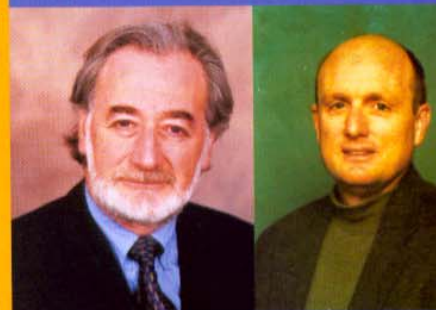


The Urge to Converge

Collaboration Sparks Innovation for Colorado Bioscience

By Dan Christopherson



Above left: Dr. Mervyn Jacobson, President/CEO, XY Inc.

Above right: Dr. Richard Casey, founder and Chief Scientific Officer, RMC Biosciences.

Left: Chris Shapard, Director of Colorado Biosciences and Emerging Technologies Initiative.



Splicing Fusing Adapting Interfacing Combining

These are connective bywords of the biosciences.

Add to that lexicon another word that embodies the direction of bioscience in Colorado: convergence.

Increasingly, professionals and organizations with varied expertise are coming together to spark new products from a variety of technological combinations. For example, photonics-medical devices, nanotech-photonics, IT-biotech, and alternative energy-biotech.

Proactively bringing together the state's leaders in these disciplines is one of the central strategies of the state's action plan to grow Colorado's bioscience cluster.

While several academic and industry groups are committed to creating collegial, interdisciplinary relationships, the official responsibility for weaving

together the statewide efforts of seemingly disparate bioscience players falls chiefly to Christine Shapard. She is the director of the state's Biosciences & Emerging Technologies Initiative, part of the Office of Economic Development and International Trade (OEDIT).

"Convergence is happening faster in the bioscience field, even faster than we thought it would," she says. "We are focusing on it, taking advantage of Colorado's unique technology assets to move ourselves ahead of the pack."

That focus is embodied on a single floor of the same downtown Denver office building where her office is headquartered. The brainchild of OEDIT Director Brian Vogt, it is called the Advance Colorado Center. In partnership with the University of Colorado at Denver and Health Sciences Center, it brings together non-profit associations and industry support programs under one roof.

Shapard says it is indicative of the state's resolve that the new center became a reality only five months after the idea

was first conceived. She sees this new office suite – opened in 2004 – as an important catalyst for convergence.

The Colorado BioScience Association became the first official tenant. Since then, several other organizations with a stake in biosciences have moved in, including CTEK Venture Centers, the Colorado Software and Internet Association, the Colorado Environmental Business Alliance/P3, the Colorado Film Commission and the Colorado Alliance for Microenterprise Initiatives. The Colorado Nanotech Initiative is set to move in by mid-2005, as is the Colorado Manufacturers Association.

By bringing together associations representing various technological disciplines, the center leverages their membership bases, networks of contacts and intellectual capital. The center also promotes dialogue between association leaders, whether it is a casual conversation in the center's coffee room or more formal interactions such as trade missions and industry conferences.

Shapard says the relatively compact size of the bioscience industry in Colorado



"Call Me Madam," the first filly in the world to have her sex predetermined, chases after her mother. Photo courtesy of XY Inc.

helps engender convergence. "Clusters form easily here. People tend to hear about each other and forge their own alliances."

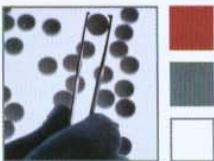
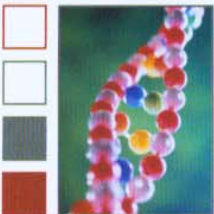
An interesting example of bioscience convergence is the linkup of agricultural animal biology, genetics, fluidics, optics and photonics. XY Inc. in Fort Collins

provides sex selection technologies to the U.S. and international dairy and livestock industries, among others. To do so, it employs a flow cytometer to sort "X" and "Y" chromosome-bearing sperm populations to help achieve desired sex-selected outcomes in

artificial insemination with at least a 90 percent accuracy rate.

In this case, XY's genetics expertise converged with two other entities, the bovine and equine breeding research group at Colorado State University (CSU) Animal Reproduction and Biotechnology Laboratory, and Cytomation, a medical technology firm manufacturing flow cytometers that rely heavily on photonics.

Dr. Mervyn Jacobson, XY's president and CEO, and the CSU Research Foundation, remain two of the major shareholders of the privately held XY Inc. Dr. Jacobson also was chairman and an early investor in Cytomation, a company that developed hardware and software to speed up the flow cytometry process over the existing state of the art. His ownership ended in 2001 when Cytomation merged with Danish-owned Dako to become DakoCytomation.



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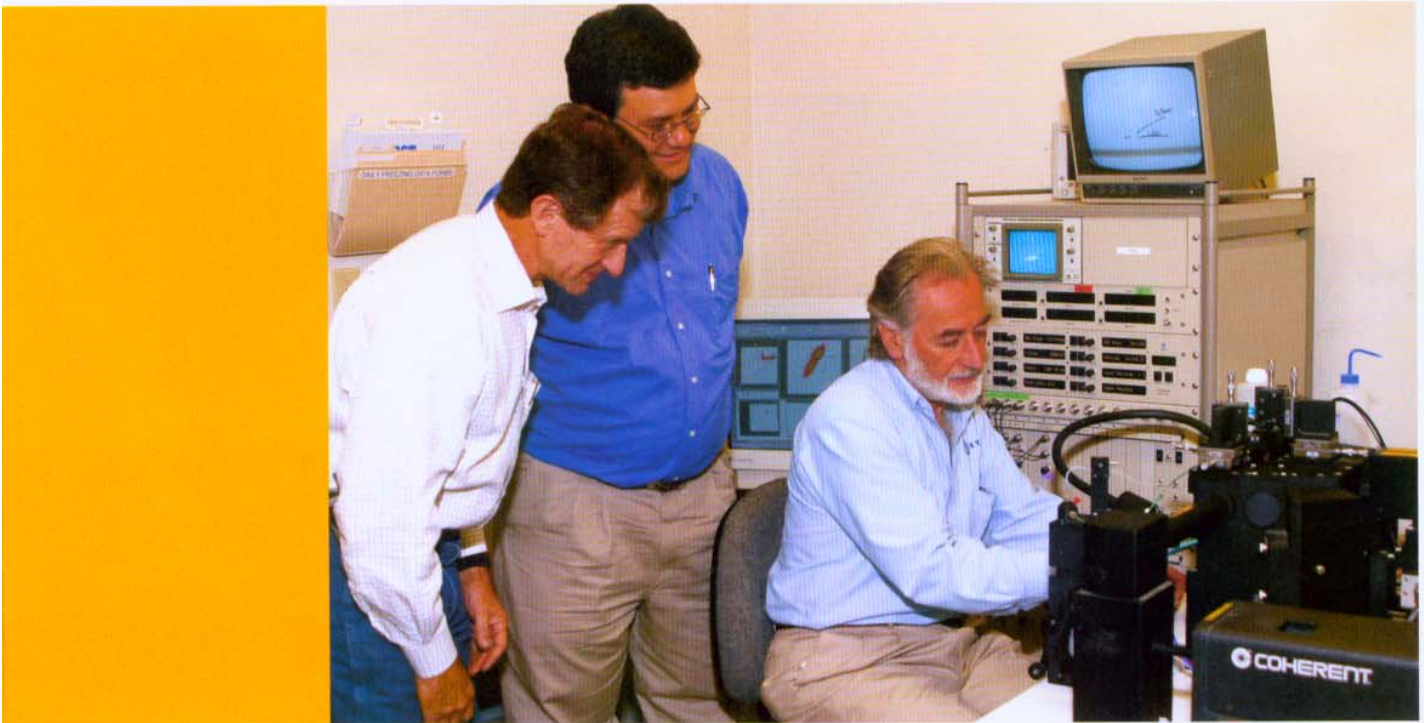
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XY Inc. CEO Mervyn Jacobson (seated) with Maurice Rosenstein and Juan Moreno, partner-owners of Inguran, XY Inc.'s first commercial licensee in the United States. Photo courtesy of XY Inc.

DakoCytomation's MoFlo SX flow cytometer (high-speed cell sorter), employed by XY, utilizes photonics technology to excite fluorescent dye in each sperm, then assemble and focus the fluorescent pulses on a detector that converts light into electrical signals; the signals are subsequently transformed into digital information and conveyed to a computer that controls the sorting process. XY Inc.'s early successes include, in 1998, the world's first sex-selected foal and, the following year, the world's first sex-selected calf, using frozen sexed sperm and artificial insemination.

Reflecting on the convergence phenomenon, DakoCytomation Vice President of Flow Cytometry, Ulrik Cordes, notes that flow cytometry itself is the result of convergence of the motivations and interests of physicists, biochemists and biologists. He feels the XY example is the perfect illustration of diverse disciplines coming together serendipitously to create a new bioscience solution.

"We developed our flow cytometers chiefly to deal with cancer cells," says Cordes, a biochemist by training. The idea of using the equipment as a workhorse to sort X's and Y's never entered into the equation as the company's flow cytometers evolved. "The only common denominator between what we designed our products for and what XY does is cells. That's all." But such re-purposing is a distinguishing characteristic of convergence, and he points out that the Jet Propulsion Laboratory has expressed an interest in someday using his company's products to learn more about life on Mars.

After the cells are sorted, diagnostic data is the bottom line for DakoCytomation. Thus, IT plays an integral role in the company's products and success, just as it does for many of the state's bioscience companies. In Colorado, the IT companies involved in supporting the bioscience field range from sales and support offices of internationally prominent names such as IBM Life Sciences to startups working hard to make a name for themselves.

Take, for example, another Fort Collins company, RMC Biosciences. Its name reflects its market niche, providing computer aided drug design services for the biopharmaceutical industry.

Convergence, in a sense, is RMC's business. According to the company's founder and Chief Scientific Officer, Dr. Richard Casey, "We are at the intersection of IT, bioinformatics and computational resources to serve the biopharma industry."

Colorado biopharms that are not large enough to afford computational modeling and bioinformatics capabilities turn to RMC. Although the company has just three employees, RMC's know-how, computational resources and molecular modeling capabilities allow smaller companies to tap into immense databases. RMC helps small biopharms screen out thousands of drug experiment options that prove to have little chance of becoming drug candidates, thus obviating the need to proceed to what would otherwise be unnecessary, costly and time-consuming in vitro and in vivo tests.

Another "small subject" generating growing interest is nanotechnology, the manipulation of matter at the molecular and atomic level to create new products. (A nanometer is about one-hundred thousandth the width of a human hair.) Experts expect nanotech to play an increasingly prominent role in bioscience convergence in Colorado.

The state currently ranks third among all 50 states in nanotech potential according to a study released earlier this year by Lux Research. This was attributed to a favorable business climate and the presence of university and federal labs in the Denver and Boulder area.

Dr. Louis Hornyak, one of the founders of the Colorado Nanotech Initiative, says that while nanotechnology is applied to many fields, Colorado's bioscience enterprises stand to benefit significantly from the state's budding nanotech community.

"Nanotech will enable the biosciences in many ways. After all, bioscience is about Mother Nature, and Mother Nature is the ultimate nanotechnologist. At the atomic and molecular level, you don't have functionality. The nano level is where combinations of atoms and molecules occur," he says, enabling functionality.

Hornyak believes Colorado's medical device industry will soon leverage nanotechnology's key functional advantages of speed, surface impact and inherent property stability. "Nanotech is where things happen extremely quickly, immediately impacting a tremendous amount of surface area," he says. Material addressed on a nanoscale level exhibits significantly different, more stable properties, opening up a world of scientific and manufacturing possibilities. "This will revolutionize bioscience."

Some companies are ahead of the nanotech curve.

Metafluidics, in Golden, brings together bio and nano in its cell sorting technology, which combines microfluidic flows and optical traps to create lab chips for microbiological research.

Zettacore, located in Denver, is the state's premier user of nanotechnology. Zettacore develops molecular memory technology and products for semi-conductors. It uses molecules to store data on semi-conductor devices. Molecular properties remain stable at the nano level, permitting very small scaling.

Another example of nanotech's impact is ALIO Industries of Wheat Ridge. The company designs and builds precision equipment for nano precision applications, including biomedical applications. The company's stage devices control motion on micro and nano scales. Its three-axis and six-axis robots are enabling advances in fiber optics alignment and sub-micron automation. Such technology opens new opportunities for medical device innovation.

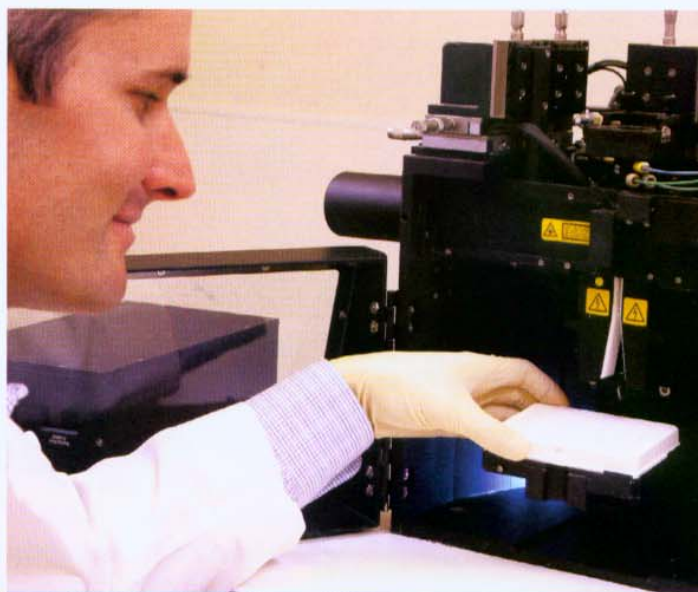


Photo courtesy of DakoCytomation.



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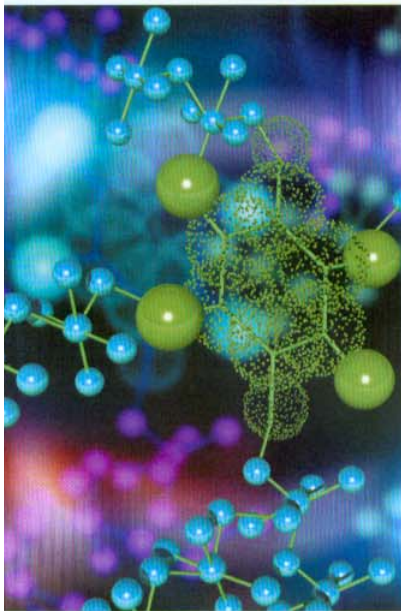
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Laser technology figures prominently in convergence. Dr. Silvia Mioc heads the Colorado Photonics Industry Association, a group promoting the role of photonics in convergence. The 70-member association hosts events focusing on biopharm, nanotechnology and homeland security, and maintains close contact with the Colorado BioScience Association and the Colorado Nanotech Initiative.

"Photonics is both an industry and a technology," Mioc says. "It serves many different industries, including the biosciences. Because photonics is non-invasive and portable, it has many bioapplications." She notes, for example, photonics is fundamental to the field of oximetry, which uses light to analyze and determine hemoglobin oxygen levels.



Nanotech and photonics converge at Spectranetics in Colorado Springs. The company's technology features an excimer laser system for minimally invasive cardiovascular procedures. Laser catheters are used to adapt to circumstances where the goal is to ameliorate blood flow.

To promote the application of photonics, among other technologies, the state set up the non-profit Colorado Advanced Technology Center to rent photonics

equipment to bioscience and other technology companies. Currently housed in Longmont, plans are underway to move the center to the University of Colorado – Denver and Health Sciences Center.

Emblematic of the trend toward convergence, the Health Sciences Center itself is moving to the new Fitzsimons campus in Aurora. "Fitz," as it is known, is a bioscience park where medical academicians, students and researchers can join with hospitals, clinics and nascent biotech, pharma and medical device companies to bring a wide, new spectrum of bioscience discoveries to light.

In Colorado, convergence is more than just a byword, it is an attitude. Every day, at every level, it is helping the industry evolve in exciting new directions. ♦

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