14 THEMES TO FOCUS ON 2019

A HANDBOOK FOR PORTFOLIO MANAGERS
Dear Investor,

We are excited to present this year’s Handbook, highlighting key investment themes that have been the centerpiece of our work in 2018. We are particularly proud of our collaborative “deep dive” reports by Cowen analysts across a variety of sectors and asset classes.

For each topic herein, we indicate the Cowen analysts with applicable domain expertise, companies in our coverage universe with leverage to the theme, representative research and select Cowen events. This year, we’ve also included illustrative data-points and analyst statements that grabbed our attention.

We believe these themes will continue to drive investment controversies and opportunities next year, demanding attention from active managers seeking alpha.

Amidst changes in our industry that have been challenging for buy-side investors and sell-side providers, we are grateful to have been validated by so many clients for our steadfast focus on insightful research.

Going into the new year, our goal at Cowen is to hold true to our Ahead of the Curve™ mission, with our analysts standing at the center of discussion and debate on key investment themes. The intellectual curiosity and analysis that fuel Cowen Research ultimately yield the actionable, non-consensus ideas that we bring to you.

We wish you all the best for the achievement of your goals in 2019.

Sincerely,

Robert Fagin
Director of Research
Cowen
Adoption of robotic process and industrial automation (RPA/IA) is on a dramatic growth trajectory, as global enterprises strive to increase productivity, control and compliance while reducing costs and addressing skilled labor shortages. As it becomes a core component of any digital transformation initiative, RPA/IA is increasingly falling under company operating expense budgets versus capital expenditure, making incremental investment more palatable. Agreements for leases and robotics-as-a-service may also facilitate continued acceleration of adoption. The evolution of robots to incorporate 3D vision, SaaS, AI and other capabilities further bolsters their addressable markets and value.
"WITH LEADING AUTOMATION PLAYERS FLUSH WITH CASH, WE ANTICIPATE CONSOLIDATION WITHIN THE PRODUCT MARKET AND COMPLEMENTARY SERVICES."

—BRYAN C. BERGIN, CFA

$25K

ESTIMATED ANNUAL COST OF ONE DIGITAL WORKER’S COMPLETION OF 15 PEOPLE’S TASKS

"WHEREAS HISTORICALLY ‘BLIND’ ROBOTS MOVED ACCORDING TO SPECIFIC PROGRAMMING LANGUAGE, DEPLOYMENT OF 2D AND NOW 3D VISION WITH AI CAPABILITY, CLOUD CONNECTIVITY AND INTEGRATION INTO ANALYTICS PLATFORMS IS CREATING NEW VALUE STREAMS."

—JOSEPH GIORDANO, CFA

DEUS EX MACHINA, PART I

2.4 MILLION

ESTIMATED UNFILLED MANUFACTURING JOBS BY 2028 DUE TO SKILLS GAP

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES
DEUS EX MACHINA, PART I
December 4, 2018
Cowen Analysts: Joseph Giordano, CFA, J. Derrick Wood, CFA

THOUGHTS POST AUTOMATION FAIR 2018
November 10, 2018
Cowen Analyst: Joseph Giordano, CFA, J. Derrick Wood, CFA

RPA/IA INSIGHTS VOL 16: FUNDING KEEPS FLOWING
November 15, 2018
Cowen Analyst: Bryn C. Bergin, CFA

KEY CONCLUSIONS FROM OUR INDUSTRIAL INNOVATION & TECHNOLOGY SUMMIT
September 21, 2018
Cowen Analysts: Joseph Giordano, CFA, Jeffrey Osborne

AHEAD OF THE CURVE® SERIES
NO RESPECT IPA EVOLUTION STILL LARGELY UNDERAPPRECIATED
Inaugural Cowen BPM Survey
May 9, 2018
Cowen Analysts: Bryan C. Bergin, CFA, Gregg Moskowitz, CFA

CHECKING IN AT SOME MAJOR VISION AND ROBOTICS RELATED SHOWS
April 23, 2018
Cowen Analyst: Joseph Giordano, CFA

AHEAD OF THE CURVE® SERIES
EMERGENCE OF 3D ANCHORS CGNX’S 26% GROWTH GOAL
March 28, 2018
Cowen Analyst: Joseph Giordano, CFA
The changing face of transportation encompasses wide-ranging technological innovations spanning electrification, autonomy, advanced safety, security and emissions control, to name only a few. The automobile of the future will reflect the end-state of a revolution currently underway as a collection of discrete hardware devices with decentralized compute platforms consolidate toward one of interconnected software-defined hardware, with its many attendant requirements and risks. Lower costs, infrastructural upgrades and improved efficiencies will accelerate disruption of the way in which goods and people are delivered, warranting keen focus on the impact to software, communication, semiconductor and sensor companies. Railcar transportation also remains on the radar.
"AS CARS SHIFT FROM A BEVY OF HARDWARE DEVICES THAT DON’T COMMUNICATE WITH EACH OTHER TO A SOFTWARE-DEFINED VEHICLE, THE CYBERSECURITY MARKET IN THIS SEGMENT IS EXPECTED TO GROW FROM $30 MILLION IN 2017 TO $2 BILLION IN 2024.”

—JEFFREY OSBORNE

EXPLORING HOW CARS COMMUNICATE AND REMAIN SECURE

157% YEAR-OVER-YEAR U.S. SALES GROWTH IN ELECTRIFIED VEHICLES

100 MILLION LINES OF SOFTWARE CODE EXPECTED TO DIRECT TYPICAL CAR OF THE FUTURE
What do the future of transportation, artificial intelligence, robotics, smart cities and IoT all have in common? Semiconductors, including capital equipment makers and companies focused on memory and connectivity, are the golden thread enabling the power, speed, memory and mobility required for increasingly constant intelligence and connectedness in all facets of our lives. Viewed as part of a long-term secular theme despite near-term challenges, we see semiconductor growth through 2022, driven by continued innovation and demand in datacenters, IoT/industrial, transportation and gaming/VR. The accelerated pace of software development for IoT subject to interconnected devices holds the potential to extend that trajectory.
"WE SUGGEST INVESTORS FOCUS ON DIFFERENTIATED SUPPLIERS LEVERAGED TO AI-INFUSED MARKETS IN DATACENTER, IoT/INDUSTRIAL, AUTO AND GAMING/VR, WITH THIS LENS SERVING AS THE PRIMARY INVESTMENT CRITERION IN SEMICONDUCTORS."  
—MATTHEW D. RAMSAY

A FRAMEWORK FOR INVESTING IN AN AI-INFUSED WORLD

“All the buzz words such as AI, deep machine learning, AR/vr, hyperscale/cloud storage, autonomous driving, and 5G imply the need for more semiconductor content, with demand for increased compute power (GPU, APU, FPGA) and storage (DRAM, NAND). Semiconductor production equipment should benefit as the thirst for processing and storing data becomes even more important.”

—KRISH SANKAR

NEW SECTOR PARADIGM, YET TRADITIONAL VIEWS ON STOCK PICKING PERSIST

15
2018 has been a breakout year for the emerging cannabis industry, reflecting Canada’s legalization of adult-use sales, pronounced growth in market capitalization of public cannabis stocks, expansion of international markets, and continued proliferation of consumer brands and novel form factors. Moreover, this accelerated pace of activity is poised to carry forward into 2019 and beyond, with legislative and regulatory developments underway that will facilitate the sale of non-THC consumer cannabis products and potentially allow U.S. banks to service the cannabis industry.

Strategic investments by leading global brands in traditional alcohol and tobacco have served to set valuation benchmarks and further validate the potential size of this nascent global market.
“AS CANNABIS INCIDENCE IN THE U.S. CLIMBS, THIS WELL-CAPITALIZED INDUSTRY HAS BEEN EVOLVING RAPIDLY AND LOOKS TO ADDRESS A FAR LARGER TAM THAN WE HAD ORIGINALLY FORECAST. WE SEE FOUR KEY VERTICALS: ADULT USE, BEAUTY AND NUTRICEUTICALS, OTC PAIN AND SLEEP, AND PHARMACEUTICALS.”

—VIVIEN AZER
VIVIEN’S VIEWS: THE DURABILITY OF DISRUPTION VS. VEXING VALUATIONS

“WE ASSIGN 75% ODDS TO ENACTMENT OF LEGISLATION PRIOR TO 2020 PRESIDENTIAL ELECTION THAT PERMITS BANKS TO SERVICE THE CANNABIS INDUSTRY.”

—JARET SEIBERG
LEGISLATION TO LET BANKS SERVICE CANNABIS LIKELY FALLS TO NEXT CONGRESS

55+
FASTEST GROWING COHORT OF CANNABIS CONSUMERS

35 MILLION
REPORTED ANNUAL U.S. CANNABIS CONSUMERS

AHEAD OF THE CURVE SERIES
CANNABIS: $75B OPPORTUNITY; CATEGORY CROSS CURRENTS KEEP US CAUTIOUS ON BOOZE
April 4, 2018
Cowen Analyst: Vivien Azer
THE CROSS-FRONTIER: THE CONFIDENCE OF CIGARETTES & CANNABIS WHAT A TOBACCO INVESTOR NEEDS TO KNOW
December 10, 2018
Cowen Analyst: Jaret Seiberg
COWEN’S CANNA-CONCLUSIONS: SUMMIT TAKEAWAYS
December 3, 2018
Cowen Analysts: Vivien Azer, Jaret Seiberg, Chris Krueger
CANNABIS POLICY: OBSERVATIONS FROM THE TAX COURT’S 280E RULING
December 3, 2018
Cowen Analyst: Jaret Seiberg
DEA PLACES EPIDIOLEX IN SCHEDULE V (GWPH)
September 27, 2018
Cowen Analyst: Phil Nadeau, Ph.D.
VIVIEN’S VIEWS: THE DURABILITY OF DISRUPTION VS. VEXING VALUATIONS
October 9, 2018
Cowen Analyst: Vivien Azer
THC TRACKER
Cowen Analyst: Vivien Azer

CANNABIS: $75B OPPORTUNITY: CATEGORY CROSS CURRENTS KEEP US CAUTIOUS ON BOOZE
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VIVIEN’S VIEWS: THE DURABILITY OF DISRUPTION VS. VEXING VALUATIONS
Cowen Analyst: Vivien Azer
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VIVIEN’S VIEWS: THE DURABILITY OF DISRUPTION VS. VEXING VALUATIONS
Cowen Analyst: Vivien Azer

LEGISLATION TO LET BANKS SERVICE CANNABIS LIKELY FALLS TO NEXT CONGRESS
Cowen Analyst: Jaret Seiberg

“We assign 75% odds to enactment of legislation prior to 2020 presidential election that permits banks to service the cannabis industry.”

—JARET SEIBERG

As cannabis incidence in the U.S. climbs, this well-capitalized industry has been evolving rapidly and looks to address a far larger TAM than we had originally forecast. We see four key verticals: adult use, beauty and nutraceuticals, OTC pain and sleep, and pharmaceuticals.”

—VIVIEN AZER

We assign 75% odds to enactment of legislation prior to 2020 presidential election that permits banks to service the cannabis industry.”

—JARET SEIBERG

Reported annual U.S. cannabis consumers

35 million

“We assign 75% odds to enactment of legislation prior to 2020 presidential election that permits banks to service the cannabis industry.”

—JARET SEIBERG

Legislation to let banks service cannabis likely falls to next congress

55+

Fastest growing cohort of cannabis consumers

35 million

Reported annual U.S. cannabis consumers

As cannabis incidence in the U.S. climbs, this well-capitalized industry has been evolving rapidly and looks to address a far larger TAM than we had originally forecast. We see four key verticals: adult use, beauty and nutraceuticals, OTC pain and sleep, and pharmaceuticals.”

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—JARET SEIBERG

Reported annual U.S. cannabis consumers

35 million
Blockchain holds the potential to reinvent transactional and back office processes to meet the needs of e-commerce, social media, IoT and the Internet’s many creations of the last 20 years. We see an evolutionary path for adoption of Blockchain while it remains in the Innovator phase, with years to come before it crosses Moore’s Chasm. In these early innings of Blockchain evolution, we look to Supply Chain Management and Financial Services as key use cases for the transparency, tracking, ledgering and reduced costs Blockchain has to offer. Consultants and IT services participants are likely to benefit first from this developing theme, while the next wave of value creation may be realized by Blockchain solutions providers.
“ALTHOUGH NOT A PANACEA, OUR WORK VALIDATES BLOCKCHAIN AS DIFFERENTIATED TECHNOLOGY, WITH STRONG FIT AROUND FINANCE & SUPPLY CHAIN USE CASES, AND BOLSTERED BY EMERGENT STANDARDS AND CORPORATE LEADERSHIP.”

— BLOCKCHAIN: BEYOND BITCOIN, THE ENTERPRISE EVOLUTION

31% OF SOFTWARE ENGINEERS AND DEVELOPERS WE SURVEYED ARE INVOLVING BLOCKCHAIN IN THEIR PROJECTS

5+ ESTIMATED YEARS TO WIDESPREAD ADOPTION
The work of our Washington policy analysts has become an endurance sport, with 2018’s key issues including trade and tariffs, NAFTA, KORUS, midterms, the Mueller investigation, GAO Kavanaugh, cabinet shuffles, China, Russia, cannabis, currency wars, Paris, Saudi sanctions, government shutdown, drug pricing, agriculture subsidies, tax reform, Farm Bill, STATES Act, SAFE Act, NATO, Iran, North Korea, immigration, FIPSA, GIES, privacy, FTC, FCC, CCEG, antitrust, M&A, net neutrality, ACA, Medicaid, VHA, FDA, opioid biosimilars, CMS, pre-existing conditions, CFIUS, and the defense budget. We will continue to stay ahead of these and more in 2019, against the backdrop of a divided congress and looming 2020 election.
82% DECREASE IN SIGNIFICANT REGULATION (IMPACT OF $100M+) BETWEEN 2016 AND 2017

MARCH 1, 2019

UPCOMING TARIFF ESCALATOR DEADLINE
Cybersecurity breaches in 2018 have been particularly notable for their impact to shareholder value, causing meaningful redirection of management attention amidst urgent efforts to remediate technologies and rebrand brands. Breaches and heightened privacy concerns, bolstered by increased regulatory scrutiny, continue to drive investment in the protection of critical infrastructure, data, devices and apps. Companies in the sector continue to show substantial sales growth while consistently introducing new products and services at higher price points. Increasing customer shift toward cloud represents another opportunity for cross-selling and up-selling by vendors in 2019.
“AS THE AUTOMOBILE OF THE FUTURE BECOMES MORE INTERCONNECTED FROM 2019 TO 2025, WE SEE COMMUNICATION AND CYBERSECURITY BECOMING PARAMOUNT. VENDORS INVOLVED IN DOMAIN CONSOLIDATION ARE BEST POSITIONED.”

—JEFFREY OSBORNE

EXPLORING HOW CARS COMMUNICATE AND REMAIN SECURE

52% OF SOFTWARE RESSELLERS SURVEYED SEEING CUSTOMER PURCHASE DECISIONS DRIVEN BY GLOBAL DATA PROTECTION REGULATION

1 TRILLION+

EVENTS PER WEEK ANALYZED IN CLOUD BY SINGLE MACHINE LEARNING PLATFORM FOR THREAT INTELLIGENCE

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE™ SERIES

EXPLORING HOW CARS COMMUNICATE AND REMAIN SECURE

October 19, 2018

Cowen Analysts: Jeffrey Osborne, Matthew D. Ramsay, Paul Silverstein, Joseph Giodano, CFA

TAKEAWAYS FROM CROWDSTRIKE’S USER CONFERENCE

September 18, 2018

Cowen Analysts: Gregg Moskowitz, CFA

COWEN SECURITY GLOBAL RESELLER SURVEY, VOLUME XI

October 1, 2018

Cowen Analyst: Gregg Moskowitz, CFA

COWEN’S 5TH CONFERENCE: KEY TAKEAWAYS FROM SECURITY PANEL

July 19, 2018

Cowen Analyst: Gregg Moskowitz, CFA

HIGHLIGHTS FROM THE COWEN NETWORKING AND CYBERSECURITY SUMMIT

December 11, 2018

Cowen Analyst: Gregg Moskowitz, CFA

COWEN COMPANY COVERAGE

AKAMAI TECHNOLOGIES AKAM

AMPHENOL APH

CARBON BLACK CBK

CISCO SYSTEMS CSCO

F5 NETWORKS FFIV

ITT CORPORATION ITT

JUNIPER NETWORKS JNPR

LEAR LEA

PROOFPOINT PFPT

SPLUNK SPLK

VISTEON CORPORATION VC

NXP SEMICONDUCTOR NXPI

TE CONNECTIVITY TY

RAPID7 INC RPD

PALO ALTO NETWORKS INC PANW

SPLUNK SPLK

SELECTED EVENTS

46TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE

May 29-31, 2018 | New York, NY

4TH ANNUAL COMMUNICATIONS INFRASTRUCTURE SUMMIT

August 6-7, 2018 | Boulder, CO

5TH ANNUAL COWEN’S NETWORKING & CYBERSECURITY SUMMIT

December 11-12, 2018 | New York, NY

COWEN ANALYSTS

J. DERRICK WOOD, CFA
JEFFREY OSBORNE
ROMAN SCHWEIZER
JOSEPH GIORDANO, CFA

COURT SKEEL, PAUL SILVERSTEIN
NICK YAKO
As Amazon shifts to faster, costlier delivery speeds to drive the value proposition of Amazon Prime, we expect to see ongoing changes in the dynamics governing logistics, payments and other key transactional components of the eCommerce business. Rising fulfillment requirements and compressed delivery times fuel debates around margin sensitivity and options for increased capacity through expansion of relationships with logistics providers, or even consolidation. The potential for Amazon to disrupt the payments arena could serve as a substantial cross-selling opportunity, opening up new markets and propelling further U.S. eCommerce penetration.
$15 BILLION
AMAZON’S ESTIMATED COST OF U.S. LAST-MILE DELIVERY IN 2018

WE ESTIMATE A RELATIVELY MODEST $5B-$6B AMAZON PAY REVENUE OPPORTUNITY IN THE U.S.—BUT A $50B+ OPPORTUNITY IN CROSS-SELLING SELECT SERVICES INTO POTENTIAL SMALL AND MIDSIZE BUSINESSES (SMBS).”
—HOW PAYMENTS COULD BE THE NEXT SECTOR TO FACE AMAZON DISRUPTION

4.3 BILLION
ESTIMATED U.S. LAST-MILE PACKAGES DELIVERED BY AMAZON IN 2023

“WE CONTINUE TO BELIEVE WE ARE STILL IN THE EARLY DAYS OF U.S. ECOMMERCE DISRUPTION, WITH PENETRATION RISING FROM ~10% OF U.S. RETAIL SALES TO ~15% IN 2018-23E. AMAZON REMAINS ARGUABLY THE KEY DRIVER (AND BENEFICIARY) OF THE BROADER CONSUMPTION SHIFT ACROSS VERTICALS.”
—JOHN BLACKLEDGE
US E-COMMERCE DISRUPTION 2.0: ‘18 LIKELY ANOTHER RECORD YEAR

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES
U.S. E-COMMERCE DISRUPTION 2.0: 18 LIKELY ANOTHER RECORD YEAR
January 11, 2018
Cowen Analyst: John Blackledge

AHEAD OF THE CURVE® SERIES
AMAZON FULFILLMENT CENTER TOUR: IMPRESSIVE AND A HUGE AUTOMATION OPPORTUNITY
February 27, 2018
Cowen Analysts: Joseph G.DOMBRA, ETF

AHEAD OF THE CURVE® SERIES
HOW PAYMENTS COULD BE THE NEXT SECTOR TO FACE AMAZON DISRUPTION
April 16, 2018
Cowen Analysts: George Mihalos, John Blackledge

AHEAD OF THE CURVE® SERIES
IF YOU BUILD IT, THE PACKAGES WILL COME: ASSESSING AMZN’S U.S. DEMAND & DELIVERY CAPACITY
May 4, 2018
Cowen Analysts: John Blackledge, Helane Becker

COWEN TMT CONFERENCE: ASSESSING AMZN’S U.S. DEMAND & DELIVERY CAPACITY PANEL
May 11, 2018
Cowen Analysts: John Blackledge, Helane Becker

AHEAD OF THE CURVE® SERIES
AMAZON: HUNGRY FOR MORE U.S. GROCERY MARKET SHARE
December 11, 2018
Cowen Analyst: John Blackledge

COWEN COMPANY COVERAGE

AMAZON.COM INC. AMZN
Cognex Corp. CGNX
FARFETCH FTCH
FEDEX CORP. FDX
GAMING.COM GMGR
MASTERCARD INC MA
PAYPAL HOLDINGS INC PYPL
UNITED PARCEL SERVICE UPS
VISA INC. V
WAYFAIR INC. W

SELECTED EVENTS

4TH ANNUAL FUTURE OF THE CONSUMER CONFERENCE: BREAKTHROUGH CONCEPTS AND CUSTOMER EXPERIENCES
April 2-3, 2018 | New York, NY

46TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE
May 29-31, 2018 | New York, NY

6TH ANNUAL INTERNET & MEDIA BUS TOUR
August 6-9, 2018 | Seattle, WA, San Francisco, CA, Los Angeles, CA

COWEN ANALYSTS

JOHN BLACKLEDGE
JULIE BELFELT
GEORGE M. DOMBRA
JASON SEGAL
THOMAS CHARBONNIER
ANDREW CHANDLER, CFA
KEVIN SOLOMAN, CFA
JOSEPH GOLDBERG, CFA

THOMAS CHARBONNIER
ANDREW CHANDLER, CFA
KEVIN SOLOMAN, CFA
JOSEPH GOLDBERG, CFA

THOMAS CHARBONNIER
ANDREW CHANDLER, CFA
KEVIN SOLOMAN, CFA
JOSEPH GOLDBERG, CFA
The rising prominence of Gen Z and millennial consumers is revolutionizing the retail industry, creating opportunities and risks as brands are increasingly in flux with rapidly shifting trends driven by social media. This consumer cohort is strongly motivated by convenience, culture and curation, with focus on engagement and a loyalty experience that maintains consistent personalization. The relationship with the customer must be nurtured throughout the phases of purchase, before a transaction is consummated and well after goods have been sold. Experiential retail offers an opportunity for brick and mortar businesses, while models focused on price/value and style are also well positioned.
"GEN Z AND MILLENNIAL CONSUMERS MAY GROW TO 70% OF THE GLOBAL POPULATION IN THE NEXT DECADE AND INHERIT $30 TRILLION IN WEALTH, AMPLIFYING THEIR INFLUENCE ON THE RETAIL INDUSTRY."

—GEN Z + MILLENNIALS, PART II: FOCUS GROUPS

"~90% OF AGES 18-54 AND 82% OF AGES 55+ INDICATED AMAZON WAS THEIR PREFERRED CHANNEL, EITHER SOLELY OR BLENDED WITH OTHER ONLINE AND PHYSICAL STORE OPTIONS. SPEED IN DESIGN, MERCHANDISING, AND SUPPLY CHAIN WILL BE KEY TO FUTURE MARGIN STRUCTURE, ROIC AND CORRESPONDING EQUITY VALUATION."

—GEN Z + MILLENNIALS RESHAPE APPAREL, FOOTWEAR, AND ACCESSORIES
Myriad diagnostic, digital and life science tools are on the precipice of playing key roles in extending life, reducing health care costs, and managing chronic diseases. Lower cost and rapid genetic sequencing has prompted plans for major population genetic programs globally. Liquid biopsy tools could provide primary care physicians with screens to detect genetic diseases in asymptomatic patients. Continuous glucose monitors generate data to allow for better management of diabetes, with seamless integration into delivery tools. Finally, synthetic biology tools are playing a growing role in drug development. Moreover, many of these advances hold the potential to create new and more sustainable sources of food, energy, fertilizers, and drugs, serving multiple end-markets.
“SYNTHETIC/INDUSTRIAL BIOLOGY IS A DYNAMIC AND EVOLVING MARKET WITH MANY NEW APPLICATIONS AND MORE TO COME. THAT IS THE EXCITING PART. THE CHALLENGING PART IS THAT THE STAGE OF DEVELOPMENT AND RAPID PACE OF EVOLUTION RENDERS FORECASTING QUITE CHALLENGING.”

—DOUG SCHENKEL
DNA SYNTHESIS LEADER POSITIONED TO BOOST BROADER SYNBIO GROWTH

30%+
ESTIMATED U.S. CGM VOLUME GROWTH THROUGH 2020

10-20 DAYS
TYPICAL TURNAROUND TIME FOR SUPPLY OF SYNTHETIC DNA

DOUG SCHENKEL
JOSHUA JENNINGS, M.D.
CHARLES RHYEE

COWEN COMPANY COVERAGE

June 28, 2018 | San Francisco, CA
SELECTED EVENTS

10TH ANNUAL HEALTH CARE CONFERENCE
March 13-14, 2018 | Boston, MA
1ST ANNUAL FUTUREHEALTH CONFERENCE
August 28, 2018 | San Francisco, CA
4TH ANNUAL ACADEMY OF FUTUREHEALTH CONFERENCE
October 9-10, 2018 | New York, NY
17TH ANNUAL MEDTOOLS CONFERENCE
October 11-12, 2018 | New York, NY

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE® SERIES
DIGITAL THERAPEUTICS: DAWN OF A NEW TREATMENT CLASS
June 22, 2018
Cowen Analyst: Charles Rhyee

MATERA PRESENTS ITS FIRST LIQUID BIOPSY DATA IN BREAST CANCER
December 4, 2018
Cowen Analyst: Doug Schenkel

DNA SYNTHESIS LEADER POSITIONED TO BOOST BROADER SYNBIO GROWTH
November 24, 2018
Cowen Analyst: Doug Schenkel

INITIATION: CLEARLY WELL POSITIONED IN CLINIC, WITH BIOPHARMA, AND VIA PIPELINE
October 29, 2018
Cowen Analyst: Doug Schenkel

AHEAD OF THE CURVE® SERIES
SPRING 2018 EXACT SCIENCES’ COLOGUARD SURVEY
June 16, 2018
Cowen Analyst: Doug Schenkel

AHEAD OF THE CURVE® SERIES
SECOND ANNUAL PROPRIETARY CORE LAB SEQUENCING SURVEY
February 5, 2018
Cowen Analyst: Doug Schenkel

AHEAD OF THE CURVE® SERIES
COWEN’ S 2018 DIABETES DEVICE SURVEY- FIFTH ANNUAL
January 26, 2018
Cowen Analysts: Doug Schenkel, Joshua Jennings, M.D.
The $562 billion worldwide biopharmaceutical industry is positioned to deliver mid-single digit growth through 2023, supported by promising R&D pipelines. We believe innovative therapeutics with clearly superior clinical profiles can command meaningful market share and pricing power across a wide range of therapeutic categories. As we evaluate the potential of a biopharma company to develop into the next generation of premier large cap players generating outsized returns, we focus on the following fundamental factors: (1) commercial pipeline with significant sales potential, (2) rich mid to late stage pipeline of drug candidates, (3) reliable candidate generation platform and/or proven business development strategy, and (4) management track record.
“BREAK EVEN IS OFTEN NOT A MAJOR FOCUS FOR INVESTORS AS THE TREMENDOUS POTENTIAL DRIVEN BY PIPELINE CANDIDATES CAN MAKE ANY ANALYSIS CHALLENGING, AND COMPANIES POISED TO JOIN THE NEXT GENERATION OF OUTPERFORMERS MAY VARY WIDELY IN PROXIMITY TO THIS FINANCIAL EVENT.”

—THE BEST OF THE NEXT: WHO WILL BE PART OF THE NEXT GENERATION OF LARGE CAPS?

31% OF ESTIMATED 2023 GLOBAL DRUG SALES IN ONCOLOGY

$759 BILLION ESTIMATED 2023 GLOBAL DRUG SALES BY ~85 LEADING LARGE AND MIDCAP BIOPHARMA COMPANIES

COWEN COMPANY COVERAGE
OVER 200 STOCKS ACROSS BIOTECHNOLOGY, MAJOR PHARMACEUTICALS AND SPECIALTY PHARMA

SELECTED EVENTS
38TH ANNUAL HEALTH CARE CONFERENCE March 14, 2019 | Boston, MA
21ST ANNUAL THERAPEUTICS CONFERENCE October 9-10, 2018 | New York, NY
IO NEXT SUMMIT November 9, 2018 | National Harbor, MA

REPRESENTATIVE RESEARCH
MICROBIOME SCIENCE: FROM BUGS TO DRUGS November 30, 2018
Cowen Analysts: Chris Shibutani, M.D., Marc Frahm, Ph.D., Phil Nadeau, Ph.D.
SECOND ANNUAL COWEN IO NEXT SUMMIT WRAP UP November 12, 2018
Cowen Analysts: Chris Shibutani, M.D., Marc Frahm, Ph.D., Phil Nadeau, Ph.D., Boris Peaker, Ph.D., CFA
AHEAD OF THE CURVE™ SERIES RETROSPECTIVE & FORECAST: INSIGHTS FROM LEADING TRANSLATIONAL ONCOLOGISTS ON NOVEL IO TARGETS November 6, 2018
Cowen Analysts: Chris Shibutani, M.D., Marc Frahm, Ph.D., Phil Nadeau, Ph.D., Boris Peaker, Ph.D., CFA, Yaron Werber, M.D.
THERAPEUTIC CATEGORIES OUTLOOK Cowen Analysts: Cowen Health Care Team
Cowen Analysts: Ritu Baral, Phil Nadeau, Ph.D.
ANNUAL HEALTH MARKET UPDATE: STEADY 6-8% GROWTH REMAINS ON TAP May 15, 2018
Cowen Analyst: Steve Scala, R.Ph., CFA

COWEN ANALYSTS
RITU BARAL, R.Ph., CFA
MARC FRAMH, Ph.D.
PHIL NADEAU, Ph.D.
Boris Peaker, Ph.D., CFA
CHRIS SHIBUTANI, M.D.
STEVE SCALA, R.Ph., CFA
YARON WERBER, M.D.
Excitement at the opportunities presented by 5G abounds, with still-visionary use cases such as autonomous vehicles and remote surgery at times seeming narrow in light of the profound transformation 5G will enable. It is increasingly clear that every industry, every vertical, and nearly every aspect of humanity will be impacted. IoT connectivity will create a new revenue opportunity for carriers, but at just 5% of the overall TAM, the real value creation will occur “up the stack” where carriers have historically not fared well. However, carriers will sit in an advantageous position in command of 5G data, allowing each one to play to its respective strengths.

— COLBY SYNESAEL

TAKEAWAYS FROM MWC AMERICAS; CARRIERS CHOSE THEIR OWN 5G ADVENTURE

“THE 5G USE CASES WILL BE REVOLUTIONARY, BUT THE NETWORK IS EVOLUTIONARY.”

— COLBY SYNESAEL

TAKEAWAYS FROM 5G PANEL; FIXED WIRELESS WORKS (FOR VERIZON)

REPRESENTATIVE RESEARCH
TAKEAWAYS FROM IR MEETING; COMPETITION, 5G, AND M&A
December 3, 2018
Cowen Analysts: Colby Synesael, Gregory Williams, CFA

TAKEAWAYS FROM CABLE BUSINESS SERVICES SOLID TRENDS, 5G BACKHAUL AN OPPORTUNITY
November 22, 2018
Cowen Analysts: Colby Synesael, Gregory Williams, CFA

TAKEAWAYS FROM MWC AMERICAS; CARRIERS CHOSE THEIR OWN 5G ADVENTURE
September 12, 2018
Cowen Analysts: Colby Synesael, Gregory Williams, CFA

TAKEAWAYS FROM 5G PANEL; FIXED WIRELESS WORKS (FOR VERIZON)
May 31, 2018
Cowen Analysts: Colby Synesael, Gregory Williams, CFA

SG SPECTRUM PORTFOLIO MAKES FOR QUITE A DISH
March 26, 2018
Cowen Analysts: Colby Synesael, Gregory Williams, CFA

A GOVERNMENT 5G NETWORK – REALLY?
January 29, 2018
Cowen Analyst: Paul Gallant

COWEN COMPANY COVERAGE
AMERICAN TOWER AMT
AMPHENOL CORPORATION APH
AT&T T
CROWN CASTLE INTERNATIONAL CCI
DISH NETWORK CORP. DISH
CEVA CEVA
INTEL INTC
QORVO QRVO
QUALCOMM QCOM
SBA COMMUNICATIONS SBA
SKYBOW/S NWK
Sprint $ T
T-MOBILE TMUS
VERIZON COMMUNICATIONS V Z
ZAYO GROUP HOLDINGS ZAYO

SELECTED EVENTS
46TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE May 29-31, 2018 | New York, NY
4TH ANNUAL COMMUNICATIONS INFRASTRUCTURE SUMMIT August 6-7, 2018 | Boulder, CO
5TH ANNUAL NETWORKING & CYBERSECURITY SUMMIT December 11-12, 2018 | New York, NY
The International Marine Organization (IMO) is set to enforce its lower sulfur standards on bunker fuels, which will reduce sulfur allowed in fuel used by ships from 3.5% to 0.5% starting January 1, 2020. This regulation, known as "IMO 2020," is expected to be met with a high level of compliance, and there is a high degree of confidence around its implementation date, with implications for diesel/jet prices, airline fares, container demand, trucking, rail and logistics. Our discussions suggest impacts will be bullish for refiners, and will begin to manifest in 2019, ahead of the implementation date.
**COWEN COMPANY COVERAGE**

**AMERICAN AIRLINES (AAL)**
**CALUMET SPECIALTY PRODUCTS PARTNERS (CLMT)**
**CANADIAN NATIONAL (CNI)**
**C.H. ROBINSON (CHRW)**
**DELTA AIRLINES (DAL)**
**DELTA AIRLINES, DAL**
**EXPEDITORS INTERNATIONAL (EXP)**
**FLUOR (FLS)**
**HOLLYFRONTIER CORP (HFC)**
**ITT CORPORATION (ITT)**
**LANDSTAR (LSTR)**
**MARATHON PETROLEUM CORPORATION (MPC)**
**PAR PACIFIC HOLDINGS (PARR)**
**PBF ENERGY (PBF)**
**PHILLIPS 66 (PSX)**
**RADIANT LOGISTICS (RLGT)**
**UNITED AIRLINES (UAL)**
**VALERO ENERGY CORPORATION (VLO)**

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**COWEN ANALYSTS**

**JASON GABLEMAN**
**MELANIE GROSS**
**DAVID DECKELBAUM, CFA**
**MATTHEW ELKOTT**
**MARC BIANCHI, CFA**

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**REPRESENTATIVE RESEARCH**

**KEY TAKEAWAYS FROM COWEN’S ENERGY & NATURAL RESOURCES CONFERENCE**

December 4, 2018
Cowen Analysts: Marc Gableman, CFA; Gabe Daoud, Jr.; David Deckelbaum, CFA; Jason Gableman.

**REASSURING BULLISH IMO 2020 OUTLOOK**

December 3, 2018
Cowen Analyst: Jason Gableman.

**IMO 2020 IMPACT TO THE TRANSPORTATION SECTOR**

December 3, 2018
Cowen Analysts: Jason Gableman; Melanie Besler; Jason H. Seidl; Matt Elkott.

**COWEN CONFERENCE CALL ON AGEEAN, THE BUNKER FUEL MARKET, AND IMPACT OF IMO 2020**

November 12, 2018
Cowen Analysts: David Epstein, CFA; Jason Gableman.

**RETAIL LEVEL-SET: BEFORE AND AFTER IMO 2020**

September 12, 2018
Cowen Analyst: Jason Gableman.

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**SELECTED EVENTS**

**ENERGY & NATURAL RESOURCES CONFERENCE**

December 3-4, 2018 | New York, NY
COWEN CONFERENCE CALL ON AGEEAN, THE BUNKER FUEL MARKET, AND IMPACT OF IMO 2020
November 12, 2018

**17TH ANNUAL GLOBAL TRANSPORTATION CONFERENCE**

September 10, 2018 | Boston, MA

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**“WE ESTIMATE WTI COULD TRADE AT $60, BRENT CLOSE TO $70, AND DIESEL PRICES BETWEEN $90 AND $100.”**

—IMO 2020 IMPACT TO THE TRANSPORTATION SECTOR

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$71 / BBL

3.4 MILLION BPD HIGH SULFUR MARINE FUEL TO BE REPLACED BY LOWER SULFUR FUEL / DIESEL

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“WE ESTIMATE WTI COULD TRADE AT $60, BRENT CLOSE TO $70, AND DIESEL PRICES BETWEEN $90 AND $100.”

—IMO 2020 IMPACT TO THE TRANSPORTATION SECTOR

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$71 / BBL

3.4 MILLION BPD HIGH SULFUR MARINE FUEL TO BE REPLACED BY LOWER SULFUR FUEL / DIESEL
2018 saw Europe’s implementation of the General Data Protection Regulation (GDPR), along with extensive discussion of potential European government action to require access to Facebook and Google proprietary data for promotion of greater competition and innovation. During this time, Facebook also found itself at the center of controversy and congressional hearings once it was revealed that user data had been made available to a third-party firm for uses pertaining to political messages during the 2016 U.S. election. As stock prices react to cybersecurity breaches and regulation of data protection moves to the fore, privacy becomes an increasingly important theme in fundamental analysis.
“75% of senior ad buyers surveyed by Cowen indicated no plans to adjust Facebook AD spending following the Cambridge Analytica revelations.”

—COWEN’S INAUGURAL MIDYEAR AD BUYER SURVEY

“In our view, the right to be forgotten when it comes to credit histories is less radical than it first appears, as the existing law already requires most data to be forgotten after 7 years.”

—RIGHT TO BE FORGOTTEN: CREDIT BUREAU, ECONOMY RISK

REPRESENTATIVE RESEARCH

AHEAD OF THE CURVE™ SERIES
COWEN’S INAUGURAL MIDYEAR AD BUYER SURVEY
July 18, 2018
Cowen Analyst: John Blackledge

AHEAD OF THE CURVE™ SERIES
RIGHT TO BE FORGOTTEN: CREDIT BUREAU, ECONOMY RISK
April 11, 2018
Cowen Analysts: George Mihalos, Jaret Seiberg

FTC PRIVACY RULING IS QUITE ENCOURAGING FOR FACEBOOK AND GOOGLE
November 14, 2018
Cowen Analyst: Paul Gallant

TOP POLICY MAKERS DATA PRIVACY LEGISLATION, BUT WE REMAIN SKEPTICAL
September 24, 2018
Cowen Analyst: Paul Gallant

FB UPDATE: US ENGAGEMENT TRENDS, CONGRESSIONAL TESTIMONY, AND EST. CHANGES
April 12, 2018
Cowen Analyst: John Blackledge

FB’S MARK ZUCKERBERG STRUCK THE RIGHT TONE DURING CNN INTERVIEW
March 22, 2018
Cowen Analyst: John Blackledge

SHADING BACK EUROPEAN POLICY CONCERNS FOR INTERNET COMPANIES
January 24, 2018
Cowen Analysts: John Blackledge, Paul Gallant

SELECTED EVENTS

46TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE
May 29-31, 2018 | New York, NY

TMT POLICY DAY
September 20, 2018 | Washington, DC

11TH ANNUAL BANK REGULATION DAY
July 10, 2018 | Washington, DC

6TH ANNUAL INTERNET & MEDIA BUS TOUR
August 6-9, 2018 | Seattle, WA, San Francisco, CA, Los Angeles, CA

COWEN COMPANY COVERAGE

AMAZON AMZN
AT&T T
CHARTER COMMUNICATIONS CHTR
CISCO CSCO
FACEBOOK FB
GOOGLE GOOG
TWITTER TWTR
CONTACT COWEN RESEARCH

ROBERT FAGIN
Director of Research
646 562 1310
robert.fagin@cowen.com

LISA THOMAS
Associate Director of Research
646 562 1388
lisa.thomas@cowen.com

SELECT 2019 COWEN CONFERENCES

40TH ANNUAL AEROSPACE/DEFENSE CONFERENCE
February 2019 | New York, NY

39TH ANNUAL HEALTH CARE CONFERENCE
March 2019 | Boston, MA

5TH ANNUAL FUTURE OF THE CONSUMER CONFERENCE
April 2019 | New York, NY

47TH ANNUAL TECHNOLOGY, MEDIA & TELECOM CONFERENCE
May 2019 | New York, NY

CANNABIS SUMMIT
May 2019 | Toronto, ON

4TH ANNUAL FUTUREHEALTH CONFERENCE
June 2019 | San Francisco, CA

5TH ANNUAL COMMUNICATIONS INFRASTRUCTURE SUMMIT
August 2019 | Boulder, CO

INTERNET & MEDIA BUS TOUR
August 2019 | Seattle, WA, San Francisco, CA

12TH ANNUAL GLOBAL TRANSPORTATION CONFERENCE
September 2019 | Boston, MA

22ND ANNUAL THERAPEUTICS CONFERENCE
September 2019 | New York, NY

8TH ANNUAL MEDTOOLS UNLOCKED CONFERENCE
September 2019 | Houston, TX

4TH ANNUAL INDUSTRIAL INNOVATION & TECHNOLOGY SUMMIT
November 2019 | New York, NY

3RD ANNUAL IO NEXT SUMMIT
November 2019 | Washington, D.C.

9TH ANNUAL ENERGY & NATURAL RESOURCES CONFERENCE
December 2019 | New York, NY

6TH ANNUAL NETWORKING & CYBERSECURITY SUMMIT
December 2019 | New York, NY

3RD ANNUAL EAST COAST CANNABIS SUMMIT
December 2019 | Boston, MA

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