# The Infectious Disease SuperCluster

An Interdisciplinary Approach to Address Global Challenges in Infectious Diseases

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Introduction

Infectious diseases remain major causes of morbidity and mortality throughout the world and cause immeasurable suffering and loss for individuals, families and societies. Indeed, 1/3 of deaths in humans are attributable to infectious diseases (this percentage is undoubtedly greater in many developing countries), and infectious diseases are major impediments to social and economic development in countries and regions that can least afford them. Similarly, infectious diseases of animals and plants constitute major threats to societies and economies and constitute a true global challenge to human kind. The causes for the resurgence, emergence, and continuing importance of these diseases are multifactorial, and include: the lack of affordable vaccines, therapeutics, and diagnostics, the lack of economic incentives for industry to develop new products to combat infectious diseases, and the need for new effective policies and practices for detection, treatment, and control of infectious diseases. The continued importance of these diseases is also caused in part by emergence of new diseases, changes in societies, ecosystems, human demographics and behavior, economic development and land use, international travel and commerce, breakdown of public health measures, poverty, war, famine, and social inequality.

Clearly, novel, multi- and inter-disciplinary approaches are necessary to help address the global challenge of infectious diseases. Current academic models do not adequately promote these approaches and there are few strategies and incentives to promote collaborative research endeavors. New discoveries and methodologies must be moved from the laboratory into markets or policies to help control diseases. Clearly, existing processes for commercialization of discoveries are inadequate for responding to the global challenge of infectious diseases. Universities must more proactively translate research results to commercial application, sound government policy and education.

The CSU Infectious Disease SuperCluster

The Colorado State University approach to help address the global challenge of infectious diseases is to establish a multidisciplinary academic supercluster with a focused collaborative research and product/policy development agenda in infectious diseases. The ID SC is based upon the nationally and internationally recognized programs in infectious disease research at CSU. The ID SC will build upon the substantial ID capacity, expertise, and resources available at CSU, including the Rocky Mountain Regional Center of Excellence for Biodefense and Emerging Infectious Diseases, the Rocky Mountain Regional Biocontainment Laboratory, the two Emerging Virus and Prion Disease Units, the Veterinary Diagnostic Laboratory and Professional Veterinary Medical Program, the Department of Microbiology, Immunology and Pathology, the Mycobacteriology Research Laboratories, the Arthropod-borne and Infectious Diseases Laboratory, and many other infectious diseases programs and initiatives. The CDC-Division of Vector-borne Diseases, USDA – Arthropod-borne Animal Diseases Research Laboratory, the USDA – National Wildlife Research Center, and the USDA – Centers for Epidemiology and Animal Health complement, expand, and enrich the ID research, teaching, and training opportunities for the existing ID programs at CSU. Indeed, CSU and the many partner institutions/agencies provide unparalleled zoonotic and infectious diseases programs. The ID SC will exploit this globally recognized expertise and resources. The ID SC will enhance and expand the ability of the ID programs to address human, animal, and plant infectious diseases by mobilizing talents and facilities from all parts of the university and by partnering proactively with
government, industry and foundations to help address this global challenge. The prospects for research and academic growth, procurement of external funding for basic and applied research, and product/policy development in infectious diseases at CSU are outstanding.

**The ID SC Mission and Goals**

The overall mission of the ID SC is to develop and implement effective interventions for human, animal and plant infectious diseases of global importance. The ID SC will provide an organizational structure to mobilize, integrate, and develop CSU talents, resources, and infrastructure to help reduce the terrible global burden of infectious diseases and to overcome barriers to international trade of agricultural products due to infectious disease. The overarching goals of the ID SC are to:

- Enhance the overall ID research, training, and service capacity at CSU to promote research discoveries, policy development, and capacity to address infectious diseases issues in the state, nation, and the world.

- Accelerate development and application of ID products and best practices to detect, prevent and treat infectious diseases worldwide, by partnering with industry, government, foundations, and other entities to move discoveries to usable products and best practices into effective policies to combat infectious diseases.

More specific goals and the respective action items for the ID SC include the following. Some action items address more than a single goal, but they are only listed under one of the specific goals.

- Mobilize a multidisciplinary consortium - - the Infectious Disease SuperCluster - - to fully establish CSU as a world leader in basic and applied research in animal infectious diseases

*Identify and mobilize all CSU resources available to ID Research*

*Institute a developmental research and capacity building grant program for ID SC members to encourage innovation and synergy and interdisciplinary and interdepartmental efforts.*

*Create a series of annual workshops that focus upon ID Cluster needs and opportunities, that will emerge as important research agenda and policy making meetings, and that will bring visibility and recognition to the ID SC.*

*Establish an annual meeting/retreat comprising all stakeholders in the ID SC to foster a sense of community and purpose, to establish collaborations and networks, and to promote accountability.*

*Create a WEBSITE and newsletter to promote electronic communications.*

*Develop an ID course that cross-cuts the ID Clusters and serves as an effective means of promoting ID education and assembling and organizing available expertise*

*Establish an interdepartmental ID graduate program with multiple tracks to reflect expertise*

*Develop the Biosafety/Biosecurity Training Program (Course, Internships, MS program*
Expand overall federal and foundation grant funding in ID.

- Exploit the ID SC and CSU ID capacity and establish CSU as the world leader in the study and control of infectious diseases and
  
  * Develop a world-recognized Comprehensive Infectious Disease and Zoonoses Center, emphasizing emerging infectious diseases
  * Improve and expand basic ID research, initiate a true systems biology approach in select areas of strength
  * Develop and implement effective strategies and policies to ensure worldwide food safety (including prion diseases) and overcome ID barriers to international trade of agricultural products
  * Develop an advertising / marketing plan to make the ID SuperCluster and MicroRx nationally and internationally recognized
  * Organize and host national ID meetings workshops at CSU to increase visibility of the ID SC and programs
  * Create endowed chairs in ID research areas
  * Develop a prioritized and coordinated plan for technology acquisition, facility development, and laboratory renovations
  * Establish the Veterinary Diagnostic Laboratory as a diagnostic and surveillance center that is fully integrated into the ID research mission
  * Develop platform technologies and methodologies to detect, prevent, and treat diseases worldwide
  * Development of live animal models and imaging technologies for discovery science and translational research

- Accelerate development and implementation of products and practices that provide effective interventions for human, animal, and plant infectious diseases of global importance.
  
  * Develop the MicroRx enterprise arm for translational research and technology transfer and aggressively develop CSU ID intellectual property
  * Provide active support to the IDSC in all aspects of tech transfer and economic development
  * Actively promote the development of facilities such as an animal core and GMP/GLP capacity that will assist in these efforts
  * Increase developmental fund raising and establishing connections with industry both to augment traditional sources of funding and to provide sufficient capital for high cost translational efforts
  * Increase active partnerships with organizations external to CSU to complement existing strengths and import new opportunities to the ID arena
  * Encourage entrepreneurship among CSU ID faculty

Based upon opportunities, needs, and available expertise, the ID SC MOC may change the priority or alter these goals in the future.
The ID SC is being developed to address the global challenge of IDs. This novel multidisciplinary program will exploit, develop, and enhance ID expertise, talents, and resources across the campus, and will promote interactions and collaborations across organizational, departmental, and college boundaries. The ID SC will also reach beyond the campus to industry, government, foundations, NGOs, etc. to move products into the marketplace and to promote policies that help reduce the burdens of infectious diseases.

To accomplish these disparate goals, the ID SC is organized into two arms: an academic arm and an enterprise arm. The two arms are linked organizationally and philosophically to translate research discoveries from the laboratory bench to the bedside, the pen side, and field side, and to develop and promote best practices and policies to prevent and control infectious diseases. The overall missions of the two arms of the ID SC are:

- **Academic arm** – to enhance and build academic capacity in ID at CSU, to expand and diversify research funding support, to provide incentives for multidisciplinary research and activities, to develop policies and practices to control IDs, and to mobilize the considerable talents and resources across the campus to help combat IDs.

- **Enterprise arm** – to move research discoveries to market efficiently and expeditiously to address global challenge of infectious diseases, to promote economic development, and to induce an entrepreneurial mind set in faculty and programs for translational research.

The organizational structure of the ID SC is presented Figure 1. The Academic Arm of the ID SC is presented in Figure 1a, and the Enterprise Arm, MicroRx, is presented in Figure 1b. The Director of the ID SC also serves as the Chief Scientific Officer of MicroRx, which is the enterprise component of the IDSC. The terms of reference for key personnel and committees are provided after the figures.

**Figure 1. ID SC Organizational Structure**

Under Construction

**The ID SC Academic Arm.** The Academic Arm of the ID SC is administratively located in the Office of the Vice President for Research. The VPR has overall responsibility for the CSU research enterprise. The key components of the Academic Arm are: The Director, the Advisory Committee, the External Advisory Committee, the Management and Oversight Committee, the Infectious Disease clusters, and the ID Cluster Leaders.
**Figure 1a. The Infectious Disease SuperCluster**

**ID Supercluster Academic Arm:**

- **Vice President for Research**
- **Director, ID SC**
- **Chief, Scientific Officer**
- **Management & Oversight Committee**
  - **Internal Advisory Board**
  - **External Advisory Board**
- **ID Clusters**
  - Bacterial Diseases & MRL
  - Prion Diseases
  - Vector-Borne & Viral Diseases
  - Translational Research & Entrepreneurship
  - Plant Diseases
  - Decision Support Systems?
  - ID Educ. & Outreach?

**Research at Colorado State University—Local Discovery...Global Impact**

**Director:** Dr. Barry Beaty will serve as Director of the ID SC and as the Chief Scientific Officer of MicroRx. Dr. Beaty will have overall responsibility for the ID SC, will oversee and coordinate all aspects of the research and program development and enhancement activities of the academic portion of the ID SC. The Director will also serve as Chair of the MOC, will coordinate and facilitate MOC activities, will manage the ID SC budget, and supervise ID SC personnel. He will prepare annual and interim reports for the IAC, the EAC, and the VPR, prepare, issue, and supervise the review of proposals, and will promote program coherence and enhancement. He will interface regularly with the Internal and External Advisory Committees to establish and review overall ID SC direction, emphases, and productivity. He will establish and maintain lines of communication with and will be the primary contact for the ID SC for CSU administration, including Department Heads, Associate Deans, Deans, faculty, other stakeholders, the public, and the press. He will organize and supervise the annual meeting/retreat of the ID SC, oversee the development of the ID SC courses, seminar series, and will work with the respective Cluster Leaders to organize the annual work shops.

The Director will be appointed for a two year term, and will be reviewed annually by the VPR. Reappointment will be predicated upon a satisfactory review. The Director will also serve as the Chief Scientific Officer of MicroRx, the enterprise arm of the ID SC, which is administratively located in the CSU Foundation. In this capacity, he will work with the CSU Ventures CEO and the MicroRx staff to promote translational research, to proactively pursue IP, to manage a pipeline of ID products for translational research and development, and to promote economic development. This joint appointment approach will ensure and maximize interactions and communications between the two components of the ID SC.
**Internal Advisory Committee:** The Internal Advisory Committee is a very important component of the ID SC administration. The IAC will facilitate inter-college and inter-departmental interactions and collaborations. The IAC’s function differs from that of the External Scientific Advisory Committee. The IAC will provide guidance on overall policy, procedures, opportunities, and program development and capacity needs and will ensure that the ID SC is responsive to university and ID SC goals and mission. It will also review institutional roles and commitments, recommend actions to address disputes arising between components of the ID SC, and generally promote and advertise ID SC related activities and programs. The composition of the IAC will provide organizational access to the college and higher administration levels at CSU, thereby facilitating resource acquisition, conflict resolution, communication, and commitment. Members of this committee will receive semi-annual and annual reports, be briefed periodically on ID SC activities, and will participate in the annual program review. The IAC will provide feedback to the VPR on ID SC progress and potential.

The IAC will be comprised of the Associate Deans for Research or their designees (eg, Department Head of a relevant Department) from each of the CSU colleges. If a college does not have faculty and programs associated with the ID SC, it will not be required to participate in the IAC. However, the ID SC will be a dynamic enterprise and opportunities and needs for new ID Clusters will undoubtedly arise. Thus all colleges are encouraged to participate in this important committee. The IAC will also have a representative from the Office of the Provost and from the Office of the VPR.

**External Advisory Committee:** This committee is critical for the development, productivity, and success of the ID SC, and it will provide invaluable expertise, advice, and quality assessment for the ID SC. The EAC will be charged to provide the Director and MOC with expert external advice on program development, enhancement, operation, productivity and quality. The ESAC will provide input at the request of the MOC on specific research and capacity building proposals or projects, and will provide invaluable expertise and advice to the MOC and the PI on program productivity, quality, and opportunities. This committee will participate in the annual meeting. The Director and MOC will provide semi- and annual reports to the EAC for their evaluation. The EAC will provide the MOC with its assessment of the research and training projects and will suggest actions to enhance the productivity of the ID SC. The Director and MOC will act upon this review, and will discontinue nonproductive projects, enhance projects that have made significant progress, and add new projects with great potential. *In toto*, the EAC will provide extraordinary experience in infectious disease research, in development and marketing of products, and in development of policies and programs for ID control. Such advice will be invaluable for overall ID SC program development and enhancement.

The EAC will be comprised of five outstanding scientists and ID practitioners from outside of CSU. The EAC membership will reflect the broad goals of the ID SC activities, ie - ID research and training, product development, and policy implementation, and will provide expertise from academia, industry and government. The committee members will have staggered terms to provide both for continuity in program review as well as to provide new perspectives and ideas for the ID SC.

**Management and Oversight Committee:** This committee is the principal administrative committee of ID SC, and responsible for the overall development, direction, management, administration and supervision of ID SC activities and programs.
A subgroup of the MOC, an internal scientific review group, will review ID SC Research and Capacity Building and Infectious Disease Activities for scientific merit, responsiveness to ID SC goals and other criteria as appropriate. The MOC will select proposals for funding and monitor them for productivity. The MOC may establish ad hoc committees to address ID SC initiatives and activities as needed. The MOC will meet monthly to address ID SC activities, opportunities, needs, etc. A majority vote of the MOC will be required to approve, initiate, or discontinue ID SC activities.

The MOC will be comprised of the Leader of each of the ID Clusters and the Director of the ID SC will serve as Chair of the MOC.

**Infectious Disease Clusters:** The Infectious Disease Clusters are the keys to the success of the ID SC. The Clusters are predicated upon the fact that researchers naturally congregate via discipline-based foci and that establishing and enhancing clusters of scientists from and across scientific or academic disciplines is the most efficient mechanism to promote scientific, product, and policy achievements. This approach has been extremely successful at CSU and builds upon the extraordinary successes of programs such as the Arthropod-borne and Infectious Diseases Laboratory and Mycobacterial Research Laboratories in the Department of Microbiology, Immunology, and Pathology. These clusters frequently transcend academic boundaries and the faculty are linked by a common theme or endeavor, vision, approach, and organizational structure. This community or cluster of scientists then pursue training grants, program project grants, a cluster based course and seminary series, making the whole much greater than the sum of the parts and strengthening the ability of the ID SC to address its mission and achieve its goals.

The ID clusters will be strategically selected and supported, will promote synergy of the faculty across the campus, will provide an umbrella organization for faculty to procure funding and support, will provide opportunities for collaborations with established researchers and ID practitioners and programs, and will provide a visible and accessible point of contact for faculty and other stakeholders from other disciplines and clusters. Selected potential ID Clusters listed below to illustrate the organizational schema of the ID SC. A number of other ID Clusters have been proposed and are already established or being discussed. The tentative list includes:

- Bacterial diseases (MRL)
- Viral and Vector-borne diseases (AIDL)
- Prion and molecular diseases
- Plant diseases
- Ecology of diseases (GDPE)
- Epidemiology of IDs (APHI)
- Entrepreneurship and translational research (GSSE)
- Medicinal chemistry and structural biology
- Decision support systems and bioinformatics
- Food safety
- Behavior and outreach
- Biomedical engineering
- Resistance
More detailed information on the respective ID Cluster and Cluster Leader is provided at http://www.cvmbs.colostate.edu/mip/idsc. Each ID Cluster will be reviewed every three years by the IAC and VPR. The composition of ID Clusters will likely change over time, reflecting new opportunities, needs, etc. in ID. Some may merge with other ID Clusters or be discontinued based upon the review by the IAC and VPR. Each Cluster will receive a modest operations budget each year to manage and promote the ID Cluster activities.

**Cluster Leaders:** The Cluster Leaders are outstanding scientists with experience and expertise in the respective ID Cluster area and pertinent disciplines. The respective ID Cluster Leaders and the Clusters are described in more detail at http://www.cvmbs.colostate.edu/mip/idsc/clusters.htm The CLs will organize and promote activities to enhance ID capacity in their respective areas, will develop new interactions and collaborations across the ID SC, ensuring integration of appropriate members from across campus into cluster activities, will promote grant submission and product development, will identify and manage the focused research issues pertinent to the Cluster, and will provide invaluable advice and mentoring to faculty in their respective Clusters. The CLs will oversee cluster activities, ensuring that they are responsive to the mission and goals of the ID SC, proactively pursue and coordinate cluster specific research and capacity building proposals, and will organize or oversee cluster specific meetings and workshops. The CL will manage the Cluster operations budget and ID Cluster specific Capacity Building or ID Activities budgets. Very importantly, the CL will serve as a member of the Management and Oversight Committee of the ID SC. The Cluster Leaders will be appointed for 2 or 3 year terms by the Director with the agreement of the Internal Advisory Committee.

**Figure 1b. The Infectious Disease SuperCluster: Enterprise Arm**

Under Construction

**The ID SC Enterprise Arm:** The enterprise arm of the ID SC will be administratively located in the Colorado State University Research Foundation. The key components of the enterprise arm are Colorado State University Ventures, the CSU Ventures Board, the CSU Ventures CEO, MicroRx, the Chief Scientific Officer, the Chief Operations Officer, the Sector Specialist, SRA, and Development Officer. MicroRx will serve as the enterprise activity for the ID SC. The overall mission of MicroRx is two fold: the first is directly focused upon technology transfer and commercialization of products to control infectious diseases. Emphases will include invention disclosures and patents, licensing arrangements, corporate partnerships, and regulatory requirements for product development. The general goals are to develop an efficient system to identify ID intellectual property and product opportunities at CSU, to populate a pipeline of products for translational research and product development, and to promote business incubation and economic development. Inherent in these goals is the instillation of entrepreneurial and translational research thinking in CSU faculty in a manner that will not adversely affect basic research excellence and productivity, but that will complement and indeed even expand these opportunities. The second mission of MicroRX is to work with the Vice President for University Development and other development offices at CSU to
actively pursue development funding, endowed chairs, resource donations, etc associated with the visible and robust ID SC programs and talents.

The CSU Ventures CEO will oversee the enterprise arm of the respective superclusters at CSU. The CSO, through cross-functional relationships and in conjunction with the MicroRx COO, will oversee a team of supercluster staff including a technology sector manager, senior research administrator, and a special director of development. The CSO will also work extensively with CSU Venture’s Board and CEO, CSURF’s Real Estate Office (REO), and the CEO and staff of CSURF. The CSO will work extensively with CSU’s Vice President of Research, The Vice Provost of Outreach and Strategic Partnerships, the Associate Vice President of Economic Development, and the Provost. The CSO will be responsible for developing appropriate research, commercialization, and industry interaction goals and metrics related to the ID SC. The COO will be responsible for developing appropriate financial, accounting, and operational goals and metrics related to the ID SC.

**ID SC Funding Opportunities**

The ID SC currently has two developmental grant funding opportunities: Research grants and ID Capacity Building and Activities Grants. These funding opportunities will address ID Research and Capacity Building needs and opportunities. These grant programs are also designed to promote discussions, interactions and collaborations between ID SC members, ID Clusters, etc., which will benefit the ID SC and its ability to address and enhance its mission and achieve its goals.

**Research Proposals** The ID SC will announce a call for research proposals in infectious diseases annually. The typical successful proposals will address research needs and opportunities in infectious diseases, will be multidisciplinary (eg, co-investigators from different Departments, Colleges, Programs, etc.), and will address issues pertinent to one or more of the ID clusters. Translational research proposals with product development potential and proposals that bridge disciplines are especially encouraged.

The typical research proposal will be for $30,000 to $50,000 direct costs per year (F&A costs are not allowed) and may be renewed for one additional year, depending upon progress and review. All proposals will be reviewed by the Management and Oversight Committee and an ad hoc review committee of the IDSC. The complete RFA, the format for the research proposal and deadlines are all provided on the ID SC website.

[http://www.cvmbs.colostate.edu/mip/idsc/](http://www.cvmbs.colostate.edu/mip/idsc/)

**Capacity Building and Activities Proposals** The ID SC will announce a call for capacity building and specific infectious disease activities proposals annually. These proposals will typically be one time requests, and will be less than $20,000. The successful proposal will typically be multidisciplinary, will address specific needs and opportunities of the respective clusters (eg, small equipment, meeting attendance, retreats, speakers, etc), will build the capacity and address program enhancement and coherence issues, and will be coordinated through the pertinent ID Cluster. All proposals will be reviewed by the Management and Oversight Committee and an ad hoc review
committee of the IDSC. The complete RFA, the format for the research proposal and deadlines are all provided on the ID SC website.  
http://www.cvmbs.colostate.edu/mip/idsc/

**Membership in the IDSC**

ID SC membership will be obtained through application to a standing committee of the MOC. Benefits of membership will include eligibility for the ID SC grants programs and access to ID SC-sponsored events and activities. In exchange for these privileges, members are expected to actively participate in ID SC activities, meetings, and programs. Potential members will submit a two page NIH Biosketch and any other supporting information that they may desire to Dr. Beaty or to the pertinent Cluster Leader. Membership information will be maintained in the administrative core, and will provide a resource for the Director, Cluster Leaders, and for others who need access to talents and expertise in specific ID areas. Membership will be for three years, and depending upon participation in ID SC activities, renewable by the MOC during the annual review of the program.

**Outputs and Milestones**

**Year 1**

1. Establish and staff the administrative core of the IDSC.
2. Meet with College leadership and faculty to introduce the ID SC, to strategize, and to mobilize talents and resources from across the university for the ID SC initiatives.
3. Establish the ID Clusters and select Cluster Leaders
4. Finalize the Management and Oversight Committee, the Internal Advisory Committee, and the External Advisory Committees
5. Institute ID SC research and capacity building RFAs, issue the call for proposals, and fund the successful proposals.
6. Establish and staff the Administrative core of MicroRx.
7. Create an IDSC website as both a tool for communication as well as the posting of ID talents and resources for the ID community
8. Develop an interdisciplinary ID course to both further ID education and outreach and to serve as a catalyst to build the IDSC community
9. Hold the first ID SC Workshop in conjunction with the opening of the Rocky Mountain Regional Biocontainment Laboratory
10. Develop a prioritized plan for technology acquisition.
11. Develop a prioritized plan for facilities and program development.

**Year 2**
The year two milestones and deliverables will depend in part upon prioritization activities in year 1. However activities will likely include:
1. Submit at least two shared instrumentation grants based upon the consensus plan for technology acquisition to federal agencies.
2. Submit at least one NCRR grant based upon the prioritized plan for facilities.
3. Create a targeted interdepartmental Infectious Disease Training Program and submit a training grant application.
4. Develop a formal biosafety training program.
5. Initiate successful developmental fund raising for ID research activities.
6. Identify and establish corporate, government and institutional partnerships relevant to the targeted objectives of the IDSC.
7. Identify first (of many) viable candidate diagnostics, therapeutics and vaccines to address targeted major objectives.
8. Obtain first (of many) US and international patents on IDSC-initiated technologies.
9. Establish active corporate partnerships to fund technology transfer and phase I trials of anti-ID compounds.

**Year 3**

1. Increase extramural grants in ID research by at least 10% a year and break the $50 million mark for extramural funding for ID research for the fiscal year.
2. Successfully compete for at least one new multi-investigator program project center / consortium grant.
3. Increase the number of patents applied for by IDSC researchers by 50%.
4. Establish first endowed chair for ID research through successful developmental fund raising.
5. Initiate first (of many) phase I trial of an IDSC-generated compound / vaccine.
6. Host a national/international ID meeting at CSU.