

Annual Report Fiscal Year 2013

NDSU Wheat and Durum Continue to Reign

Executive Summary by Dale Zetocha



The NDSU Research Foundation's licensing revenue reached a new record of over \$2.17 mil-

lion in FY-13. The 'Faller', 'Barlow', 'Glenn', and 'Prosper' wheat varieties, and the 'Dakota Pearl' potato variety, along with the 'Eclipse' black bean were the leading licensing revenue contributors.

Fifty-one licenses were executed of which fifteen were exclusive, and 36 nonexclusive. New technologies and varieties licensed include the liquid cyclohexasilane technology, 'Dakota Russet' potato, 'Elgin-ND' wheat and 'Rio Rojo' small red bean.

NDSURF has distributed approximately \$13.5 million in license and research fees to NDSU Agricultural Departments/Units and breeders/ inventors since FY-94. NDSURF maintains two endowments that support the spring wheat and durum wheat breeding programs. A total of \$647,709 was added to the spring wheat endowment in FY-13.

NDSURF continues to pursue multiple licensing opportunities for technologies resulting from the great research at NDSU. A few start -up companies were in the process of being formed in FY-13 that will likely result in licenses in the next year.

'Barlow' Hard Red Spring Wheat, known for its high yield potential, superior baking quality and resistance to disease

Supreme in North Dakota Wheat generated over \$960,000 in research fee/royalty revenue to the NDSU Research Foundation in FY-13, of which a portion will be used to support continuing wheat breeding research at NDSU. The ND Agricultural Experiment Station at NDSU, has developed four of

the top five hard red spring wheat varieties, accounting for **nearly 46%** of the 5.70 million acres of spring wheat planted in North Dakota in 2013. The top hard red spring wheat variety planted in North Dakota was 'Barlow' with 18.0% of the acres, followed by 'Glenn' with 10.1% and then 'Faller' with 9.0% and newly released 'Prosper' at 8.8%.

NDSU-developed varieties were planted on **nearly 53%** of the acres in North Dakota with nine of the top nineteen spring wheat varieties planted in 2013. The 'Mott', 'Steele-ND', 'Howard', 'Reeder' and 'Alsen' varieties were the other NDSU-developed varieties planted. Several of these varieties were planted in the neighboring states of Minnesota, South Dakota, and Montana. 'Glenn', 'Barlow', 'Faller'

and 'Prosper' have also been licensed by the NDSU Research Foundation in Canada. Dr. Mohamed Mergoum, NDSU's spring wheat breeder, is responsible for developing most of these varieties.

Even more impressive is that nine of the top ten durum wheat varieties, accounting for **over 92%** of the 840 thousand acres planted in North Dakota in 2013, were developed at NDSU. The top durum wheat variety planted in North Dakota was the 'Divide' variety with 33.4% of the acres, followed by 'Alkabo' with 19%, 'Mountrail' with 12.7%, 'Tioga' with 10.7%, 'Lebsock' with 10.3%, 'Grenora' with 2.3%, 'Dilse' with 1.5%, 'Ben' with 1.5%, and 'Pierce' with 1.0%. Several of these durum varieties were also planted in Montana. Dr. Elias Elias, *University Distinguished Professor* in Plant Sciences, is NDSU's durum wheat breeder who developed these varieties. The 'Divide', 'Alkabo', 'Grenora', and 'Tioga' varieties generated over \$68,000 in research fee/royalty income in FY-13 to the NDSU Research Foundation which also in return, provides partial support to the NDSU durum breeding research program.



Dr. Elias Elias, NDSU's Durum Wheat Breeder and University Distinguished Professor of 2012

The planted acreage statistics are based on a survey of wheat and durum producers conducted in June by the North Dakota Field Office of USDA's National Agricultural Statistics Service.

FACTS: NDSU is recognized as one of the nation's top 108 public and private universities by the Carnegie Commission on Higher Education's elite category of "Research Universities Very High Research Activity". NDSU has averaged well over \$100 million in research expenditures for the last several years. The NDSU Research Foundation's intellectual property licensing revenue continues to rank high nationally, relative to other universities and/or associated research foundations without medical schools, other land grant universities with and without medical schools, and those peer institutions as defined by the North Dakota University System.

Dole gtocho

Patent Pending LEAP Technology Used in 'Smart Paper'

NDSU

team at the NDSU

Center

noscale

and

Re-

Founda-

for Na-

Engineering (CNSE) located in

Science



Dr. Val Marinov holds a prototype "smart paper" document realized in the form of an RFIDenabled "banknote," fabricated using the LEAP technology. The image in the inset is a backlit photograph clearly showing the embedded RFID antenna and chip.

the Research II building of the Research and Technology Park. The process called LEAP or Laser Enabled Advanced Packaging allows for contactless laser-assisted assembly for ultra-small components to be placed at specific locations and orientations within flexible substrates such as paper. With the addition of RFID chips embedded in the paper or potentially a host of other substrates, tracking is possible, thus making it "smart paper". The process is also cheaper, faster, and more precise than current methods of tracking. Another major benefit of smart paper could be to prevent counterfeiting of currency and important documents. Dr. Marinov and his team are continuing to develop this technology for potential scale-up for mass production and cost reduction.

The LEAP process could be used in many other applications, including tracking devices, RFID tags, paper currency, smart cards, lottery tickets, voter ballots, mass transit passes, and wearable electronics as well as for assembling LED's or MEMS components. A number of companies have expressed interest in this technology and discussions are in the works. With the right industry partner, "smart paper" could be in the marketplace within the next few years.

"LEAP is a disruptive technology because it extends the capabilities of electronics packaging beyond what is possible today with the conventional robotic ("pick-and-place") methods. LEAP enables the high-rate, precision assembly of electronic and other discrete components, such as MEMS components, with dimensions well below those possible with the conventional methods." states Dr. Val Marinov.

Technology Licensing Updates



Elinor Specialty Coatings, LLC solves problems in coatings-related markets through technology and scientific research. Elinor is concluding successful field trials and marketing BronzeShield[™], a reversible coating that addresses a challenge in the maintenance and preservation of bronze art and monuments, to conservators across the country.

BronzeShield[™] was developed from technology Elinor licensed from the NDSU Research Foundation in 2011. Elinor expects to have their first sales of BronzeShield™ within the next few months. For more information go to : http://www.elinorcorp.com

AkzoNobel

AkzoNobel Aerospace Coatings is the global leader in the manufacture, development and supply of coatings for the OEM and MRO sectors of the Commercial, Airline and General Aviation markets as well as the Military Aerospace and Military Ground Equipment markets. In 2006, Akzo Nobel Aerospace Coatings, Inc., entered into a license agreement for exclusive use of an anticorrosion magnesium primer coating for aluminum substrates to be used in the aerospace industry. This coating, developed at NDSU's Department of Coatings and Polymeric Materials, uses magnesium rather than the current chromium materials which are known to be toxic and carcinogenic. After considerable Department of Defense (DOD) testing on airplanes and further development, Akzo Nobel has made modest sales of this coating in the past two years and is working to further develop it, gain military and commercial specifications, and expand the market. Approvals have been achieved in European military and commercial markets and in the North American general aviation sector. For more information go to : http://www.akzonobel.com

Dakota Technologies Inc., located in Fargo, ND was founded in 1993 to develop fluorescence-based instrumentation to map subsurface petroleum contamination. Dakota continues to manufacture and sell petroleum contaminant detection identification and screening products in several countries. Dakota also provides site characterization services in 35 states, Canada and Europe. The NDSU Research Foundation holds an equity position in Dakota. For more information go to : http://www.dakotatechnologies.com

Technology Licensing Updates Continued



The term "Big Data" is used by Treeminer, Inc. to represent the challenge of analyzing ever increasing volumes of data with limited computer resources. Treeminer is meeting that challenge with the patented data mining technology package it licensed from the NDSU Research Foundation back in 2011. In the past year, Treeminer successfully introduced this award winning Vertical Data Mining technology developed at NDSU by Dr. William Perrizo. The crux of this technology is that it organizes data in thin vertical strips rather than horizontally. By organizing data vertically and then compressing it into a patented data structure called a pTree (predicate tree), dramatic reductions in analysis times can be gained over existing methods. Treeminer's initial product using this technology, *vMiner*, has been completed and is currently in trial with several commercial customers. *vMiner* has demonstrated clear and significant performance advantages for the analysis of structured data such as database or spreadsheets and images, as well as unstructured data, such as text documents. Treeminer's product literally takes analysis tasks that could take hours or days to complete and does them in minutes.

Over the past year, Treeminer made its first sale to a public sector customer, and they are expecting additional revenue from that sector this year. Treeminer's value proposition is simple. The world will collect more data this year than in the entirety of human existence combined! This data, if harvested, can provide unprecedented benefits. To commercial organizations, this data represents both revenue and productivity opportunities. To medical firms, this data will help in seeking cures for diseases. To public sector customers, it will help analyze data, so that they can provide more efficient services to its citizens. Treeminer is using this Vertical Data Mining technology to revolutionize the data mining market, doing in minutes what currently takes hours or days, thus potentially benefiting us all. "We are finding that the technology developed at NDSU is relevant to the problems facing large organizations overwhelmed with data analysis" said Mark Silverman, CEO. "While we still have work to do to establish our technology in the market, we are extremely pleased with the progress we've made to date, and the opportunities in front of us."

For more information go to : http://www.treeminer.com



c2renew corporation, a company that was founded to provide renewable based materials to a variety of companies that would not only benefit agricultural producers, but also be staffed with engineers who want to stay in the region with high-tech, well-paid positions. In 2012, c2renew signed a license and equity agreement with the NDSU Re-

search Foundation for a technology that creates performance-driven biocomposite materials by incorporating agricultural by-products into plastics for a wide range of applications. Dr. Chad Ulven developed this technology along with his team in the Mechanical Engineering Department of NDSU.

Corey Kratcha, CEO of the company is also an NDSU graduate and said they have closed their angel investment round of funding and have continued to build out their customer portfolio. They have also expanded into providing engineering services to a couple of companies. "The past year has been an exciting year for growth within c2renew. We have begun working with new companies and within new industries and look forward to building a long-standing company," - Corey Kratcha, CEO



Biomass (upper left) compounded with resin (lower left) produces c2renew's biocomposite material (lower right) which can be molded into parts for end use companies

For more information go to : http://www.c2renew.com



Fluorescence Innovations (FI), a spin-off of Dakota Technologies, which designs, builds and markets instrumentation that measures the fluorescence lifetime properties of biological systems,

transferred its operations from Bozeman, MT to Minneapolis, MN in the second half of 2012. The move was made to foster closer relationships with the University of Minnesota, which is working with FI on their innovative drug discovery platform, particularly as related to live cell assays. The work is being funded through various grants, including an NIH STTR award, as well as internal funding. In parallel, Fluorescence Innovations continues to produce new instrumentation concepts, including a microplate reader that records full fluorescence spectra. Various partnering or license arrangements are in discussion to bring the FI products to market. For more information go to : http://www.fluorescenceinnovations.com

Horticultural Varieties Contributing to Income in FY-13

Copper Delight™ Juniper Dakota Goldcharm® Spirea Dakota Goldrush® Potentilla Dakota Sunspot® Potentilla Prairie Gem® **Flowering Pear** Prairie Spire® Green Ash Dakota Pinnacle® Asian White Birch Blueberry Delight® Juniper Snow Mantle® Gray Dogwood Prairie Radiance® Winterberry Euonymus Copper Curls® Pekin Lilac Northern Acclaim® Thornless Honey-locust Prairie Dream® Paper Birch Prairie Horizon® Manchurian Alder Prairie Torch® Hybrid Buckeye Prairie Statesman® Swiss Stone Pine Prairie Expedition® American Elm Prairie Stature® Hybrid Oak Prairie Reflection® Laurel Willow Royal Splendor® Norway Spruce Northern Flare® Sugar Maple Prairie Pioneer® Dwarf Chinkapin Oak



| Royalties & License Fees | | | |
|--------------------------|-----------|--|--|
| Barley | 114,510 | | |
| Durum | 68,120 | | |
| Edible Beans | 221,057 | | |
| Flax | 2,935 | | |
| Herb Adj. | 41,873 | | |
| Horticulture | 41,640 | | |
| Oats | 97,304 | | |
| Potatoes | 301,627 | | |
| Soybeans | 60,589 | | |
| Wheat | 960,554 | | |
| Total | 1,910,209 | | |



3%

FY13 Distribution for Agricultural Re-

FY13 Agricultural License Revenues were distributed to the following entities: 1.255 1,255 17,505 10,802 48.534 748 10.678 6.304 24,805 37,443 240,771 397,591 152 152 437 437 1,761 1,841 5,549 68 730 483 21,080 31,511 886 886 2,023 2,023 289 289 4,873 4,873 553 553 1,892 27,096 1,262 1,841 68 608 927 20.499 NDSU Plant 4,879 1,067 9.859 66,292 1,873 48,726 132,695 NDSU Plant 172,709 172,709 43,764 14,578 56,541 1,004 16,016 19,485 29.464 74.954 30,546 88.135 374,488 927 927 **RF Endov** 8.226 2.228 16,580 182 2,669 2.325 7.716 14,377 4,366 64,698 123,366 29.364 198.376 658,714 78,283 32,355 139,105 2,071 28,115 63,323 41.145 1,270,851

ND Agricultural Research License Income

NDSU Research Foundation



NDSURF Mission:

The mission of the NDSU Research Foundation is to provide support for NDSU by protecting, adding value to and commercializing intellectual property that is developed through research activities at NDSU.

Origin of NDSURF:

The NDSU Research Foundation was established May 30, 1989, and incorporated in North Dakota as a scientific and educational not-for-profit organization under Section 501 (c) (3) of the Internal Revenue Code to interact with business and industry and to expand NDSU's ability to commercialize its research discoveries.

PLORE

NDSU Research Foundation Licenses 'Dakota Russet' Potato

Hoverson Farms and R.D. Offutt Company entered into an Exclusive License Agreement with the NDSU Research Foundation for 'Dakota Russet', a potato variety developed at NDSU. 'Dakota Russet' is a dual-purpose potato in that it can be used as fresh tablestock, or processed into frozen items for sale in the marketplace.

The National Fry Processing Trials (NFPT) supported the identification of 'Dakota Russet' (ND8229-3) as a top performing variety with high potential for Quick Serve Restaurants (QSR). The 'Dakota Russet' has been categorized as having specific gravities equal to or better than Burbank, low sugars, marketable yield better than Burbank, and lower acrylamide levels than Burbank. In QSR analysis, 'Dakota Russet' displayed processing characteristics that are required for meeting QSR customer requirements.



⁶Dakota Russet' has attractive tubers with golden flaky skin and creamy white flesh

The favorable environmental profile of 'Dakota Russet' includes its



Excellent French Fry Quality

resistance to sugar ends, Verticillium wilt, and several water rots, in addition to a reduced need for nitrogen. 'Dakota Russet' presents an excellent opportunity to develop best practices for

reducing the use of pesticides, fumigants and fertilizers while enhancing sustainable agricultural practices. Reducing the carbon footprint in the growing process helps make 'Dakota Russet' a potentially "greener" potato of the future.

The license rights enable Hoverson Farms and R.D. Offutt Company to produce, promote and commercialize 'Dakota Russet' in the U.S. and Canada. Hoverson Farms and R.D. Offutt Company are in the process of producing seed for large scale commercialization of the Dakota Russet. Mini-tubers and a small quantity of first field generation seed were produced in 2013. Seed increases will continue as Hoverson/R.D. Offutt Company move towards industry commercialization.

For more information go to http://www.hoversonfarms.com/.

Top Horticultural Varieties Contributing to Revenue in FY13

The best selling horticultural variety contributing to revenue in FY13 was Dakota Pinnacle® Asian White Birch, followed by Dakota Goldcharm® Spirea, Dakota Sunspot® Potentilla, Prairie Dream® Paper Birch, and Prairie Spire® Green Ash. For more information on these and our other horticultural varieties, visit our website:





Dakota Goldcharm®



Dakota Sunspot®



Prairie Dream®



Dakota Pinnacle®

NDSU Agricultural Varieties

Contributing to Revenue

11 110

arley

Conlon MUSA 31 N. Dayman Pinnacle Rawson Stellar-ND

Durum

Alkabo Divide Grenora Tioga

Edible Beans

Avalanche Navy Bean Eclipse Black Bean Lariat Pinto Bean Maverick Pinto Bean ND307 Pinto Bean Stampede Pinto Bean Rio Rojo Small Red Bean

Carter

Beach Dawson Drover Hi-Fi Maida Newburg Nugene Rockford Souris Taipan

Potatoes AC Peregrine Red Dakota Crisp Dakota Jewel Dakota Pearl Dakota Rose Dakota Russet Dakota Trailblazer Goldrush NorDonna

NorValley Soybe Ashtabula Blue Horizon ProSoy Sheyenne Traill ND1005T ND1100S

Whea Barlow Faller Glenn Howard Mott ND901CL Plus Steele Prosper





gricultur

Treasure Valley Seed Company Licenses 'Rio Rojo'

Treasure Valley Seed (TVS) located in Homedale, Idaho entered into a license agreement with the NDSU Research Foundation for 'Rio Rojo', a small red bean variety developed at NDSU. TVS supplies high quality seed products that are produced from the arid western growing regions of the U.S. The license is non-exclusive in Minnesota and North Dakota, and exclusive in all other U.S. states. 'Rio Rojo' recently received Plant Variety Protection and is noted for its superior yield – 11% higher than any other available small red bean variety. In addition, 'Rio Rojo' offers the highest level of disease resistance among all small red bean commercial varieties. 'Rio Rojo' will be available for distribution in 2014.

For more information go to : http://www.tvseed.com

Income

NDSU Research Foundation Statement of Revenues and Expenses

| July 1 | , 2012 | - June | 30, | 2013 | |
|--------|--------|--------|-----|------|--|
|--------|--------|--------|-----|------|--|

| Income | | | |
|---|-----------|-------------|-------------|
| Research Fees and Royalties | | \$1,898,683 | |
| License Fees | | 174,065 | |
| Patent Cost and Other Reimbursements | | 100,237 | |
| Litigation Settlements | | 18,482 | |
| Interest | | 10,034 | |
| Dividends | | 94,161 | |
| Contributions | | 500,000 | |
| Investment Return | | 580,104 | |
| Total Income | | | \$3,375,766 |
| Expenses | | | |
| Total Legal and Related | | 510,488 | |
| Patent | \$471,316 | | |
| Licensing | 8,253 | | |
| Plant Variety Protection and Related | 22,852 | | |
| Research Fee Collection & Other | 7,286 | | |
| Trademark | 781 | | |
| Total Salaries and Operating | | 373,076 | |
| Total Research Fees and Royalties Disbursed | | 1,204,278 | |
| NDSU Dept/College/NDAES | 790,028 | | |
| Breeder/Inventor | 399,798 | | |
| Non-NDSU Royalty Disbursed | 14,452 | | |
| Total Expenses | | | \$2,087,842 |
| Increase in Net Assets | | | 1,287,924 |
| Net Assets at Beginning of Year | | | \$3,681,209 |
| Net Assets at End of Year | | | \$4,969,133 |
| | | | |

NDSU Research Foundation Statement of Assets and Net Assets

June 30, 2013

| Assets (Foundation) | , | Market Value |
|--|-----------|--------------|
| Current Assets (Foundation) | | |
| Operating Checking and Savings | \$20,019 | |
| Fund 81294 | 1,909 | |
| Other Savings | 165,282 | |
| Prepaid Expenses | 13,551 | |
| Investments | 150 | |
| Total Current Assets | | \$200,911 |
| Property & Equipment | | |
| Office Equipment | 11,788 | |
| Less: Accumulated Depreciation | (11,788) | |
| Net Property & Equipment | | 0 |
| Other Assets | | |
| Plant Sciences Endowment Assets: | | |
| Durum Wheat Endowment | | |
| Money Market | 12,024 | |
| Mutual Funds | 1,587,498 | |
| Spring Wheat Endowment | | |
| Money Market | 11,839 | |
| Mutual Funds | 1,857,378 | |
| Total Plant Sciences Endowments | | \$3,468,739 |
| Sociology Endowment | | \$356 |
| Anthropology Endowment | | \$38 |
| University Studies Endowment | | \$59,750 |
| Math Endowment | | \$12,406 |
| Science & Math Endowment | | \$1,916 |
| ADHM Endowment | | \$3,176 |
| Assets (NDSU/RF Endowment) | | |
| Cash Accounts (Endowment) | | |
| Money Market State Bank and Trust | 60,080 | |
| Money Market Dain Rauscher | 139,912 | |
| Total Cash Accounts (Endowment) | | \$199,992 |
| Investment at Dain Rauscher | | -0- |
| Investment at State Bank and Trust | 721,854 | |
| Investment at Vanguard - S&P 500 | 332,948 | |
| Total NDSU/RF Endowment Investments | | \$1,054,802 |
| Total Other Assets | | \$4,801,175 |
| Total Assets | | \$5,002,086 |
| Restricted Assets (Foundation) | | |
| Restricted Assets - Anthropology | | \$38 |
| Restricted Assets – Math | | 12,406 |
| Restricted Assets - Plant Sciences | | 3,468,739 |
| Restricted Assets - Sociology | | 356 |
| Restricted Assets - University Studies | | 59,750 |
| Restricted Assets – Science & Math Endowment | | 1,916 |
| Restricted Assets – ADHM | | 3,176 |
| Restricted Assets - NDSU/RF Endowment | | 1,254,794 |
| Unrestricted ASSETS | | 167,958 |
| Total Restricted and Unrestricted Assets | | \$4,969,133 |

Three Plant Variety Protection Certificates (PVP's) Issued in FY13

'ND1100S' Soybean PVP 201200030 issued April 30, 2013, Breeder: Ted Helms



'ND1100S' is a small-seed, specialty-type soybean with high yield and good iron-deficiency chlorosis score. It is licensed exclusively to Blue Horizon, Inc.in Bloomington, MN.

'Prosper' Wheat PVP 201100402 issued July 16, 2012, Breeders: Mohamed Mergoum

'Prosper' has a very high grain yield, better than 'Faller' with good milling qualities and good baking properties. It is licensed in the Midwest and Canada.

'ND1005T' Soybean PVP 201100097 issued August 14, 2012, Breeder: Ted Helms

'ND1005T' Soybean was developed primarily for high yield, early maturity, tolerance to irondeficiency chlorosis, and high protein. It is licensed exclusively to SunOpta of Moorhead, MN.

Issued Patents FY13

Amorphous boron carbide films for P-N junctions and method of fabricating the same

US Patent No. 8,237,161 issued Aug. 7, 2012

Inventors: Anthony Caruso, Joseph Sandstrom, David Bunzow The example at the right is a P-N junction semiconductor device created from this technology. These boron-rich semiconductor materials can be used in high temperature, corrosive and radioactive environments.

Antifouling Materials Containing Cationic Polysiloxanes

US Patent No. 8,278,400 issued Oct. 2, 2012 Inventors: Bret Chisholm, David Christianson, Shane Stafslien, Philip Boudjouk, Johnson Thomas This is an environmentally friendly coating containing a biocide for use in marine or medical applications.

Siloxane Polymer Containing Tethered Fluoroquinolone

US Patent No. 8,283,432 issued Oct. 9, 2012 Inventors: Sane Stafslien, Bret Chisholm, Alexander Kugel This coating technology, which also includes issued patent 8,071,706, has applications in coating medically implanted devices for the prevention of microbial infection.

Anchored Polysiloxane-Modified Polyurethane Coatings and Uses thereof

US Patent No. 8,299,200 issued Oct. 30, 2012 Inventors: Dean Webster, Abdullah Ekin, Stacy Sommer This coating with excellent adhesion and mechanical strength could be used as marine anti-fouling coating or in anti-graffiti paints.

Functionalized Nanoceria Composition for Ophthalmic Treatment

US Patent No. 8,337,898 issued Dec. 25, 2012 Inventors: Manas Haldar, Sanku Mallik This is a drug delivery vehicle for the treatment of glaucoma.

Quaternary Ammonium Functionalized Cross-Linked Polyalkylsiloxanes with Anti-Fouling Activity

US Patent No. 8,372,384 issued Feb, 12, 2013 Inventors: Bret Chisholm, Partha Majumdar, Philip Boudjouk, Shane Stafslien This stable, polymeric, anti-fouling, and anti-microbial surface coating may have marine and biomedical applications.

Polyol Photosensitizers, Carrier Gas UV Laser Ablation Sensitizers, and Other Additives and Methods for Making and Using Same

US Patent No. 8,445,174 issued May 21,2013 Inventors: Dean Webster, Zhigang Chen This invention which also includes issued US Patent No. 8,114,567, utilizes polyol photosensitizers, carrier gas UV laser ablation sensitizers and other additives that can be used in making carrier films.

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Diagram of hCAII—a compound that blocks the activity of an enzyme believed to play a central

