

# Research And Graduate Education

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## The Institute for Combinatorial Discovery

*Sixth in a Series on the Presidential Initiatives*

The Institute for Combinatorial Discovery (ICD) is one of the selected presidential initiatives. Its genesis was developed as a result of talks with the IPRT Industrial Advisory Board. This new, but increasingly vital, scientific arena is a strong fit with current faculty members and staff. With the addition of new hires in strategic areas, ISU is focused on becoming a world leader at the forefront of expanding combinatorial science.

So what is Combinatorial Discovery? It is a method to quickly find optimal solutions to complex scientific problems. It is a parallel process rather than a serial process.

It may be easier to explain the process using the pharmaceutical industry which pioneered the process. Chemists can make hundreds or thousands of compounds that may or may not be worth pursuing testing for therapeutic effectiveness; that may or may not be in the right proportions; that may or may not have the right “ingredients.” Previously, the process for testing potential drugs proceeded serially, moving from one step to the next to determine whether a certain drug compound might prove effective. Now, through combinatorial discovery, it is possible to screen hundreds of possibilities at the same time, a parallel process, to look for the best options to pursue – referred to as “hot spots” – which saves significant time and costs. All the major drug companies are now using the process of combinatorial discovery and can synthesize, test and eliminate hundreds of thousands of possibilities a week.

The ICD is employing the combinatorial process in materials and interfacial sciences to develop new catalysts, adhesives, and lubricants, and to examine fundamental questions related to biocompatibility and drug delivery. Combinatorial scientists work with

“libraries” that are a collection of possibilities. Perhaps there are 10,000 combinations that should be tested for effectiveness and by using the parallel testing process, the hot spots for the target problem can be quickly identified.

The opportunities in combinatorial science are fabrication of new libraries and development of high throughput screening technologies and designing education and training programs to enable broad application of combinatorial science concepts. No such program with this breadth currently exists, and the demand for talented employees in industry has outpaced the supply pool. This demand reflects the fact that industry experts predict the breakthroughs in next generation materials will be driven by the combinatorial science work product.

The objectives of the ICD are a) to cross-fertilize interdisciplinary research teams from ISU’s top departments, programs, and research units; b) establish strategic partnerships with industry and national laboratories and c) create paradigms for research, education, scholarships and engagement that strongly overlap with ISU’s land grant mission.

The ICD also takes advantage of core state-of-the-art facilities like the Roy J. Carver Laboratory for Ultrahigh Resolution Biological Microscopy and the W. M. Keck Laboratory for the Fabrication of Microminiaturized Analytical Instrumentation.

Marc Porter is director of the ICD. Surya Mallapragada, Balaji Narasimhan, Keith Woo, and recent hire Andrew Hillier lead the program, but thirty-five other faculty members are contributing to the research and development. Faculty members from veteri-

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nary microbiology, agronomy, chemistry, physics, biochemistry, biophysics and molecular biology plus all of the engineering departments are involved in various ways, forming strong interdisciplinary teams to tackle the many facets of this research. Scientists from the ISU's Ames Laboratory are also playing key roles, as are those from partners such as the National Institutes of Standards and Technology.

A proposal to the NSF-IGERT program and to the NSF Science and Technology Centers (STC) program (full proposal submitted February 2004) are part of the long-range strategy to support the ICD. Key industrial partnerships, which include internship opportunities, are also being formed.