Blindness is no excuse not to realize your dreams!

Interview with Dr. Craig Moore, NASA, January 2005, by Dorine in ‘t Veld

In September 2004 I was a guest at SCIVIS, Space Camp for Interested Visually Impaired Students.
SCIVIS lets blind students experience that their visual impairment is no reason to stop working to realize their dreams. The message is: if you have talents for something and you go for it, you can do (almost) everything, blind or not. Sometimes you will have to do things differently or you might have to do slightly different things, but you can do them. That this is true, became clear when we were listening to Dr. Craig Moore, a blind Physical Chemist who works at NASA. His story is important not only for the kids who were at SCIVIS. I’m glad he agreed with an interview.

Dr Craig Moore

Dr. Moore, what is your function as a chemist at NASA?
I work with a group of scientists who are trying to create new materials for use in semiconductors and optics. Their potential applications could include such things as computers, electronic or optical memory, and lasers.

There is a lot of work in developing new materials. Some people must synthesize or create the material through a process of chemical reactions. Other people must arrange the material in very carefully-ordered crystals or very thin films in order for it to be useful. Still other people must test the efficiency of how well the material handles different frequencies or types of light, or how it reacts to electrical signals of different strengths. Still, people must test the material for some time to ensure that it does not degrade or fall apart over time. All of this work requires a lot of time and effort.

And what is your specific job?

I work with computer programs that model Chemistry to predict some properties of the molecules. These programs can help predict how stable the compounds are, the efficiency of how they react with light, and under what conditions the molecules should be formed such as temperature and pressure.

I can not always tell whether a material will be a good choice, but I can improve the odds of knowing that it might be. If some of the calculations show potential problems, they are reliable enough that one can almost guarantee that another compound should be considered.

I work with programs that model the behavior of single molecules, or molecules which are absorbing or sitting on the surface of crystals. There are other people who work predicting the types of crystals or films that may form from a given compound; such properties as their size, shape, hardness, and brittleness are estimated.

Usually, people suggest compounds that I should study, and I give them my preliminary findings of whether the compound seems promising. Occasionally, I might suggest compounds to them for their research.

Part of my work is to keep track of and evaluate research grants done for NASA by professors at Universities.

Well, this all sounds very important and exciting! What did you study to get this job?

I studied Chemistry in college and have a Bachelor's degree in Chemistry. I went to graduate school and received a Masters and Doctorate degree in Physical Chemistry. The particular area of study was quantum mechanics. This area studies the molecular orbitals of individual molecules. One can predict stabilities of molecules, their reactivity, what types of reactions may occur, rates of reactions, as well as how they absorb or reflect light. I took four years for my Bachelor's degree, and a little over six years for my Doctorate. I have been working for NASA for about sixteen years.

Was it difficult for you to find a job after you studied?

Before coming to NASA, I worked at a university for a little under three years doing research as a post-Doc for a professor.

I had a bit of trouble finding work after my temporary position at the university was finished. I sent out many letters and had an interview at a small college. It was through the help of a friend that I was able to work at NASA.

Would it be possible for blind students now to work with NASA?

NASA has recently increased its policies of hiring disabled people. In the next few years, many people will be retiring from NASA, so I assume that opportunities for blind people might be fairly promising.

Many people think it is hard to do (any) science if you cannot see images. Is that true? And how do you deal with images? Do you use them or even need them?

I naturally think rather geometrically or pictorially. I believe this has nothing to do with blindness, but ones own peculiarities or talents. I occasionally needed someone to explain structures of chemical compounds, or the shapes of orbitals, but not very often. I recall once using a computer to graph a molecule so I could see it; it was helpful, but I think a careful description might have worked.
Some of the more recent work that I am doing is more difficult to visualize since it involves crystals or molecules such as C60, which is shaped like a football (soccer).
Although it is preferable to visualize things, I can often get a sense from output of computer programs if something has gone wrong in the geometry of a calculation. I occasionally ask a sighted person to check a pictorial representation of my work.

Very often blind students get the advice to choose a 'text-based' study, rather than a subject with a lot of images and formula's. What is your opinion on this issue; is that a sound advice in general?
One advantage to studying Science is that one covers a relatively small amount of material in comparison with such subjects as history or law. Science depends more on a thorough examination of math or a careful detailed description of how and under what conditions research was conducted. Since braille reading is slower than print, blind people are at less disadvantage in reading in the Sciences. Often other fields require a great deal of reading, and the ability to find specific details within a large amount of text.

What was your studying period like?
In many ways studying for a blind person has changed a great deal since I was a student. I am 47 years old, and went to primary and secondary school during the 1960's and 70's. My parents moved almost 500 kilometers so I could attend a public school which had accommodations for the blind. Most of these programs were located in large cities, but I lived in a sparsely populated area of the country in a town of about 50,000 people. It was one of the first schools with opportunities for the blind located in such a small town.

How and when did you learn Braille?
I learned braille from the beginning of my education. I spent a few hours a week with teachers learning to read and write braille, and the rest of the time in regular classes. My resource or braille teachers would braille my assignments and write print on the braille homework assignments or tests that I turned in. I took manual braille writers to class, and developed a way of brailling quietly which worked if I did not have to write quickly.

So you had no problems in having your books and tests timely?
When I went to college all of this changed. I was responsible for everything. I planned my courses a year in advance. Some of my texts were recorded on tape

while others were transcribed into braille by hand by some wonderful volunteers. There were few people who both knew Braille and the technical notation used in math. When I took classes that had detailed mathematical derivations, I recorded the lectures and took notes later on a braille writer. The process was tedious, but an excellent way to learn. I could stop the tape and contemplate the lecture as it unfolded. I usually went over my assignments or exams with the professors orally after working them out in braille.

A few non technical classes required print. I was reduced to using a typewriter without the ability to edit my mistakes. I found I avoided taking a few types of classes because of this difficulty. Life would have been very different with access to personal computers or braille note takers.

And where did computers come into your story?
My first use of computers was punching computer cards. I had a device called an opticon which projected print letters onto a grid of vibrating rods. I could not always detect things like formatting errors; sometimes the keypunches had little ink on their ribbons making reading difficult.

I received braille output from special programs that were run on modified printers to produce braille on fan-fold paper. Some of my outputs were 20 centimeters thick.

My last year in college I had access to a braille terminal that printed on paper tape; the speed of the modem was 110 baud. Although slow and cumbersome, this device gave me better access to the computer.

When I went to graduate school, things became a bit easier. I had the good fortune to meet a friend who knew about the development of paperless braille for the application of computer terminals. My friend had the idea of connecting such a display to an early PC. He completed the task for my use. I believe I probably had the first PC with a braille display in the world. It was operational in 1981, and I don't think such devices were commercially available for another three or four years. I could then submit programs and read output from home, I could write and edit text. My first computer had 64K of memory and two 360K floppy drives. My work did not move from mainframes to PC's until the early 1990's.

Obviously computers made life easier for you at some points. Is that still the case? Are the programs you use in your work accessible?
I use most of the standard Microsoft products for computers though I prefer using a shareware editor called TextPad from England. Many computer programming languages have been developed over the years, but most of our programming is still done in Fortran, since the main programs we use were originally developed in the 1960's.

Does information technology nowadays make it harder or easier for blind students to do chemistry?

Since research is increasingly expensive due to salaries and increased equipment costs, theoretical predictions from computer modeling is becoming more important as a tool for saving money. The increased power of computers allows people to study more complicated chemical problems.

When I was a university student in the 1970's, people were very limited in the size of molecules that could be modeled. So I think there might be more opportunities for blind people to study and work in Chemistry today.

In addition to quantum mechanics, which is my area of Chemistry, there is an area of Chemistry called statistical mechanics. This area also uses computers; it predicts properties of chemicals based on a statistical view of how they behave. There may be related areas in Physics that apply quantum mechanics and statistical mechanics to the study of nuclei.

So, what you are saying is that your talents and interests should be leading in choosing a subject and not just to what people tell you is 'easier' or 'possible' since you are blind.

Are there in your opinion any special advantages, besides not having so much text as in law or history, studying sciences?

I have found that all my interactions with scientists and science educators have been very positive. I believe that, since scientists tend to be curious and often unorthodox people whose professions involve learning and problem solving, they tend to have positive outlooks. I have always been encouraged and people have considered how I might approach problems I had encountered in my studies and profession. I knew some blind university students in literature. While they certainly had difficulties to overcome, they did not require as much technical solutions to problems that one in Science needed. Some of their professors were quite negative toward them. I'm sure not all of their colleagues were this way, but I have never encountered this problem. I am rather easy going and prefer to avoid conflicts. I have never had to fight for what I wanted to do.

Here are some of the questions the kids had back at Space Camp:

Would it ever be possible for blind people to be an astronaut…
I believe blind people could become astronauts. As time passes there is more interest in specialized scientists, not just pilots. Although it might be some time before people would be open to the idea. It is important for the blind (or any people) to have a combination of realism and the willingness to push boundaries.

How did you become blind?
I was born prematurely and weighed about 1.3 kilograms. I was given too much oxygen in an incubator which inhibited the formation of my retina. As a result, I had a slight amount of vision in my left eye, which I completely lost at age seven. I could see large letters if they were a few centimeters from my face.

What hobbies do you have?
I enjoy traveling and outdoors activities, although I don't always have opportunities. I enjoy hiking, backpacking, camping, swimming, canoeing, and bicycling. I enjoy music, and wish I would have spent more time studying it in my youth. I enjoy hearing many types of music, particularly jazz and classical music.

Do you like reading? Who is your favorite author?
I also enjoy reading. It would be difficult to single out a favorite author or book. I like the humanitarian optimistic views of authors like John Steinbeck or Isabel Alliende.

Do you like movies?
I like some movies, but don't watch many. I have friends who often watch foreign movies and they read the subtitles to me. I have generally preferred these movies to American ones. I have seen some excellent movies from France, China, and even Iran.

Do you have children? And do you have a dog?
I have never had a family, though I have greatly enjoyed nephews, nieces, and the children of friends.
I don't have a dog, although I like animals very much. I may reconsider getting one when I'm older and have more time to walk it.

Both children and their parents may struggle with the question if their life or the life of their children would be different or better if they were not blind. How do you feel about that?
I have been blind from an early age, so I think I have adapted to it and I have accepted it easily. If I encountered another disability as an adult, I'm sure I would go through much anger before accepting it, and would not do it so easily.

There are certainly frustrations associated with being blind, but one learns to live with them. I suppose the worst are such things as finding misplaced objects and not driving. I imagine the United States is the most dependent on cars because of its lower population density and short sighted government policies.

I believe happiness depends on our approach to what opportunities or obstacles we have. I also think it depends on types of relationships or interactions we have with the people with whom we associate.

I sometimes think that if I weren't blind or if I lived in a society with better mass transportation, that I might have more friends or perhaps a family; but I must acknowledge that this might not be true.

My closest relatives live about 700 kilometers from me; yet I feel I am fairly close to them. I don't have a large number of friends, but I believe those I have are exceptional in character. I feel I am very fortunate in both my personal and professional life.

Summarizing, what are your advices to students?
I would advise students the following:

- study anything that remotely interests you
- be patient in learning what really interests you, and enjoy learning about your interests and abilities
- don't be afraid to try something; if it doesn't work, there is always something else to try
- if certain people are helpful, or certain Universities or institutions seem positive, follow the path of least resistance. However, if you wish to study some topic or learn a particular trade, and people are resistant, obtain help or advice from people with the appropriate technical expertise. If your goal seems workable, get legal help in challenging those resisting you.
- **One spends many years working, so choose something that interests you. If you can not do precisely what you want, you may find a very closely related field. If you are interested in Science, I think it is a field worth considering.**

And what are your advices to parents?
I would tell parents to be supportive of whatever their children wish to do. I would also advise them to be patient and help their children to look at the potentials as well as the possible difficulties of their choices.

Dr. Craig Moore is willing to correspond with blind students who want to ask him more questions. You can e-mail him at : craig.e.moore@nasa.gov.

If you want to know more about the Space Camp you will find it on : http://www.tsbvi.edu/space/index.htm.

If you want to ask me, the interviewer, any questions please write to me at: dorine@dvlop.nl. I'm the mother of a practically blind Dutch student, who participated in Space Camp in September 2004, then 16 years old. That was a great experience. My son is interested in sciences. He initially was discouraged to study maths, physics and chemistry in secondary education by people who thought that these disciplines would be 'inaccessible for him'. I had to fight to pave the way for him to be able to study what he has the interests and talents for. He did; I stimulate that others will too. As a parent I was active for FOVIG (the Dutch National Parents' Organization) for many years. As a professional I work in projects to further improve and innovate education for the visually impaired at Bartiméus Education. Central issues are the use of the computer and assistive technology and solutions for not being able to see images and pictures.

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