The quest for fundamental knowledge in physics is one of the most laudable goals of mankind. We have seen great strides in our understanding quantum theory and its relation to the theory of fields, although we are still searching for a theory that incorporates and unifies all the known forces observed in nature.

A major theme in this direction was the development of quantum chromodynamics (QCD), evolving from the theory of non-abelian gauge fields interacting with matter fields. The incorporation into Yang-Mills interaction with fermions and the scalar Higgs field allows the description at a perturbative level of electromagnetic, strong, and weak forces as described by Glashow, Salam, Weinberg, Georgi, and others. Asymptotic freedom, peculiar to certain quantum mechanical theories, allows certain examples to have privileged ultraviolet behavior. The discovery of this underlying property by Gross, Politzer, and Wilczek that distinguishes “good” from “bad” perturbative behavior was recognized by the award of the Nobel Prize for Physics in 2004. Related fundamental work of Coleman, ’t Hooft, and Symanzik helped enable this progress. One believes that asymptotic freedom also leads to the regular ultra-violet behavior of pure non-abelian gauge theory, leading to the existence of a mass gap and quark confinement. Explaining these phenomena rank as one of the most important unsolved theoretical questions in physics.

A two-day conference devoted to the presentation of these past advances, recent progress, and unsolved problems was planned and implemented. At this meeting we also explored the relation of these aspects of quantum field theory to other domains in particle physics.

This grant partially funded the meeting “QFT & QCD: Past, Present and Future” held at Harvard University, Cambridge, MA on March 18-19, 2005. The grant funds were used to pay the domestic travel expenses of the invited speakers as well as to videotape the lectures, and to design the website, which is a permanent addition to the website of the Physics Department at Harvard University. The participants ranged from senior scientists (including at least 9 Nobel Prize winners and 1 Fields Medalist) to graduate students and undergraduates. In all, several hundred persons from the Boston area and beyond attended each lecture.

The list of speakers, with the title of each talk, and the introducers follows:

David Gross, *The Future of Physics*, introduced by Norman Ramsey
Paul Steinhardt, *Cosmology in a False Vacuum*, introduced by Greg Moore
Murray Gell-Mann, *Recollections of Sidney*, introduced by Leon Cooper
Sheldon Glashow, *Small Matrices, Sidney, and Me*, introduced by Howard Georgi
Erick Weinberg, *Vacuum Tunneling in de Sitter Space—QFT in the Past and in the Future*, introduced by Alan Guth
Steven Weinberg, *Cosmological Correlations*, introduced by Kenneth Wilson
Gerard ’t Hooft, *Symmetry and Sidney*, introduced by Nathan Seiberg
Edward Witten, *Emergent Phenomena in Condensed Matter and Particle Physics*, introduced by Arthur Jaffe

These lectures ranged from superlative reviews of past progress, lists of important unsolved questions, to provocative hypotheses for future discovery. The project was inspirational in that it generated a great deal of interest from students and other young attendees on the internet, raising awareness and interest in the open questions of theoretical physics. All the lectures were taped and they are available for viewing on the internet through the website [http://www.physics.harvard.edu/QFT/sidneyfest.htm](http://www.physics.harvard.edu/QFT/sidneyfest.htm).

The conference lectures are also available on DVD in the Harvard Physics Research Library for the use of students and other physics researchers.

The goal of this grant was to provide an interesting meeting attractive to a large audience of top research physicists as well as outstanding students. We believe that these goals were met, as measured by the size of the audience, and the extensive discussion of the meeting on numerous websites and blogs.