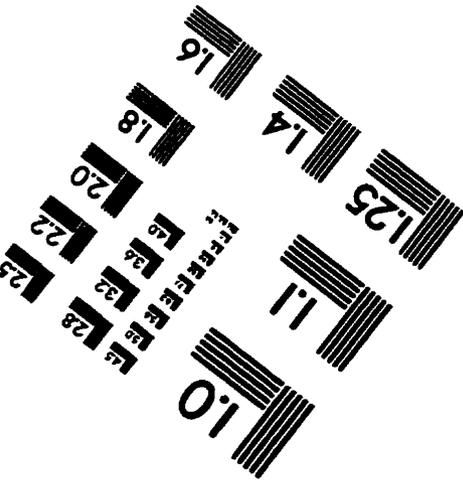
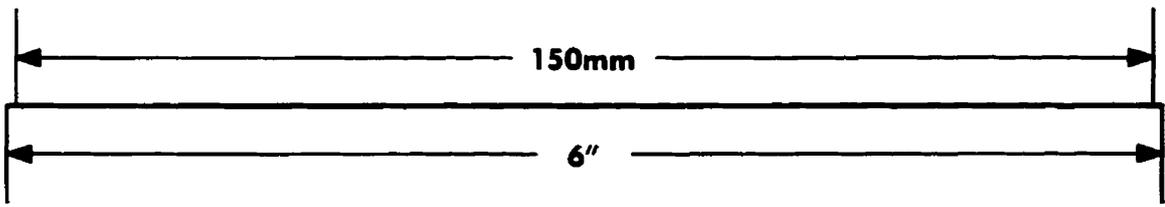
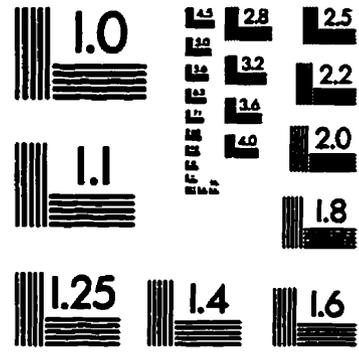
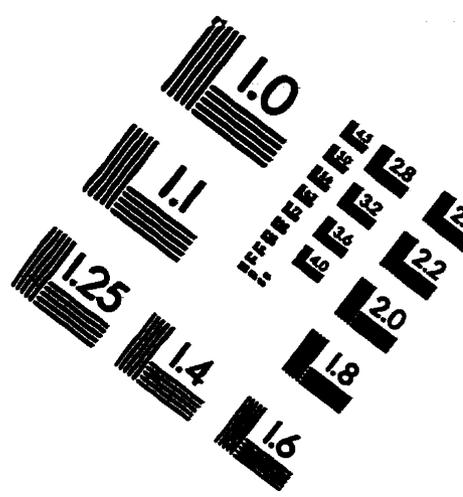
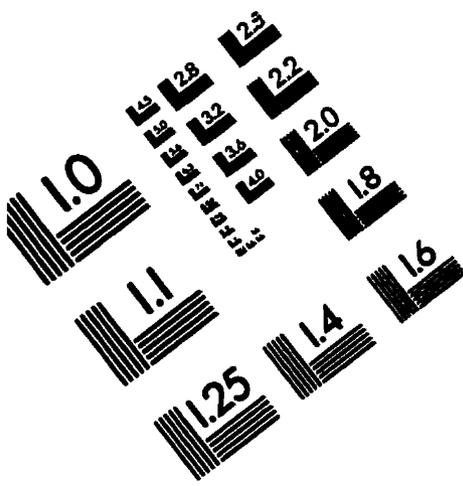
## Appendix B

Chi-Square Results<sup>a</sup> of the Number of Consistent Respondents from  
Year 1 and Year 2

	Year 1 (1989)	Year 2 (1990)
Consistent Respondents	53 (60%)	85 (55%)
Inconsistent Respondents	36 (40%)	69 (45%)
<b>TOTAL</b>	<b>89</b>	<b>154</b>

<sup>a</sup> ( $\chi^2=44$  d.f.=1 p=.51)

# TEST TARGET (QA-3)



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