HARVARD
MEDICAL SCHOOL

The Giovanni Armenise-Harvard Foundation Dean's Basic Science Grant at Harvard Medical School

Stewardship Report
November 2015

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ARMENISE-HARVARD DEAN'S BASIC SCIENCE GRANT 2014-2015

Overview

Since its inception, the Giovanni Armenise-Harvard Foundation has provided the Dean of Harvard Medical School with vital income transfers from its endowment in support of the Armenise-Harvard Dean's Basic Science Grant. The unrestricted nature of these transfers has allowed the Dean to allocate funds annually toward the School's most strategic priorities in the greatest need of supplementary funding. Because of this generous provision incorporated in the Armenise Foundation's founding articles, Harvard Medical School has continued to lead academic medical centers globally, educating future leaders while advancing science for the benefit of people around the globe.

During the 2014-2015 fiscal year, $1,689,000 was made available to Dean Flier through the Armenise-Harvard Dean's Basic Science Grant. At the Dean's direction, these funds were used to support continued investment in the vital new Information Technology Initiative that is already strengthening the School's capacity for innovation and excellence in research and education for the 21st century.

A New Paradigm in Information Technology

Harvard Medical School's Information Technology infrastructure is currently undergoing a momentous transformation. A world leader in biomedical discovery and medical education, HMS is creating a new IT paradigm that addresses the unparalleled volume of scientific data production and consumption and ensures robust support for educational innovation. Through the creation and implementation of a new IT architecture, integration of state-of-the-art equipment, increased and sustainable capacity building and planning, and development of an efficient funding model, this initiative is securing the rigor and momentum of the School's pioneering biomedical enterprise. In the realm of medical education, HMS is also a pioneer: this year saw the inauguration of four state-of-the-art medical education learning suites designed to play an integral role in the new *Pathways* MD curriculum introduced in August 2015. Supporting the School's tradition of excellence in medicine and education, this foundational Information Technology project will continue to foster the advancement of good health for individuals and communities across the globe.

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Advances made over the last year include:

i) Integration of data center space within a single location

One of the key components of this landmark Information Technology project at HMS is the consolidation of data center space within one location, both to afford significantly increased operational efficiencies and to provide essential space for growth. The establishment of a single data center was successfully completed during the last year with the integration of three previously disparate production data centers into a common location.

This single data center provides the option to expand into additional space when needed.

ii) Consolidation of data storage and architecture is streamlining performance

The consolidation of our data centers afforded us an opportunity to streamline our network topology and eliminate bottlenecks created by previous "organic" growth. In consequence, this has led to performance enhancements in our *Orchestra high performance computing (HPC) environment* as the flow of data is now optimized. The *Orchestra* cluster is a shared HPC environment at HMS that serves the School's broad and diverse research community whose IT requirements and workflows are complex. Tens of thousands of projects are run on the *Orchestra* cluster every day by IT engineers, who closely monitor the job-handling software and configuration to balance data throughput among hundreds of researchers in the HMS community.

A high performance computing environment (HPC)

iii) Upgrading of core and campus network infrastructure

The School's core and campus backbone network infrastructure has been successfully upgraded to 100GB throughout. The process of upgrading all buildings on the campus is currently underway, and will result in no less than a ten-fold increase in network bandwidth to all buildings. This increase in capacity not only ensures effective data transfer from instruments to data processing devices, but also reflects a more aggressive use of cloud based solutions to reduce the School's on-premise footprint.

iv) Key investments in data storage infrastructure

The immense volume of data produced and consumed by our scientists continues to be a primary challenge. Over the last three years, HMS has witnessed an exponential need for data storage: storage requirements have risen from less than 2 petabytes to nearly 25 petabytes. To address this issue, HMS has made significant investments in two new components of the IT infrastructure: first, storage technology that is optimized for high throughput genomic data analysis; and, two, a new archive solution implemented last summer, which allows for the moving of data no longer in active use to low-cost offline storage media. This archival storage is particularly useful in genomic research as the data life cycle is much shorter than in many other fields of science that similarly generate large volumes of data. Experiments in areas such as high energy physics may yield volumes of data, yet this data frequently requires years of subsequent research. In contrast, modern DNA and RNA sequencing technologies allow scientists to generate vast volumes of genetic data in just days, though this data undergoes a relatively short period of analysis and may be subsequently migrated offline.

v) Development of a "chargeback" structure to help address ever-increasing storage costs

In consultation with faculty and research administrators, a "chargeback" system has been developed to address the steeply rising costs of providing data storage to research faculty. Of key importance is the desire to change behavioral patterns by encouraging the more economic use of storage resources rather than redistributing costs. To this end, and as we implement this cost participation strategy, we are hiring a Data Manager who will collaborate with faculty to optimize their utilization of our data management infrastructure.

In addition, the Information Technology infrastructure provides critical resources and support for the School's new *Pathways* curriculum introduced in August of this year. This bold revision of the curriculum incorporates pedagogical approaches that foster active learning and critical thinking using a case-based approach to learning and teaching rather than a more traditional lecture format. Of

A class taught in one of the new learning suites by Dr. Richard Schwartzstein, Ellen and Melvin Gordon Professor of Medical Education.

signal importance for this innovative curriculum are the four new medical education learning suites created especially to support MD students in their early years of the program. Designed by a dedicated committee of medical education faculty, administrators and students who were also involved in transforming the curriculum, these new learning suites provide flexible environments outfitted with leading edge technology that is efficient and user friendly. Within a setting that may be configured in a variety of ways – from private work stations to small group clusters to large group conference-style formats – flexible technologies play a key role: these technologies – information technology tools and cameras, high resolution touch and stylus-driven tablets and screens – enable students and teachers to share digital resources, to connect remotely with other classrooms in the building, with any of the HMS-affiliated hospitals, or with faculty in the field anywhere around the globe.

Securing sufficient financial support for critical new initiatives in their early stages, such as this Information Technology initiative, presents an enormous challenge to Harvard Medical School. Dean Flier and his inner cabinet remain deeply grateful for the Armenise-Harvard Dean's Basic Science Grants, as they continue to afford the funds needed to advance strategic priorities at HMS.

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Microscope and materals in a new learning suite "damp" lab.