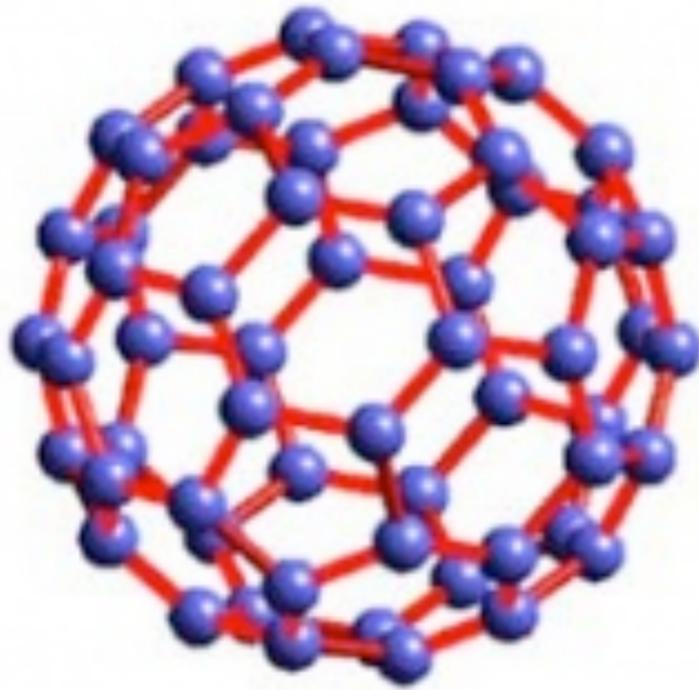


“Save the World”

In Memoriam; Richard Smalley



Libretto: Arranged by the composer from the writings of and about Richard Smalley (1943-2005)

Music: J. Todd Frazier (b. 1969)

Written for Narrator and Chamber Ensemble:

Flute

Oboe

Clarinet in Bb

Horn in F

Bassoon

Marimba (5 Octave, medium and soft yarn mallets)

Piano

Violin(s) 1

Violin(s) 2

Viola(s)

Cello(s)

Conductor

Dedicated to: Richard Smalley (*posthumous*), Chad Richard Smalley, Robert Curl, Sir Harold Kroto, Jim Heath, Sean O'Brian, Jim Tour, Paul Cherukuri, Mert and Wade Adams, Anne and Albert Chao, Reinnette and Stan Marek, and Susan and C. Richard Stasney, MD

Commissioned by: The Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University, made possible by the generous support of Anne and Albert Chao and Reinnette and Stan Marek

Concept: C. Richard Stasney, MD

Premiere: October 10, 2010, as part of the 25th anniversary celebration of the Buckminsterfullerene discovery; Narrator: Malcom Gillis, Chamber Ensemble: River Oaks Chamber Orchestra

Program Notes:

The 1996 Nobel Prize in Chemistry was shared between Rice University Chemists Richard Smalley and Robert Curl of America, and Sussex University Chemist Harold Kroto of Brittan. It was awarded for the discovery, in 1985, at Rice University in Houston, Texas, of a new form of carbon that possessed extraordinary qualities... qualities that promised to change the world of science, and the world as we know it, in significant and timely ways.

Of the 1985 research team, Smalley recalls, “Bob Curl had developed at Rice University one of the most intellectually demanding and penetrating styles of research ever witnessed by the team; Sean O’Brian had evolved just the right version of the microscope nozzle to handle the challenges of the nanoscale experiments; Jim Heath had developed an amazing talent for making “science happen” on the microscope, and when Harry Kroto joined the team from England, his intensity and scientific background blended perfectly, keeping the focus of everyone’s minds on the results coming out of the microscope.”

“Save the World” In Memoriam: Richard Smalley, is a musical composition for narrator and orchestra that illuminates the discovery and potential of nanotechnology. The goal of the work is to raise public awareness of nanotechnology, bring arts and science communities together, inspire scientists of all ages, and pay tribute to the life and work of Richard Smalley.

Version II (recommended for all audiences)

(Note to Narrator: speak naturally throughout, in sensitive response to the content and emphasis of the words, phrases and music. Begin each “Que” after a subtle direction from the conductor, who will follow your pacing with the proper response and timing of the music)

Narrator:

In 1996, the Nobel Prize in Chemistry was shared between three distinguished scientists: Rice University Chemist’s Richard Smalley and Robert Curl of Houston, Texas, and Sussex University Chemist Harold Kroto of Brittan. The team discovered a molecule of 60 carbon atoms measuring one billionth of a meter in diameter that spontaneously assembles into a sphere of hexagons and pentagons and looks exactly like a soccer ball. Because the arrangement of atoms resembled two conjoined geodesic domes, it was named a “Buckyball”, in honor of famed architect and geodesic dome inventor, Buckminster Fuller.

Widely considered the earliest and most influential discoveries in the development of nanotechnology, the “Buckyball”, lead to the discovery of a whole new world of pure carbon structures built on the nanometer scale that possess extraordinary qualities... qualities that promise to change the world of science, and the world as we know it, in significant and timely ways. Of the discovery, Richard Smalley, in his Nobel Prize speech, said “It was one of the most spiritual experiences that any of us in the original team ever experienced, but its not the discovery, but in discovering what Carbon has in store for us that is our destiny now”...

On June 22, 1999, Smalley was offered an extraordinary window of opportunity to illuminate the potential of Nanotechnology to America and to the world before the United States Congress.

These were his words:

(Music begins)

Que #1:

“Mr. Chairman, I appreciate the opportunity today to present my views on nanotechnology. There is a growing sense in the scientific and technical community that we are about to enter a golden new era. We are about to be able to build things that work on the smallest possible length scales, atom by atom with the ultimate level of finesse. These little nano-things, and the technology that assembles and manipulates them - nanotechnology - will revolutionize our industries, and our lives.”

“My own research these days is focused on carbon nanotubes – an outgrowth of the “Buckeyball” research that led to the Nobel Prize a few years ago. These nanotubes are incredible. They are expected to produce fibers 100 times stronger than steel at only 1/6th the weight – almost certainly the strongest fibers that will ever be made out of anything - strong enough, even, to build an elevator to space. In addition, they will conduct electricity better than copper, transmit heat better than diamond and membranes made from of these nanotubes are expected to have revolutionary impact in the technology of rechargeable batteries and fuel cells, perhaps giving us all-electric vehicles within the next 10-20 years with the performance and range of a Corvette at a fraction of the cost... They have also been shown to be true molecular wires, and have already been assembled into the first single molecule transistor ever built... Several decades from now we may see our current silicon micro-electronics replaced by carbon nano-electronics of vastly greater power and scope...”

“It’s amazing what one can do... just by putting atoms where you want them to go.” (*music resumes*)

Que #2:

“Let me give you just one, personal, example... I sit before you today with very little hair on my head. It fell out a few weeks ago as a result of the chemotherapy I’ve been undergoing to treat a type of non-Hodgkin’s lymphoma... While I am very optimistic, this chemotherapy is a very blunt tool. It consists of small molecules which are toxic – they kill cells in my body. Although they are meant to kill only the cancer cells, they kill hair cells too, and cause all sorts of other havoc.”

“Now, I’m not complaining. Twenty years ago, without even this crude chemotherapy I would already be dead. But twenty years from now, I am confident we will no longer have to use this blunt tool. By then nanotechnology will have given us specially engineered drugs which are nano-scale cancer-seeking missiles, a technology that specifically targets just the mutant cancer cells in the human body, and leaves everything else... blissfully alone... I may not live to see it... But I am confident it will happen... (*music resumes*) ...Cancer - at least the type that I have – will be a thing of the past...”

“Mr. Chairman, Honorable Congressmen, I believe it is in our Nation's best interest to move boldly into this new field!” (*Narrator remains standing for a moment, emphasizing his last phrase, then sits*)

(Que Narrator to stand, mm 44)

Que #3

Richard Smalley sat there in front of Congress with no hair, as a result of the chemotherapy, and talked about the promise of nanotechnology for cancer and other diseases, and how continued research will lead to breakthroughs in information technology, manufacturing, medicine and health, environment and energy, and national security, for this and future generations... and how it would pay off for his children... and children all over the world...

In response, the United States launched the National Nanotechnology Initiative, a sweeping multi billion dollar federal research and development program that coordinates the nanotechnology efforts of nearly two dozen federal agencies, including the National Science Foundation, the Department of Defense and NASA...

Dr. Smalley's accomplishments as a scientist were formidable, but his contribution to society is best measured by his passion that science can and will deliver a better world. In the final month of his life, Smalley stated with enthusiasm; "This is a magnificent time to be alive, to see these things happening in medicine and in so many other fields, and in my case to have the privilege of being a scientist in this Golden Era of Science... My own work is in a magnificently flowering mode right now. We just announced with NASA a new carbon wire that we expect will conduct electricity 10 times better than copper, have only one sixth the weight, and a strength greater than steel. If we succeed, we'll be able to rewire the world, replacing aluminum and copper in virtually every application, and permitting a vast increase in the capacity of the nation's electrical grid... That and the development of electric vehicles will enable us to wean ourselves away from gasoline, free us from dependency on middle east oil, and greatly improve the air quality in cities throughout the world."

Rick Smalley emphasized that; "Energy is the most important problem facing mankind today. The overwhelming need for new sources of clean energy in the next 50 years - energy that can come only from undiscovered technologies - means the fate of human civilization rests with the next generation of physical scientists and engineers. The United States needs a national program on par with the Apollo moon missions that will excite future generations about science... and encourage them to become researchers..."

"The message is simple...", Smalley liked to say...:

(music resumes, measure 55)

"Be a Scientist..., *(pause for note)* Save the World."

(Narrator remains standing for a moment, reflecting on his final words, then sits)