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Equity Research

Healthcare | U.S. Biotechnology

3 September 2013

Intrexon Corp.

It takes time to change the world

We initiate coverage on XON with an Equal Weight rating, PT of $25. While we acknowledge Intrexon has the potential to become the best-in-class synthetic biology platform, we would like to see a more diversified portfolio of ECCs inked with major players in various fields. Our NPV valuation of $25 is based on a steady ramp-up in ECCs discounted 10%. While we see significant upside potential in the long run, we believe a more mature portfolio is necessary to give us comfort around risk/reward.

Synthetic biology is a nascent field with promising opportunities on the horizon. Synthetic biology, the science of applying engineering principles to biology, has increasingly garnered attention as a field with immense opportunities, although it remains primarily an academic focus today. Synthetic biology promises to offer real-world solutions to issues relating to global health, food production and environmental sustainability, but is still several years from large-scale commercialization.

Intrexon is uniquely positioned with a first-mover advantage in synthetic biology. Intrexon is the first synthetic biology company to employ a platform licensing model via exclusive channel collaborations (ECCs) to leverage its technology across a broad array of end-markets (healthcare, food, energy, and environment), while preserving economics. Backed by an extensive database of DNA components, the company offers a 'one-stop shop' suite of proprietary technologies and software to construct novel gene programs that can control specific cell functions.

Prime time for Intrexon: Can it successfully execute? To date, Intrexon has signed agreements with nine ECC partners. However, in the near- to medium-term, scaling up top-line revenues will rest on Intrexon's ability to accelerate its current rate of signing new ECCs. Beyond this, we believe securing ECCs with major market-leading players across sectors (which Intrexon has yet to do) will serve as a form of validation for its technology and source of upside. Until then, we seek to establish greater clarity around the timing and identity of future ECCs before becoming more constructive on the name.

XON: Quarterly and Annual EPS (USD)

	2012	2013			2014			Change y/y	
FY Dec	Actual	Old	New	Cons	Old	New	Cons	2013	2014
Q1	-3.55A	N/A	-7.54A	N/A	N/A	N/A	N/A	-112%	N/A
Q2	N/A	N/A	0.05A	N/A	N/A	N/A	N/A	N/A	N/A
Q3	N/A	N/A	0.09E	N/A	N/A	N/A	N/A	N/A	N/A
Q4	N/A	N/A	0.09E	N/A	N/A	N/A	N/A	N/A	N/A
Year	-18.77A	N/A	-0.22E	N/A	N/A	0.30E	N/A	99%	236%
P/E	N/A		N/A			73.4			

Source: Barclays Research.
Consensus numbers are from Thomson Reuters

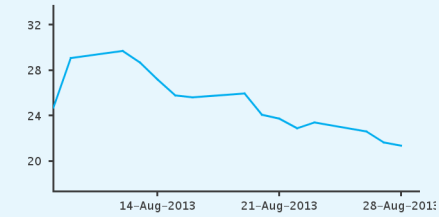
Stock Rating	EQUAL WEIGHT from N/A
Industry View	NEUTRAL Unchanged
Price Target	USD 25.00 from N/A

Price (29-Aug-2013)	USD 22.18
Potential Upside/Downside	+13%
Tickers	XON

Market Cap (USD mn)	2112
Shares Outstanding (mn)	95.21
Free Float (%)	36.08
52 Wk Avg Daily Volume (mn)	1.2
Dividend Yield (%)	N/A
Return on Equity TTM (%)	-38.72
Current BVPS (USD)	-64.19

Source: FactSet Fundamentals

Price Performance	Exchange-NYSE
52 Week range	USD 31.44-20.65



Link to Barclays Live for interactive charting

U.S. Biotechnology
Ying Huang, Ph.D.
1.212.526.5387
ying.huang2@barclays.com
BCI, New York

Christina Zhang, R.N.
1.212.526.9719
christina.zhang@barclays.com
BCI, New York

U.S. Biotechnology — **Industry View: NEUTRAL**

Intrexon Corp. (XON)

Stock Rating: EQUAL WEIGHT

Income statement	2012A	2013E	2014E	2015E	CAGR
Revenue ($k)	13,925	113,612	196,500	231,084	155.1%
EBITDA (adj)	N/A	N/A	N/A	N/A	N/A
EBIT (adj)	N/A	N/A	N/A	N/A	N/A
Pre-tax income (adj)	N/A	N/A	N/A	N/A	N/A
Net income (adj)	N/A	N/A	N/A	N/A	N/A
EPS (adj) ($)	-18.77	-0.22	0.30	0.40	N/A
Diluted shares (k)	5,533.7	82,139.8	114,140.5	119,847.5	178.7%
DPS	N/A	N/A	N/A	N/A	N/A

Margin and return data					Average
EBITDA (adj) margin (%)	N/A	N/A	N/A	N/A	N/A
EBIT (adj) margin (%)	N/A	N/A	N/A	N/A	N/A
Pre-tax (adj) margin (%)	N/A	N/A	N/A	N/A	N/A
Net (adj) margin (%)	N/A	N/A	N/A	N/A	N/A
ROIC (%)	N/A	N/A	N/A	N/A	N/A
ROA (%)	N/A	N/A	N/A	N/A	N/A
ROE (%)	N/A	N/A	N/A	N/A	N/A

Balance sheet and cash flow ($k)					CAGR
Tangible fixed assets	N/A	N/A	N/A	N/A	N/A
Intangible fixed assets	N/A	N/A	N/A	N/A	N/A
Cash and equivalents	10,403	185,595	381,363	487,061	260.4%
Total assets	151,646	305,212	508,818	619,959	59.9%
Short and long-term debt	N/A	N/A	N/A	N/A	N/A
Other long-term liabilities	1,150	3,408	5,895	6,933	82.0%
Total liabilities	66,540	72,453	216,150	254,192	56.3%
Net debt/(funds)	N/A	N/A	N/A	N/A	N/A
Shareholders' equity	85,106	232,759	292,668	365,767	62.6%
Change in working capital	9,663	-2,488	829	346	-67.0%
Cash flow from operations	-61,529	41,010	122,870	146,513	N/A
Capital expenditure	-7,491	-37,580	-64,997	-76,436	N/A
Free cash flow	N/A	N/A	N/A	N/A	N/A

Valuation and leverage metrics					Average
P/E (adj) (x)	N/A	N/A	73.4	55.9	64.7
EV/EBITDA (adj) (x)	N/A	N/A	N/A	N/A	N/A
Equity FCF yield (%)	N/A	N/A	N/A	N/A	N/A
EV/sales (x)	N/A	N/A	N/A	N/A	N/A
P/BV (x)	N/A	N/A	N/A	N/A	N/A
Dividend yield (%)	N/A	N/A	N/A	N/A	N/A
Total debt/capital (%)	N/A	N/A	N/A	N/A	N/A

Selected operating metrics				
SG&A/sales (%)	178.8	24.2	15.4	14.4
R&D/sales (%)	460.9	40.5	24.6	24.7
R&D growth (%)	-8.8	-28.3	5.0	18.0
SG&A growth (%)	36.0	10.5	10.0	10.0

Source: Company data, Barclays Research
Note: FY End Dec

Price (29-Aug-2013) USD 22.18
Price Target USD 25.00

Why Equal Weight? While Intrexon is nicely positioned as the first synthetic biology company with a platform business model, we believe large-scale application of synthetic biology across end-markets will take time. In our view, a more diverse ECC portfolio with major players would validate the technology and provide a more concrete path for the company.

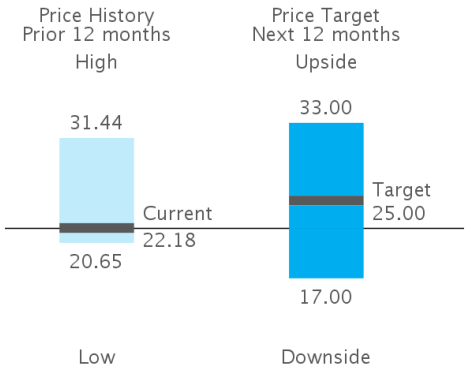
Upside case USD 33.00

In our upside case, we assume a higher rate of acceleration in signed ECCs in the outer years (200 total ECCs by 2018) as Intrexon gains critical mass. This leads us to $33/share.

Downside case USD 17.00

In our downside case, we assume no product is commercialized from the signed ECC partnerships and therefore no back-end royalties are received, and arrive at a value of $17/share.

Upside/Downside scenarios



Company Overview

Although synthetic biology is a nascent field very much still in its early innings, Intrexon has positioned itself as the first synthetic biology company to employ a unique, scalable platform model via exclusive channel collaborations (ECCs) to leverage its technology across a broad array of end-markets. The four key focus areas for Intrexon are healthcare, food, energy, and environment.

Over the last 15 years since the company was founded in 1998, Intrexon has amassed a large database of proprietary technology relating to assembling and building DNA. Ultimately, it aims to leverage that database to design, build, and regulate gene programs that can control specific cell function(s). Intrexon has a suite of complementary technologies to accomplish this, from its mAbLogix antibody discovery platform to its Laser-Enabled Analysis and Processing (LEAP) technology for cell identification, to its Cell Systems Informatics for mapping cellular pathways, to its UltraVector gene design and fabrication platform for building complex gene programs.

What is synthetic biology?

Synthetic biology is the science of applying engineering principles to biological systems, with the goal of regulating genes in a controlled fashion to achieve a desired function. According to syntheticbiology.org, a community of researchers committed to "engineering biology in an open and ethical manner," the definition of synthetic biology can be twofold: "a) the design and construction of new biological parts, devices, and systems; and b) the re-design of existing, natural biological systems for useful purposes."

By way of background, the field was born out of the discovery of deoxyribonucleic acid (DNA) in 1953 by Watson and Crick. DNA is the building block of life, containing the 'blue-print' for genetic information by encoding for the appropriate proteins and other chemicals essential to a living organism. The discovery of DNA has since led to a greater understanding of gene functions and interactions at the molecular level.

Although synthetic biology is still in its infancy, with the first international meeting on synthetic biology held only in 2004, the basic premise and concept of synthetic biology has been around for much longer. In the 1970s, scientists successfully created recombinant DNA by utilizing enzymes that could "cut-and-paste" DNA to combine DNA from more than one organism. A prime example is when the first synthetic insulin gene was inserted into E. Coli in 1978 (see Figure 1 for a timeline and evolution of the necessary tools for synthetic biology).

Synthetic biology has increasingly garnered attention as a field with immense opportunities, although it remains primarily a field grounded in academia and research. Synthetic biology holds the promise to offer real-world solutions to long-term pressing issues such as global health, food production, and environmental sustainability. However, it comes with its own set of challenges as well: questions remain around ethical and social concerns (especially from the public at large), intellectual property and potential legal infringements, and government regulation.

FIGURE 1

Timeline and Evolution of Tools of Synthetic Biology

1941	First functional program-controlled computer (Konrad Zuse)
1953	Crick and Watson describe the double helix structure of DNA
1960	First computer-aided drafting (CAD) program (Sketchpad)
1961	Discovery of mathematical principles in gene regulation
1971	First geneticall modified organisim (E. Coli)
1972	First synthetic gene (yeast)
1973	Cohen, Boyer, and Berg create first genetically engineered organism (E. Coli)
1974	First U.S. patent on rDNA (Stanely Cohen and Herbert Boyer)
1975	Asilomar Conference on Recombinant DNA
	Early genome sequencing techniques established
1976	First biotechnology firm founded (Genentech)
	NIH guidelines for Recombinant DNA
1978	Term "bioinformatics" coined
	Synthetic insulin gene inserted into E. Coli
1980	In Diamond v. Chakrabarty, the US Supreme Court rules that "a live, human-made micro-organism is patentable subject matter."
1982	U.S. FDA approves use of synthetic insulin
1983	Development of the polymerase chain reaction (PRC) DNA amplification technology
1984	First commercialized genetically modified food (Flavr Savr tomato)
1990	Human Genome Project (HGP) launched
1991	First public availability of the World Wide Web
1996	First cloned mammal (Dolly the sheep)
2000	International Human Genome Sequencing Consortium announces "working draft" of human genome
	Genetic oscillators and toggle switches published
2002	Rice genome decoded
	Chemical synthesis of polio virus genome
2003	First BioBrick DNA assembly standard published
	Human Genome Project completed
	Defense Advanced Research Projects (DARPA) synthetic biology study
2004	First international meeting on synthetic biology (Synthetic Biology 1.0)
2005	First International Genetically Engineered Machines (iGEM) competition
2008	Virus attenuation achieved via synthetic genome-scale changes in codon usage
2010	First fully synthesized self-replicating genome (Mycoplasma mycoides)
2013	Successful engineering of digital amplifying genetic logic gates and memory systems
	In Assoc for Molecular Pathology v. Myriad Genetics, the US Supreme Court rules that modified DNA can be patented but isolated naturally occurring human genes cannot

Source: Barclays Research, National Academy of Sciences

Technology Overview

Over the last 15 years, Intrexon has accumulated an extensive DNA database, industry know-how, and trade secrets from making DNA, including a large inventory of modular DNA components and an understanding of the rules that dictate their expression and activity. The ability to create unique vectors rationally and predictably is critical to scaling synthetic biology and allows Intrexon to be agnostic to a particular end-market. Instead, Intrexon can achieve results specific to an ECC across a wide swath of sectors and tailor its gene programs to focus on modifying a single gene to more complex programs controlling the expression of multiple genes.

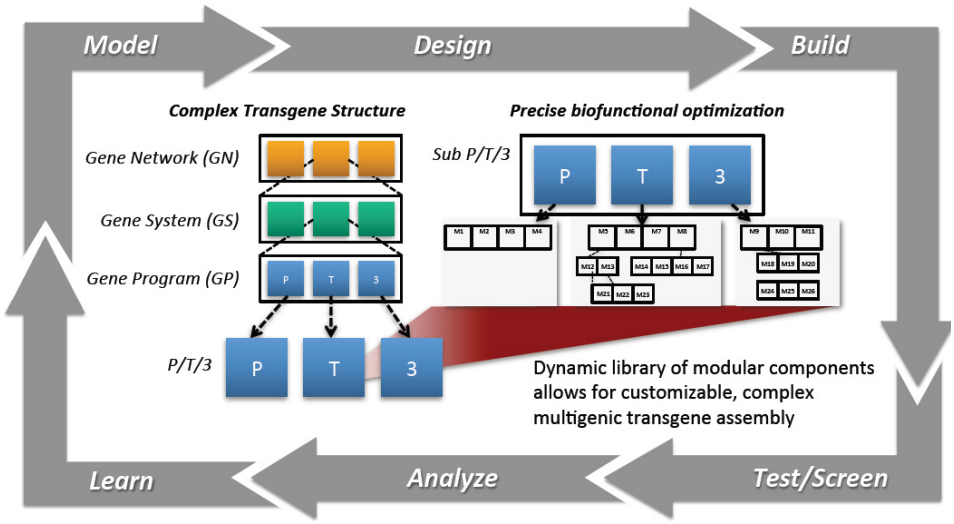
The key technologies that allow Intrexon to engineer these gene programs include:

- UltraVector and its associated library of DNA parts for constructing gene programs
- Cell Systems Informatics for mapping cellular pathways
- LEAP (Laser-Enabled Analysis and Processing) for cell identification and selection
- mAbLogix, an antibody discovery platform

What is UltraVector? UltraVector is an integrated software system that draws upon Intrexon's extensive library of modular DNA components in order to design, produce, and test biomaterials at the cellular level. UltraVector removes some of the guess-work that goes into re-engineering genes to create a desired product, whether it is to dial up or down a certain therapeutic effect, lower the cost of manufacturing, or enhance a biological function. It does so by using a computer-guided "design-build-test" model (see Figure 2).

In the "design" phase, statistical tools governed by Intrexon's proprietary set of defined rules will determine what the best "operating system" (a.k.a. cell of interest, or vector) is to make DNA. Consequently, in the "build" phase, UltraVector will assemble DNA parts together from its library of components in the most efficient manner using an underlying algorithm to optimize for complexity (e.g. multigenic) or scale (e.g. for industrial scale production).

FIGURE 2
UltraVector Platform for DNA Manufacturing



Source: Company Reports

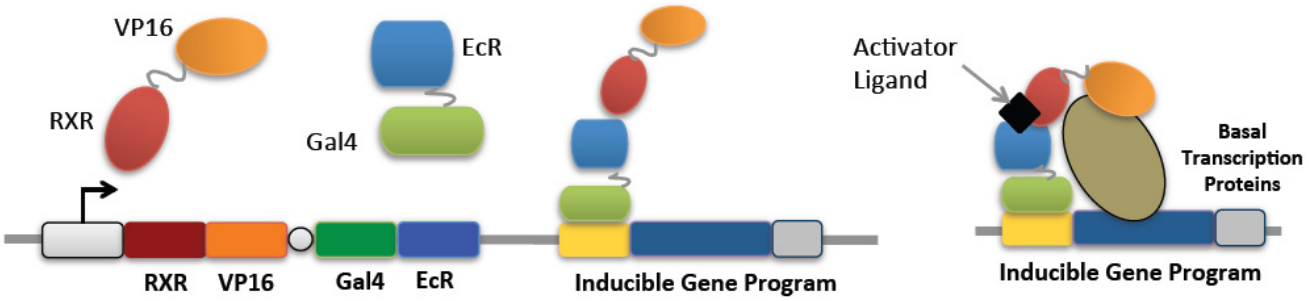
Within the UltraVector library, Intrexon has a number of differentiating technologies that can be used to improve gene regulation with greater finesse. Two examples include: 1) the RheoSwitch Therapeutic System (RTS) for more controlled gene expression via an activator ligand; and 2) Attsite recombinases for more specific gene insertion.

What is RheoSwitch Therapeutic System? As detailed below in Figure 3, RTS allows for targeted proteins or enzymes of interest to be controlled precisely through a three-part gene program:

1. the switch components (in Figure 3 below, there are two receptor protein fusions: VP16-RXR; Gal4-EcR form unstable and unproductive heterodimers without a ligand)
2. the activator ligand (in the presence of this ligand, the heterodimers become stable and bind to the inducible promoter, "switching on" cell expression)
3. the inducible promoter (which is customizable; basal transcription proteins are then recruited and the target gene is consequently transcribed)

A specific example of RTS technology being incorporated into a gene program can be found within Intrexon's ECC with ZIOPHARM Oncology. The lead candidates of this ECC are DC-IL-12 and Ad-IL-12 for the treatment of melanoma and breast cancer. Both assets utilize RTS as a biological "switch" to regulate expression of IL-12, a potent anticancer cytokine, although the vector differs (DC-IL-12 uses the patient's dendritic cells and Ad-IL-12 uses adenovirus as the host cell). RTS remains in an inactive state until the individual takes a pill with the activator ligand to "turn on" IL-12 at a specified therapeutic level and duration of time to maximize efficacy and minimize toxicity.

FIGURE 3
RheoSwitch Therapeutic System Enables Controlled Expression



Source: Company Reports

What is Attsite recombinase? Attsite recombinases are enzymes to highly specific recognition regions in the genome, which provide a method of more precise gene insertion into host cells compared to traditional methods. Traditional methods face challenges with lack of specificity for the recognition site, leading to undesired outcomes such as limited or no gene expression. Attsite recombinases, however, allow for gene insertion in a predictable and repeatable way.

What is Cell Systems Informatics? Following the UltraVector platform to construct the gene program, Intrexon's proprietary bioinformatics software will help test the program to better optimize the development of the program. The software is capable of modelling 'virtual cells' to map out the cellular signalling pathways and other interactions that could affect protein expression in order to simulate the cell's reaction, regardless of what biological system it is, from a single-celled bacteria to a human organism. These computer simulations allow for high-throughput testing and also aid with engineering novel proteins.

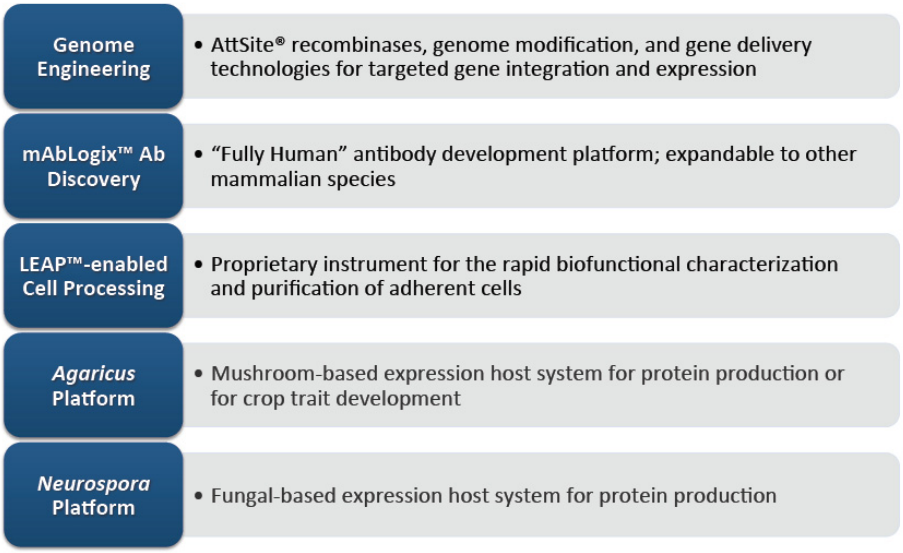
What is LEAP? Intrexon's Laser-Enabled Analysis and Processing technology (LEAP) is a tool that can identify and purify target cells of interest using a combination of image-based assays and laser. LEAP is able to isolate a single cell from a population of over 100,000 cells. LEAP accelerates the testing and learning process by quickly and accurately identifying and purifying the cells of interest from the library of cells generated by UltraVector.

A differentiated aspect of LEAP is that it is able to purify cells still attached to the plate surface. Notably, this is useful for scaling up and automating the processing of stem cells, while maintaining their health and quality. Stem cells often pose a challenge as they are damaged in traditional flow-based purification instruments.

The LEAP platform can also be utilized to achieve time and dollar savings in manufacturing products. By applying LEAP to the biomanufacturing of cell lines, the platform is able to generate more purified cell lines with greater expression of the desired protein in a shorter period of time compared to traditional methods. For instance, one aspect of Intrexon's ECC with Fibrocell relates to improving the process efficiency and manufacturing of laViv, one of Fibrocell's currently marketed products for the treatment of moderate to severe nasolabial fold wrinkles (smile lines) in adults.

What is mAbLogix? Intrexon has also built a library of over 500 million humanized B-cell antibodies (monoclonal and polyclonal) derived from lymphatic tissue (human tonsils). After exposing an antigen of interest (e.g. cancer cell or oncogenes) to its mAbLogix library, Intrexon can identify the reactive antibodies and isolate this target via LEAP and then manipulate the target to create an improved gene program via UltraVector and its Cell Systems Informatics.

FIGURE 4
Intrexon's Suite of Complementary Technologies



Source: Company Reports

Applications of Synthetic Biology

Healthcare

Of all the sectors, synthetic biology probably has the greatest number of applications to the healthcare sector. Broadly speaking, Intrexon is focused on pursuing projects relating to developing new and/or improved therapeutics, improving bioproduction (lowering COGS for biologics and other molecules), and developing diagnostic tests. Thus far, 8 out of 9 ECCs established with Intrexon have been in the healthcare field. Several examples of ongoing projects include:

- **Applications in therapeutics**:
    - Using Intrexon's proprietary RTS technology to control expression of IL-12 gene (a naturally occurring anticancer cytokine) for the treatment of melanoma and breast cancer; ZIOPHARM ECC
    - Using autologous, gene-modified fibroblasts to produce collagen VII for the treatment of recessive dystrophic epidermolysis bullosa (RDEB), a disease in which collagen VII is deficient; Fibrocell ECC
    - Using autologous, genetically modified stem-cell therapy for the treatment of spinal muscular atrophy (SMA), a disease characterized by the genetic defect in SMN1 gene, which encodes for a protein necessary for motor neuron survival; BioLife Cell Bank ECR (exclusive research collaboration)
    - Developing a novel class of broad-spectrum antibiotics (lantibiotics) for the treatment of infectious diseases (e.g. MRSA, VRE, C.diff, tuberculosis and anthrax); Oragenics ECC
    - Developing monoclonal antibodies for the treatment of certain infectious diseases (i.e., pertussis and Acinetobacter); Synthetic Biologics ECC
    - Developing bacteriophage-based therapies to target specific antibiotic resistant infections (i.e., acute and chronic wounds, acute and chronic *P. aeruginosa* lung infections, and *C. difficile* infections); AmpliPhi ECC
    - Developing human monoclonal antibodies for the treatment of melioidosis (caused by *B. Pseudomallei*, a highly resistant Gram negative bacteria); Soligenix ECC
- **Applications in animal health**:
    - Targeting chronic diseases associated with aging in companion animals; Elanco ECC
    - Prevention of certain infectious diseases in pigs; Elanco ECC
- **Applications in bioproduction**:
    - Improving the process efficiency and COGS relating to laViv manufacturing (autologous cellular product from Fibrocell); Fibrocell ECC
    - Develop a source of active pharmaceutical ingredient (API) used in the manufacture of several commonly used pain killers at a competitive cost through genetically modified cell-lines; Genopaver ECC

Food

Within the food sector, Intrexon is focused on both genetically modified animals and crops, with the goal of advancing the sustainability and efficiency of the livestock and agriculture. Examples include identifying and engineering genes for stress tolerance and drought resistance in field crops, generation of protein inhibitors against parasites that could potentially destroy field crops and genetically engineering livestock with resistance to certain diseases.

Intrexon has one ECC in the food sector with AquaBounty. Their partnership aims to develop genetically modified finfish with commercially attractive traits: improved nutritional profile, greater muscle mass, and accelerated time to maturity. Although Intrexon's AquaBounty ECC remains in research phase, AquaBounty has utilized its own technology to develop AquAdvantage Salmon (AAS), a genetically modified salmon that can grow twice as fast as traditional salmon. The AAS salmon has an alternative gene promoter from another arctic fish, the ocean pout, which turns "on" salmon growth hormone at a consistent level to accelerate the growth of the salmon through its early stages of development. Farming time for AAS salmon is approximately 18 months, compared to the typical 28 to 36 months for conventional salmon.

In our view, the regulatory success of AquaBounty's AAS is necessary to support the commercial viability of future synthetic biology projects in the food sector, given that it represents the first genetically modified animal for human consumption. Further, Intrexon has a vested interested in the success of AquaBounty as it owns a total of approximately 54% of AquaBounty shares. However, the regulatory pathway for genetically modified animals remains in uncharted territory, and clear social and ethical issues remain; for example, Europe has strongly opposed GMOs.

AquaBounty submitted a New Animal Drug Application (NADA) to the FDA back in 2010, but has faced significant delays in the regulatory process thus far. Following their NADA submission, the FDA held a public meeting to review AAS findings in September 2010. On December 26, 2012, the FDA published its Environmental Assessment (EA) for AAS, and opened up a 60 day period for public comment. On February 13, 2013, the FDA extended the comment period (which was slated to end on February 25, 2013) for another 60 days and the period has expired on April 26, 2013. We expect FDA approval in 2H13.

The EA was primarily focused around the risk of AquaBounty's AAS causing any hazards to the US environment. Should the genetically modified salmon escape, survive, migrate and reproduce outside its confined space, it could potentially jeopardize US populations of threatened or endangered Atlantic salmon. Interestingly, AquaBounty has proposed that the manufacturing of AAS occur strictly ex-US (in secure facilities with multiple security containments verified and validated by the FDA in Canada and Panama), such that no live fish would be produced, grown, or imported in the US and would therefore have no effect on the US environment. Further, the AAS will be genetically engineered to be triploid (i.e., sterile) and all-female to restrict the possibility of reproducing.

Separately, the FDA also released a preliminary Finding of No Significant Impact (FONSI), in which they evaluated the safety risk to the salmon and the consumer. They concluded that AAS is safe on both fronts, and importantly, that "food from AAS is as safe as food from conventional Atlantic salmon" and that there is "reasonable certainty of no harm from consumption of food from...AAS." **Based on the FDA's conclusion that AAS approval has no adverse effect on the US environment and AAS is safe to eat, we believe there is a high likelihood of approval.**

In agriculture, Monsanto is one of the leading agricultural companies with a focus on genetically modified crops and vegetables. Monsanto has a number of partnerships in place,

including but not limited to: AgraQuest, BASF, Cellectis, Ceres, Chromatin, Complix, deVGen, DHM, Dow AgroSciences, evogene, GrassRoots Biotechnology, Intergrain, Mendel Biotechnology, protabit, Sapphire Energy, Senesco, and Valent. Earlier this year, Monsanto purchased Agradis, a company jointly formed by Synthetic Genomics and Plenus. The purchased assets related to microbes that can improve crop productivity. Separately, Monsanto made an undisclosed equity investment in Synthetic Genomics.

Energy

Within the energy and chemicals sector, one of the most attractive aspects of synthetic biology is the potential to economically scale up production on an industrial scale.

Intrexon currently does not hold any ECCs in this sector, but is focused on developing an alternative energy source using engineered microbes in the energy space, as well as developing an economically attractive alternative to carbon petroleum (the current mainstay as carbon feedstock) in the chemical industry. Within energy, Intrexon has already demonstrated proof-of-concept for the conversion of methane to isobutanol (an alternative alcohol-based fuel) via genetically engineered bacteria. Isobutanol can potentially be mixed to create a renewable solvent or gas blendstock, or processed into other fuel sources such as jet fuel or feedstock for certain plastics. Additionally, a by-product of this conversion process is fish meal. Management believes it could leverage this by selling the fish meal, currently a $1bn market.

However, efforts to produce a source of alternative energy using bacteria or other organisms have largely been unsuccessful in the last several years, despite major oil companies supporting a number of biofuel initiatives. ExxonMobil, the largest US oil company, inked a $300mn deal (with the potential to go up to $600mn) with Craig Venter's synthetic biology company, Synthetic Genomics (SGI), in 2009 in order to explore the potential of algae-based fuel. However, after SGI missed a performance milestone in 2011 (failed at an Exxon pond despite producing enough oil in a greenhouse tester), the agreement was restructured to focus on long-term R&D rather than commercialization. Of note, the deal was focused exclusively on naturally occurring algae, and Venter believes that the use of synthetic algae is necessary to properly scale up and effectively compete with oil.

Chevron, the second largest US oil company, has invested in Codexis, Solazyme, LS9, among others in its support for biofuel research. Chevron also formed a joint venture with lumber company Weyerhauser in February 2008. The development project, named "Catchlight Energy," was shelved in 2010 when Chevron decided a profit margin of 5-10% was not adequate. Original plans were to invest $370mn towards the project in 2013, but the budget was later cut back to only approximately $9mn.

In August 2009, BP put $10mn towards Market Biosciences in an effort to create fuel source from fermented algae. BP also invested $90mn in Verenium, an ethanol company, and more recently, established a multi-year collaboration with Synthetic Genomics to explore microbial solutions to improve the recovery of coal bed methane (CBM), a potential alternative source of natural gas. Shell also invested a total of $300mn in R&D on Codexis, but ended the partnership in 2012. All in all, Shell has over 70 research alliances in biofuels.

According to Desmond King, president of Chevron Technology Ventures, we have seen the oil industry as a whole contract its R&D dollars towards biofuels. Craig Venter, CEO of SGI, also conceded that Exxon's current investment with them is only "a fraction of what it was earlier on," and BP has also "cut way back" on its funding. On the other hand, the oil industry has not entirely given up on biofuels; they continue to make investments, although with realistic expectations and on a smaller scale.

Environment

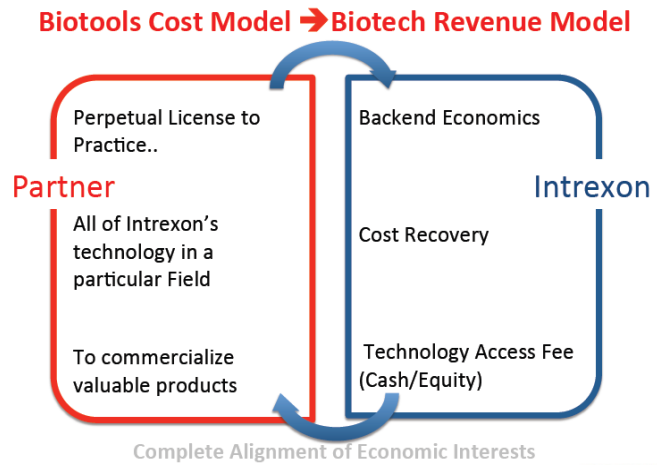
The environment sector represents one of Intrexon's more early stage sectors. Intrexon also does not hold any ECCs in this sector, but is focused on developing ECCs for biosensors, bioremediation (preventing contamination of industrial sources of soil and groundwater), and specialty processes such as applications for activated microbial filtration, targeting waterborne pathogens, and the de-nitrification of waste and surface water. Other examples of applications of synthetic biology in the environment may include modifying the traits of non-edible plants to be commercially attractive, such as genetically engineered turf grass to prevent grass on the golf course from browning.

Platform Business Model

Intrexon is a platform company built on licensing its synthetic biology technologies to companies across its four core focus areas (healthcare, food, energy, & environment) via exclusive channel collaborations (ECCs). ECCs allow Intrexon to scale up easily and quickly, while mitigating market risk (ECCs will lead development and commercialization efforts). This business model lets Intrexon focus on its core competency, remain agnostic to a particular sector/end-market, but still preserves economics for Intrexon.

FIGURE 5

Intrexon's Business Model Based on Licensing Technology Platform



Source: Company Reports

There are three main revenue sources from ECCs: 1) upfront and milestones (which can be paid through either cash or equity); 2) cost recovery (e.g. reimbursement for manufacturing the ECC's product); and 3) royalties. Intrexon will have increased operating leverage as the number of ECCs signed grows (management aims to have ~50% of operating expenses paid for by ECCs by YE'14, with ~20-25% opex funded by ECCs today).

ECCs can also become repeat customers, e.g., Fibrocell (FCSC) has returned for an additional ECC. Intrexon first began signing ECCs in 2011, after establishing this business model in 2010. From January 6, 2011 through March 31, 2013, Intrexon consummated a total of ten ECCs with nine collaborators (eight of which are in healthcare: Fibrocell, Elanco, Ziopharm Oncology, Synthetic Biologics, Oragenics, AmpliPhi Life Sciences Corp., Genopaver, and Soligenix and one in food: AquaBounty Technologies).

Please see Figure 8 for an overview of each individual deal terms, and Figure 6 and Figure 7 for the timing of when these deals were signed. In addition to the ten ECCs in place, Intrexon also has an Exclusive Research Collaboration (ERC) with BioLife Cell Bank, in which BioLife Cell Bank holds the option to form an ECC later.

FIGURE 6

Timeline of ECC signed by Intrexon (2011- present)

Jan-11	ZIOP ECC
Nov-11	Elanco ECC
Jun-12	Oragenics ECC
Aug-12	BioLife ERC
Aug-12	Synthetic Biologics ECC
Oct-12	Fibrocell ECC
Feb-13	AquaBounty ECC
Mar-13	AmpliPhi ECC
Mar-13	Genopaver ECC
Apr-13	Soligenix ECC
Jun-13	Fibrocell repeat ECC

Source: Barclays Research, Company Filings

FIGURE 7

Number of Intrexon's ECCs Accelerating Each Year

1Q11	2Q11	3Q11	4Q11	1Q12	2Q12	3Q12	4Q12	1Q13	2Q13	3Q13	4Q13
• ZIOP			• Elanco		• OGEN	• BioLife • SYN	• FCSC	• ABTX • APHB • Genopaver	• SNGX • FCSC (repeat)		

*BioLife not an ECC, it is an Exclusive Research Collaboration with potential to become ECC

Source: Barclays Research, Company Filings

FIGURE 8

Overview of Current ECCs

	Company	Ticker	Date ECC entered	ECC Focus	Phase	Upfront Technology Access Fee Paid	Milestones	Cost Recovery	Back-end Economics	Addtl Comments
1	ZIOPHARM Oncology	ZIOP	1/6/2011	IL-12 program for melanoma and breast cancer	DC-IL-12 (Phase I) Ad-IL-12 (Phase II)	3,636,926 shares of ZIOP (valued at $17.5mn)	10/24/12: 1st P2 patient dosed, 3,636,926 shares of ZIOP (valued at $18.3mn)	XON manufactures drug product and small molecule activator ligand; ZIOP reimburses mfg costs	50% quarterly net profits on product sales	*XON has purchased ~$21mn of ZIOP shares to date; remaining obligation of $29mn
2	Elanco (animal health division of Eli Lilly)	LLY	11/28/2011	1) targeting certain chronic diseases associated with aging in companion animals 2) prevention of certain infectious diseases in pigs	research	Cash (undisclosed amount)	aggregate of $2.25mn per product based on performance, regulatory, and sales based milestones		royalties in the mid- to upper-single digits and lower-dougle digits based on net product sales	
3	Fibrocell	FCSC	10/5/2012	1) treatment of recessive dystrophic epidermolysis bullosa (RDEB) 2) improve process efficiency and COGS relating to LAVIV manufacturing	research	1,317,520 shares of FCSC (valued at $7.6mn)			1) Royalties of 7% of net sales <$25mn, Royalties of 14% of net sales >$25mn 2) Quarterly royalty of 33% of COGS savings relating to LAVIV mfg improvement	
			6/28/2013 (Repeat ECC)	Engineered autologous fibroblast cells for localized tx of autoimmune and inflammatory disorders: including morphea (localized scleroderma), cutaneous eosinophilias and moderate to severe psoriasis	research	FCSC shares valued at $7.5mn for supplemental access fee				
4	Oragenics	OGEN	6/5/2012	lantibiotics for infectious diseases including MRSA, vancomycin-resistant Enterococcus faecalis, C.diff, M. Tuberculosis and anthrax, in humans and companion animals	research	4,392,425 shares of OGEN (valued at $6.6mn)	Aggregate value equalling 10% of OGEN's outstanding shares (can be paid in stock or cash)		25% quarterly net profits on product sales	
5	Synthetic Biologics	SYN	8/6/2012	monoclonal antibody therapies for treatment of certain infectious diseases (treatment of pertussis and Acinetobacter infections)	preclinical	3,552,210 shares of SYN (valued at $7.8mn)	Addtl regulatory milestones payable cash or stock (IND filing $2mn; first to occur-1st commercial sale or mktg approval of $3mn)		Tiered royalties of upper-single to lower-double digits based on net product sales	*Nov 2011: 1st ECC to develop gene therapeutic product for pulmonary arterial hypertension (April 2013 ECC was terminated due to lack of support by SYN)
6	AquaBounty	ABTX	2/14/2013	Genetically modified finfish for human consumption that is more nutritious, has increased muscle mass, and grows quickly to maturity.	research				16.7% quarterly gross profits for each product	*XON owns 53.82% of AquaBounty shares as of 3/15/13; on 2/14/13 3 individuals designated by XON were appointed to AquaBounty's board of directors (+right to
7	AmpliPhi	APHB	3/29/2013	Bacteriophage-based therapies to target specific antibiotic resistant infections (include bacterial infections associated with acute and chronic wounds, P. aeruginosa lung infections, and C.diff)	research	24,000,000 shares of APHB	Aggregate milestones of up to $7.5mn per product (payable in cash or stock)		Tiered royalties of upper-single digits of net product sales	
8	Genopaver (LLC formed by affiliates of Third Security)	private	3/29/2013	Microbial production of an API used primarily in the mfg of several commonly used pain killers (attempt to develop source of this component at a commercially competitive cost)	research	$3mn cash			Royalties of lower-double digits on gross profits of each product	
9	Soligenix	SNGX	4/27/2013	Human monoclonal antibody therapies for the treatment of melioidosis (caused by B. pseudomallei, a highly resistant Gram - bacteria)	research	1,034,483 shares of SNGX	Aggregate milestones of up to $7mn per product (payable in cash or stock)		Royalties of upper-single to lower-double digits on net product sales	
*	BioLife Cell Bank	private	8/1/2012	Autologous, genetically modified stem-cell therapy for humans for the treatment of spinal muscular atrophy (SMA)	research	Greater of 15% fully diluted fair market value of BioLife, or $6.8mn (payable cash or stock)	Aggregate milestones of up to $10% of fully diluted equity of BioLife (payable cash or stock)		30% quarterly profits for each product	* Exclusive Research Collaboration with option to form ECC later; option expires 8/1/13

Source: Barclays Research, Company Filings

NPV Valuation

In our net present value analysis of Intrexon's cash flows from 2014-2018, we arrive at $25/share assuming a discount rate of 10% and terminal growth rate of 3%. We made a generalized assumption that across sectors, each ECC would result in a three year trajectory of cost recovery reimbursement, of which Year 1 would be 50% of the cost recovery achieved in Year 2 and 3. The cost recovery amount assumed in Year 2 and 3 was $1mn for the average new ECC vs. $500k for a repeat ECC vs. $5mn for a platform ECC.

In terms of upfront payments, an average of $50mn was assumed to be received from a platform ECC. Based on the current healthcare non-platform ECCs, a mixture of cash and equities ($1mn and $3mn, respectively) was assumed for the upfront technology access fee paid. For food and environmental ECCs, given they represent more early-stage sectors for Intrexon, we assumed a more modest upfront payment at a third of the payment projected for healthcare ECCs (i.e., $333k in cash and $1mn in equities). Lastly, for energy ECCs, we assumed a $25mn upfront payment, which incorporates a 50% probability of success given a more restrained funding environment among major oil companies in the US today. Further, we made an assumption that on average, each ECC would generate a $7.5mn milestone payment at Year 3 from the initiation of the partnership.

Based on management guidance, we made assumptions around the number of ECCs Intrexon would sign each year in the 2013-2018 timeframe. Our projections are outlined below in Figure 9. Applying the projected number of ECCs in each sector to the appropriate assumed upfront, milestone, cost recovery (plus potential back-end royalties) streams of revenue, we arrived at the following top-line estimates (please see Figure 10).

FIGURE 9

Projected number of signed ECCs by sector

	2013E	2014E	2015E	2016E	2017E	2018E
Healthcare						
Beginning of Year ECCs	5	15	28	42	59	79
New Repeat Customers	2	3	3	4	5	5
New ECCs	7	9	11	13	15	17
New Platform ECCs	1	1	0	0	0	0
Year Ending ECCs	15	28	42	59	79	101
Food						
Beginning of Year ECCs	0	4	8	11	14	17
New Repeat Customers	0	0	1	1	1	1
New ECCs	4	3	2	2	2	2
New Platform ECCs	0	1	0	0	0	0
Year Ending ECCs	4	8	11	14	17	20
Energy						
Beginning of Year ECCs	0	1	2	3	4	5
New Repeat Customers	0	0	0	0	0	0
New ECCs	1	1	1	1	1	1
New Platform ECCs	0	0	0	0	0	0
Year Ending ECCs	1	2	3	4	5	6
Environmental						
Beginning of Year ECCs	0	2	5	9	13	17
New Repeat Customers	0	0	1	1	1	1
New ECCs	2	3	3	3	3	3
New Platform ECCs	0	0	0	0	0	0
Year Ending ECCs	2	5	9	13	17	21

Source: Barclays Research estimates

FIGURE 10
Summary of ECC Revenues by Sector

$ in thousands	2013E	2014E	2015E	2016E	2017E	2018E
Cost Recovery Revenues						
HC	$ 11,500	$ 25,750	$ 34,750	$ 35,500	$ 36,250	$ 42,250
Food	2,000	8,000	13,250	11,750	6,250	6,250
Energy	500	1,500	2,500	2,500	2,500	2,500
Environmental	1,000	3,500	6,750	8,250	8,750	8,750
Total	$ 15,000	$ 38,750	$ 57,250	$ 58,000	$ 53,750	$ 59,750
Upfront Revenues (cash and equities)						
HC	$ 78,000	$ 86,000	$ 44,000	$ 52,000	$ 60,000	$ 68,000
Food	$ 5,333	$ 54,000	$ 2,667	$ 2,667	$ 2,667	$ 2,667
Energy	$ 12,500	$ 12,500	$ 12,500	$ 12,500	$ 12,500	$ 12,500
Environmental	$ 2,667	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Total	$ 98,500	$ 156,500	$ 63,167	$ 71,167	$ 79,167	$ 87,167
Milestone Revenues						
HC	$ -	$ -	$ 52,500	$ 67,500	$ 82,500	$ 97,500
Food	-	-	30,000	22,500	15,000	15,000
Energy	-	-	7,500	7,500	7,500	7,500
Environmental	-	-	15,000	22,500	22,500	22,500
Total	$ -	$ -	$ 105,000	$ 120,000	$ 127,500	$ 142,500
Royalty Revenues						
HC	$ -	$ 250	$ 667	$ 3,167	$ 35,667	$ 118,167
Food	-	-	-	-	-	24,000
Energy	-	-	-	-	-	-
Environmental	-	-	-	-	-	2,000
Total	$ -	$ 250	$ 667	$ 3,167	$ 35,667	$ 144,167
Total Revenues from ECCs	$ 113,500	$ 195,500	$ 226,084	$ 252,334	$ 296,084	$ 433,584

Source: Barclays Research estimates

FIGURE 11
Summary of NPV Valuation

	2013 E	2014 E	2015 E	2016 E	2017 E	2018 E
Revenue Forecast	$ 113,500	$ 196,500	$ 231,084	$ 267,334	$ 335,084	$ 488,584
yoy change		73%	18%	16%	25%	46%
R&D	$ 46,008	$ 48,308	$ 57,004	$ 63,844	$ 61,610	$ 46,207
SG&A	$ 27,517	$ 30,269	$ 33,296	$ 36,625	$ 40,288	$ 44,317
Total Costs	$ 73,525	$ 78,577	$ 90,300	$ 100,470	$ 101,898	$ 90,524
Aquabounty opex	$ 5,000	$ 5,750	$ 8,625	$ 15,525	$ 31,050	$ 40,365
Changes in Portfolio	$ -	$ -	$ -	$ -	$ -	$ -
Op Profit	$ 34,975	$ 112,173	$ 132,159	$ 151,339	$ 202,136	$ 357,695
Effective tax rate			38%	38%	38%	38%
Plus: D&A	$ 35,888	$ 62,132	$ 73,067	$ 84,529	$ 105,951	$ 154,487
Change in Working Capital	$ (2,489)	$ 830	$ 346	$ 363	$ 678	$ 1,535
Less: Capital Expenditures	$ (37,543)	$ (64,997)	$ (76,436)	$ (88,426)	$ (110,836)	$ (161,610)
Free Cash Flow	$ 30,831	$ 110,138	$ 78,916	$ 90,295	$ 121,117	$ 216,183
NPV of Cash Flows	$ 30,831	$ 100,126	$ 65,220	$ 67,840	$ 82,725	$ 134,233
Terminal Value						$ 3,180,980
NPV of Terminal value						$ 1,975,138

Prob. Adjusted NPV ($ mns)	$ 2,456,113
Net Cash	$ 254,677

Total	**$ 2,710,790**
Shares Out.	**106,563**
Per Share	**$25**

Time of Valuation	2014
Terminal Growth Rate	3%
Discount Rate	10%

Source: Barclays Research estimates

Risks

- **Platform risk:** Intrexon is a platform company built on ECCs and therefore may fail to maintain existing ECCs or enter into new ECCs. Given the business model requires upfront and milestone payments from an increasing number of ECCs to grow top-line in the near-term, there is risk to Intrexon's projected revenue stream should ECCs be terminated, delayed or fail to materialize.

- **Development and commercialization risk**: Intrexon relies on its ECCs to develop, commercialize and market products, which may not be successful. For example, AquaBounty's AquAdvantage Salmon (AAS), the first genetically modified animal for human consumption, is awaiting regulatory FDA approval but has seen significant delays in the regulatory process. The signing of additional ECCs in the future does not guarantee Intrexon will receive back-end economics via royalties. This would require the successful commercialization of a product enabled by Intrexon's synthetic biology technologies. To date, no products using Intrexon's technology have reached commercialization.

- **IP risk around its proprietary synthetic biology technologies**. Some of the in-licensed patents in the US will expire as early as 2014 and some of Intrexon's own patients will expire as early as 2017. Patents relating to its key technology including gene switches such as RheoSwitch, activator ligand technology, and cell identification/selection technology will expire between 2017 and 2034. Counterpart patents ex-US if granted will expire from 2018 to 2032. However, products emerging from an ECC are patentable and can likely provide longer runway for IP protection.

Management Team

Randal J. Kirk, Chairman & CEO

R.J. Kirk was named Chairman in February 2008 and later appointed CEO of Intrexon in April 2009. Mr. Kirk serves on the Board of Directors of Halozyme Therapeutics, as well as the Board of Directors of ZIOPHARM Oncology, Inc. In addition, Mr. Kirk is Founder, Senior Managing Director and CEO of Third Security, LLC, an investment management firm. Prior to Intrexon, Mr. Kirk served on the Board of Directors of Clinical Data, Inc. starting in September 2002 and became Chairman in December 2004, and served in that capacity until the NASDAQ-traded company was acquired by Forest Laboratories, Inc. in April 2011. Mr. Kirk was also Chairman of the Board of New River Pharmaceuticals Inc., a specialty biopharmaceutical company he founded in 1996, which was later acquired by Shire in April 2007. From February 2000 to May 2002, Mr. Kirk served as a member of the Board of Directors of Scios, which was later acquired by JNJ on April 2003.

Thomas D. Reed, PhD, Founder & CSO

Dr. Reed is a molecular geneticist with over twenty years of experience in recombinant DNA technology. Dr. Reed co-founded Intrexon in 1998 and continues to serve on the Board of Directors. Dr. Reed received his B.S. in Genetics from the University of California-Davis and then completed his M.S. at Wright State University in Biological Science. Dr. Reed received his Ph.D. from the University of Cincinnati in Molecular and Developmental Biology.

Krish S. Krishnan, MS, MBA, COO

Mr. Krishnan brings many years of experience in the life sciences industry, having held key executive roles at several companies including, most notably, his tenure as Chief Financial Officer, Chief Operating Officer, and board member of New River Pharmaceuticals, Inc. Previously, he served as a Senior Managing Director of Third Security, LLC between 2001 and 2008 and as a board member of Biotie Therapies Oyj between 2008 and 2009. Mr. Krishnan started his career as an engineer with E.I. Dupont de Nemours in Wilmington,

Delaware. He received a B.S. in Mechanical Engineering from the Indian Institute of Technology, a M.S. in Engineering from UT, Ohio, and an M.B.A. in Finance from The Wharton School at the University of Pennsylvania.

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Primary Stocks (Ticker, Date, Price)

Intrexon Corp. (XON, 29-Aug-2013, USD 22.18), Equal Weight/Neutral, A/C/D/J/L/O

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Overweight - The stock is expected to outperform the unweighted expected total return of the industry coverage universe over a 12-month investment horizon.

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U.S. Biotechnology

Alexion Pharmaceuticals (ALXN)	ARIAD Pharmaceuticals (ARIA)	BioMarin Pharmaceutical (BMRN)
Celgene Corp. (CELG)	Dendreon Corp. (DNDN)	Halozyme Therapeutics Inc. (HALO)
Idenix Pharmaceuticals (IDIX)	Incyte Corp. (INCY)	Intrexon Corp. (XON)
Medivation Inc. (MDVN)	Onyx Pharmaceuticals (ONXX)	Regeneron Pharmaceuticals (REGN)
Tetraphase (TTPH)	Vertex Pharmaceuticals (VRTX)	

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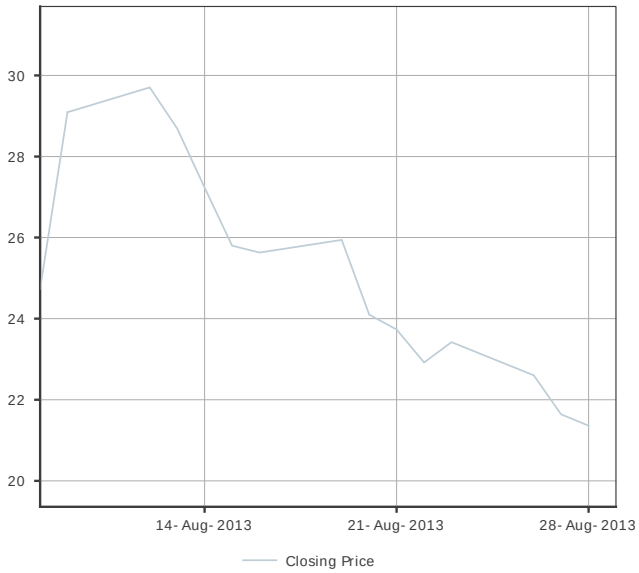
Intrexon Corp. (XON)

	Stock Rating	Industry View
USD 22.18 (29-Aug-2013)	**EQUAL WEIGHT**	**NEUTRAL**

Rating and Price Target Chart - USD (as of 29-Aug-2013) **Currency=USD**



Date	Closing Price	Rating *	Price Target

*The rating for this security remained Not Rated with target price USD 25.00 during the relevant period.

Link to Barclays Live for interactive charting

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Valuation Methodology: In our net present value (NPV) analysis of Intrexon's cash flows from ECCs during 2014-2018, we arrive at $25/share assuming a discount rate of 10% and terminal growth rate of 3%.

Risks which May Impede the Achievement of the Barclays Research Price Target: Risks include: (1) Intrexon is a platform company built on ECCs and therefore may fail to maintain existing ECCs or enter into new ECCs, (2) development and commercialization risk: Intrexon relies on their ECCs to develop, commercialize and market products, which may not be successful, and (3) IP risk around their proprietary synthetic biology technologies (expire between 2017-2034). However, products emerging from an ECC are patentable and can likely provide longer runway for IP protection.

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