Acceptance Speech of

PROFESSOR SAJEEV O. JOHN

Co-Winner of the 2001

King Faisal International Prize for Science

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Your Royal Highness, Prince Abd Allah bin Abd Al-Aziz
The Crown Prince, Deputy Chairman of the Council of Ministers and
Head of the National Guard
Your Royal Highnesses
Your Excellencies
Distinguished Guests

It is my great honour to accept the 2001 King Faisal International Prize for Science along with Professor Yang. I am most grateful to the King Faisal International Prize for endorsing my scientific endeavours in this manner and I am truly delighted by the choice of your selection committee that brings me here today along with my esteemed colleagues.

The field in which I have worked for more than 15 years deals with light. Light comes in both visible and invisible forms. It enters our daily experience no matter what our background. It pervades our culture, it is associated with truth and beauty, and it is central to both our artistic forms of expression and our sciences. It is indeed surprising that something so commonplace continues to be a source of scientific discovery.

The scientific understanding of light goes back more than a century, when a physicist, James Clerk Maxwell, deduced a precise and elegant mathematical description of the propagation of light. This theory of electromagnetic wave propagation was shortly thereafter tested and verified by another physicist, Heinrich Hertz. There began the age of wireless communication. This soon allowed ships at sea to communicate with their home base. Today, the same basic discovery provides us with the use of radio, television, and mobile phones.

The invention of the laser in the latter half of the 20th century was another milestone in the science and technology of light. Within the broad spectrum of light, both visible and invisible, the laser allows us to select very precise parts of the spectrum and to harness the power of light. Laser light allows us to probe the structure of matter with unprecedented accuracy, it provides medical practitioners with a cutting tool sharper than any surgeon's knife, and allows us to modulate communication signals for high speed data transfer along the internet.

This brings me to my own work which began when I was a PhD student at Harvard University. As a graduate student in 1984, I asked the question whether it is possible to create a material that could trap or "cage" the light from a laser. Such a material would need to be very different from any material that occurs in Nature or any material that mankind has ever synthesized. Such a question is not something that professors normally expect from their graduate students. I was left largely to myself to pursue the answer to this new line of scientific inquiry. I have to especially thank my parents for their steadfast love and support during those years.

Materials have played such an important role throughout the course of human history that we name entire epochs after the predominant material of the time. We can trace this as far back as the Stone Age and the Bronze Age. The 20th century is regarded by many as the Age of Artificial Materials. Semiconductors of electricity stand out in this regard. Semiconductors facilitate the microscopic manipulation of electricity. Historians will remember the 20th century as the Age of Electronics because of the technological revolution resulting from semiconductor physics. Along this line of technological progress, one might ask, "What will distinguish the 21st century from those of the past?" Many scientists around the world have already suggested an answer. Namely, the 21st century will be the Age of Photonics in which novel materials that allow us to microscopically mould and manipulate the flow of laser light will surpass the electronic circuits and materials of the past.

Not knowing how the future of optical technology was going to evolve, I moved to Princeton University in 1986. Some experimentalists who had read my paper of 1984 were already attempting to create materials that could localize light. In order to establish a more systematic protocol for materials synthesis, I published a paper in 1987 while at Princeton, suggesting that light could be trapped or caged in certain artificially created crystals. These are now referred to as photonic band gap materials, the semiconductor equivalent for light. In these photonic band gap materials, it is possible to create microscopic circuits for light in much the same way that today's computer chips contain microcircuits for electricity.

Commercial interest in the field of photonics is already exploding. Photonic band gap materials are poised to surpass and in many cases displace existing methods for routing and processing optically encoded information. Some of the world's biggest telecommunication and networking companies are already hiring teams of scientists to work in this field and venture capitalists are investing in smaller start-up companies that may bring photonic band gap technology to the marketplace. My own company, KeraLight Technologies Inc., which I founded in November of last year, hopes to be a leader in this exciting opportunity.

The domain of electricity is changing already and will continue to change in the 21st century. There was a time when our telephone calls were carried by electricity over copper wires. Today, using laser light, undersea fiber optic cables carry our voice communications and data with such clarity that a pin drop in Riyadh can be heard clearly in Toronto. Optical fibers are also replacing electrical wires in shorter distance communications such as local access networks and computer-to-computer communications. The time will come when communications even within a single computer chip may take place with tiny beams of laser light rather than electricity and optical computers will become a reality. Such computers may be faster and more capable than the ones we have today.

I had my first contact with Saudi science when I was still a highschool student in Canada. There, at the University of Western Ontario, where my father was a professor, I met a brilliant young post-doctoral scientist from Saudi Arabia. I believe he is today His Excellency Professor Dr. Hashim A Yamani, Minister of Industry and Electricity. He might very well have forgotten me, but I have not forgotten him.

Your Royal Highness, I will therefore keep a soft corner in my heart for electricity, even as we move into the new age of photonics! I will also remember with pleasure the new scientific and the human contacts I have made during my visit here and the courtesy of your people.

The King Faisal International Prize is a great honour for me, my son David, my wife Reena, and my parents. It is likewise a great honour for my university and my country. I hope it will give me greater freedom to carry on the work that I have very briefly described to you and enable me to bring these dreams to reality. Thank you for this opportunity to address you and your distinguished audience here today.