J.P. Morgan 2020 Healthcare Conference

Michel Vounatsos, Chief Executive Officer

January 13, 2020

Forward-looking statements

This presentation contains forward-looking statements, including statements made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995, relating to: our strategy and plans; corporate strategy update; potential of our commercial business and pipeline programs; the prospects of our product portfolio; pipeline potential and progress; anticipated clinical trials and data readouts; the potential benefits, safety, and efficacy of our products and investigational therapies; risks and uncertainties associated with drug development and commercialization; regulatory filings, product launches, and the timing thereof; reimbursement activities; anticipated benefits and potential of investments, collaborations, and business development activities; the timing and execution of stock repurchases; our future financial and operating results; and other financial matters. These forward-looking statements may be accompanied by words such as “aim,” “anticipate,” “believe,” “could,” “estimate,” “expect,” “forecast,” “goal,” “intend,” “may,” “plan,” “potential,” “possible,” “will,” “would,” and other words and terms of similar meaning. Drug development and commercialization involve a high degree of risk, and only a small number of research and development programs result in commercialization of a product. Results in early stage clinical trials may not be indicative of full results or results from later stage or larger scale clinical trials and do not ensure regulatory approval. You should not place undue reliance on these statements or the scientific data presented.

These statements involve risks and uncertainties that could cause actual results to differ materially from those reflected in such statements, including: our dependence on sales from our products; difficulties in obtaining and maintaining adequate coverage, pricing, and reimbursement for our products; failure to protect and enforce our data, intellectual property, and other proprietary rights and the risks and uncertainties relating to intellectual property claims and challenges; uncertainty of long-term success in developing, licensing, or acquiring other product candidates or additional indications for existing products; failure to compete effectively due to significant product competition in the markets for our products; failure to successfully execute or realize the anticipated benefits of our strategic and growth initiatives; risks relating to technology failures or breaches; the risk that positive results in a clinical trial may not be replicated in subsequent or confirmatory trials or success in early stage clinical trials may not be predictive of results in later stage or large scale clinical trials or trials in other potential indications; risks associated with clinical trials, including our ability to adequately manage clinical activities, unexpected concerns that may arise from additional data or analysis obtained during clinical trials, regulatory authorities may require additional information or further studies, or may fail to approve or may delay approval of our drug candidates; the occurrence of adverse safety events, restrictions on use with our products, or product liability claims; our dependence on collaborators, joint venture partners, and other third parties for the development, regulatory approval, and commercialization of products and other aspects of our business, which are outside of our full control; risks associated with current and potential future healthcare reforms; failure to comply with legal and regulatory requirements; the risks of doing business internationally, including currency exchange rate fluctuations; risks relating to management and key personnel changes, including attracting and retaining key personnel; risks relating to investment in our manufacturing capacity; problems with our manufacturing processes; risks related to commercialization of biosimilars; fluctuations in our operating results; fluctuations in our effective tax rate; risks related to investment in properties; the market, interest, and credit risks associated with our portfolio of marketable securities; risks relating to our share repurchase programs; risks relating to access to capital and credit markets; risks related to indebtedness; environmental risks; risks relating to the distribution and sale by third parties of counterfeit or unfit versions of our products; risks relating to the use of social media for our business; change in control provisions in certain of our collaboration agreements; and the other risks and uncertainties that are described in the Risk Factors section of our most recent annual or quarterly report and in other reports we have filed with the U.S. Securities and Exchange Commission (SEC).

These statements are based on our current beliefs and expectations and speak only as of the date of this presentation. We do not undertake any obligation to publicly update any forward-looking statements.

Where science meets humanity

Pioneering science

Diligent execution

Strong momentum

Biogen

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Strong momentum

Biogen

The time is now for neuroscience

#1 **Cause of disability** globally

#2 **Cause of deaths** worldwide

Current Core Business

~2.5M patients with multiple sclerosis

Spinal muscular atrophy: A **leading genetic cause of infant mortality**

Near-Term Opportunities

~50M patients with dementia

<5 years average life expectancy for patients with ALS

Stroke: **5th leading cause of death** in the U.S.

Up to 200,000 patients with inherited retinal disorders in the U.S.

Biogen

Source: Lancet Neurology, 2017; World Health Organization; The ALS Association; American Heart Association; Biogen, data on file.

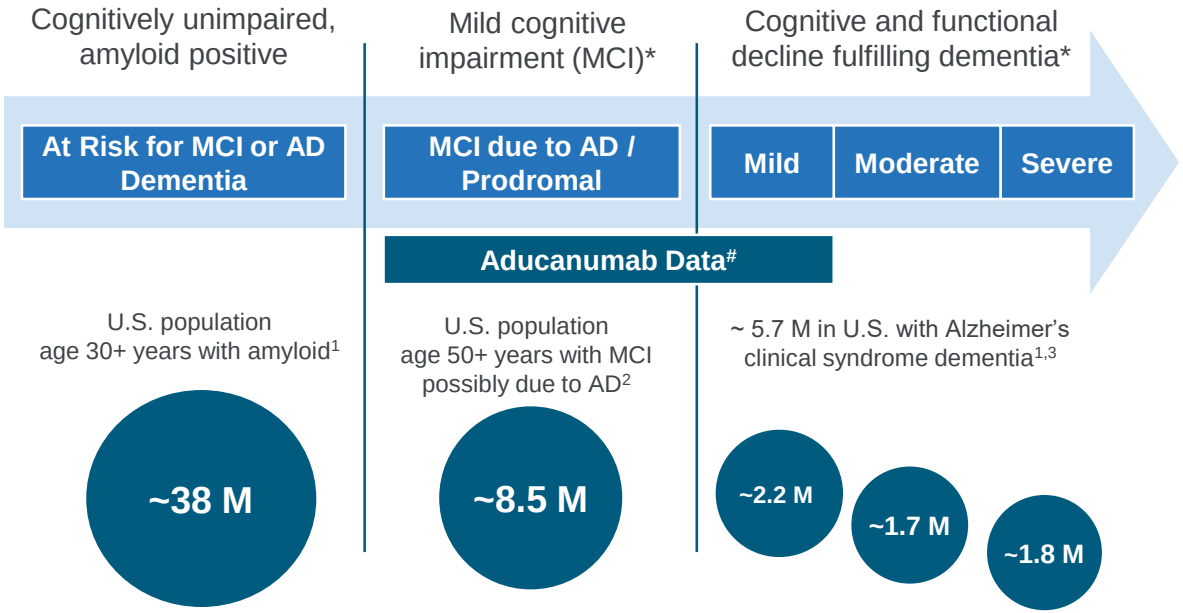
Leading in Alzheimer's disease

- **Sufficient exposure to high dose aducanumab reduced clinical decline across multiple clinical endpoints**
- **Actively engaging with the FDA as well as regulators in Europe and Japan**
- **Working to complete a regulatory filing in the U.S. as soon as possible**
- **If approved, aducanumab would become the first therapy to reduce clinical decline in Alzheimer's disease**
- **Advancing a broad portfolio including BAN2401, multiple tau-directed assets, and novel preclinical programs**

Note: Aducanumab and BAN2401 are being developed in collaboration with Eisai.

Significant unmet need in Alzheimer's disease

Alzheimer's Disease U.S. Prevalence



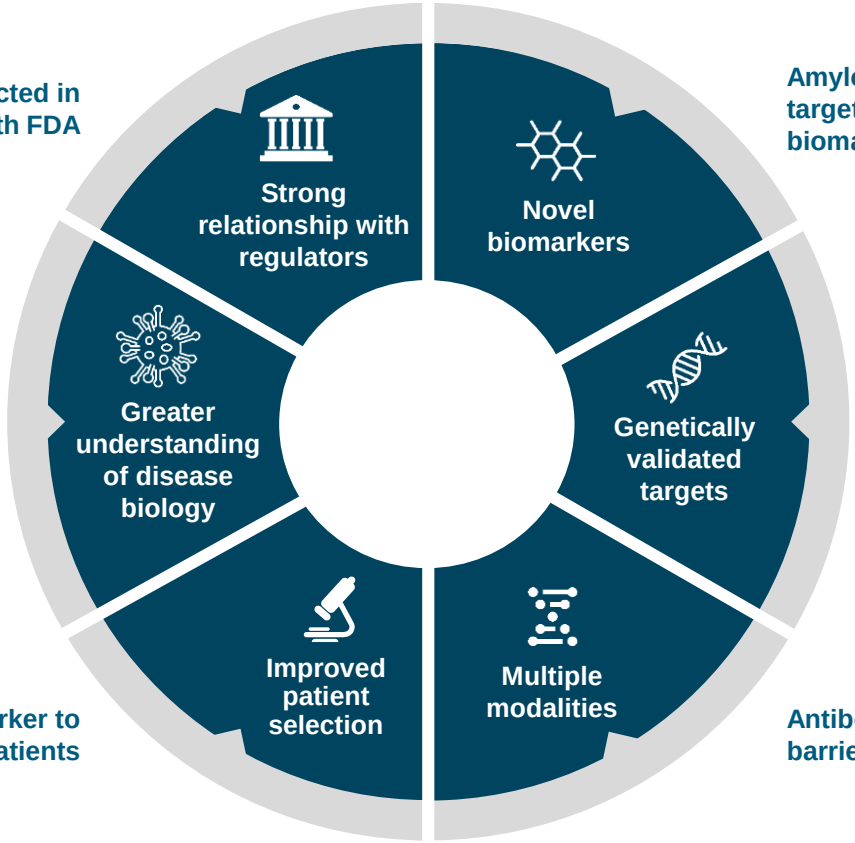
* Estimates based on clinical diagnosis. Not all patients may be amyloid positive.

Data obtained in individuals with confirmed amyloid positivity and a clinical diagnosis of MCI due to AD or mild AD dementia.

Biogen

1. Alzheimer's Association Facts & Figures 2018; 2. Petersen et al 2018 Neurology; Knopman et al 2016 Alz & Dement; 3. Hebert et al. 2003 Arch Neurol; Alzheimer's Association Changing the Trajectory of Disease 2015.

Aducanumab exemplifies Biogen's asymmetric core capabilities



Analyses conducted in consultation with FDA

Amyloid PET biomarker for target engagement and biomarkers of tau pathology

Role of aggregated forms of amyloid beta and linkage to tau

Causative role of amyloid beta supported by human genetics

Amyloid PET biomarker to select the right patients

Antibodies can cross the blood brain barrier at therapeutic concentrations

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Pioneering science across broad pipeline

Amyotrophic lateral sclerosis (ALS)
Tofersen, BIIB078#

Alzheimer's disease
Aducanumab*, BAN2401*, gosuranemab, BIIB076, BIIB080

Stroke
Glibenclamide IV

Lupus
Dapirolizumab pegol*, BIIB059

Parkinson's disease
BIIB054

Biogen

*Collaboration program
Option agreement

Biomarkers for target engagement and disease activity

Aducanumab* (Aβ mAb) – Alzheimer's

- Reduction of amyloid plaque (PET) demonstrating target engagement
- Reduction in tau pathology as measured by both CSF tau and tau PET

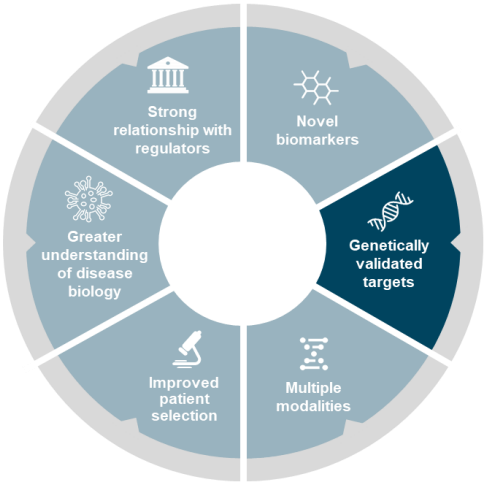
Tofersen (BII067) - ALS

- Significant reductions on SOD1 protein in the CSF demonstrating target engagement
- Reduction in neurofilament as biomarker of disease activity

Glibenclamide IV (BIIB093) – Stroke

- Significant reduction in midline shift, an imaging measure of brain swelling

Pioneering science across broad pipeline



Parkinson's disease
BIIB054, BIIB094#

Alzheimer's disease
Aducanumab*, BAN2401*, gosuranemab, BIIB076, BIIB080

Amyotrophic lateral sclerosis (ALS)
Tofersen, BIIB078#

Neuropathic pain
BIIB074, BIIB095

Spinal muscular atrophy
BIIB110

Inherited retinal disorders
BIIB111, BIIB112

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* Collaboration program
# Option agreement

Pursuing genetically validated targets

Aducanumab* (Aβ mAb) – Alzheimer's

- Mutations in amyloid precursor protein can cause early onset Alzheimer's disease

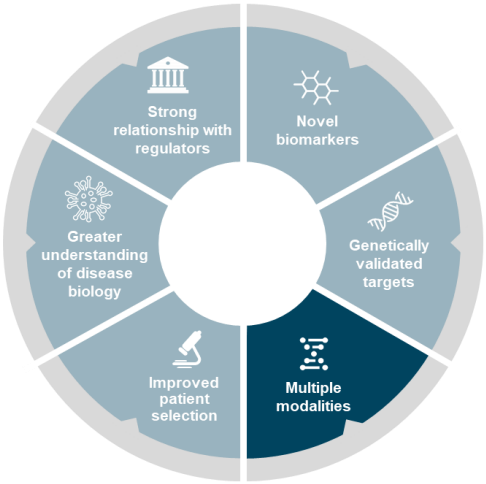
BIIB078# (IONIS-C9$_{Rx}$) – ALS

- Genetic variants of C9orf72 are the most common genetic cause of ALS

BIIB054 (α-synuclein mAb) – Parkinson's

- Mutations in α-synuclein can cause familial forms of Parkinson's disease

Pioneering science across broad pipeline



Oral protein degraders

Monoclonal antibodies

Oral splicing modulators

Gene therapy

Antisense oligonucleotides

Additional biologics

Traditional small molecules

Biogen

Leveraging multiple modalities to maximize probability of success

Aducanumab* (Aβ mAb) – Alzheimer's

- Monoclonal antibody that selectively binds aggregated forms of amyloid beta

BIIB111 (gene therapy) – Choroideremia

- Gene therapy aiming to address root cause of rare genetic disease leading to blindness

BIIB094# (ION859) – Parkinson's

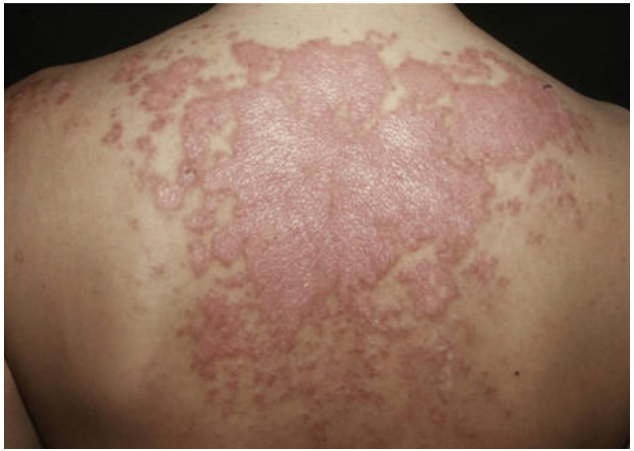
- Antisense oligonucleotide (ASO) targeting LRRK2, the most common genetic cause of Parkinson's disease

* Collaboration program
# Option agreement

Positive phase 2 results for BIIB059 in lupus

BIIB059 (anti-BDCA2)

- **Large market opportunity (~ 800,000 patients in G7) with limited treatment options**
  - Cutaneous lupus erythematosus (CLE): skin disorder
  - Systemic lupus erythematosus (SLE): systemic disease with joint involvement
- BIIB059: monoclonal antibody designed to **reduce production of inflammatory cytokines** (e.g., type-I interferon)
- Phase 2 LILAC study **met its primary endpoints** for both CLE and SLE:
  - CLE: Dose response of BIIB059 on percent change from baseline in CLASI-A* score at week 16 (**p<0.001**)
  - SLE: Reduction in change from baseline in total active joint count at week 24 **(p=0.037**)
- Planning to advance BIIB059 to **Phase 3**



Skin lesions in CLE

(Uva et al., 2012)

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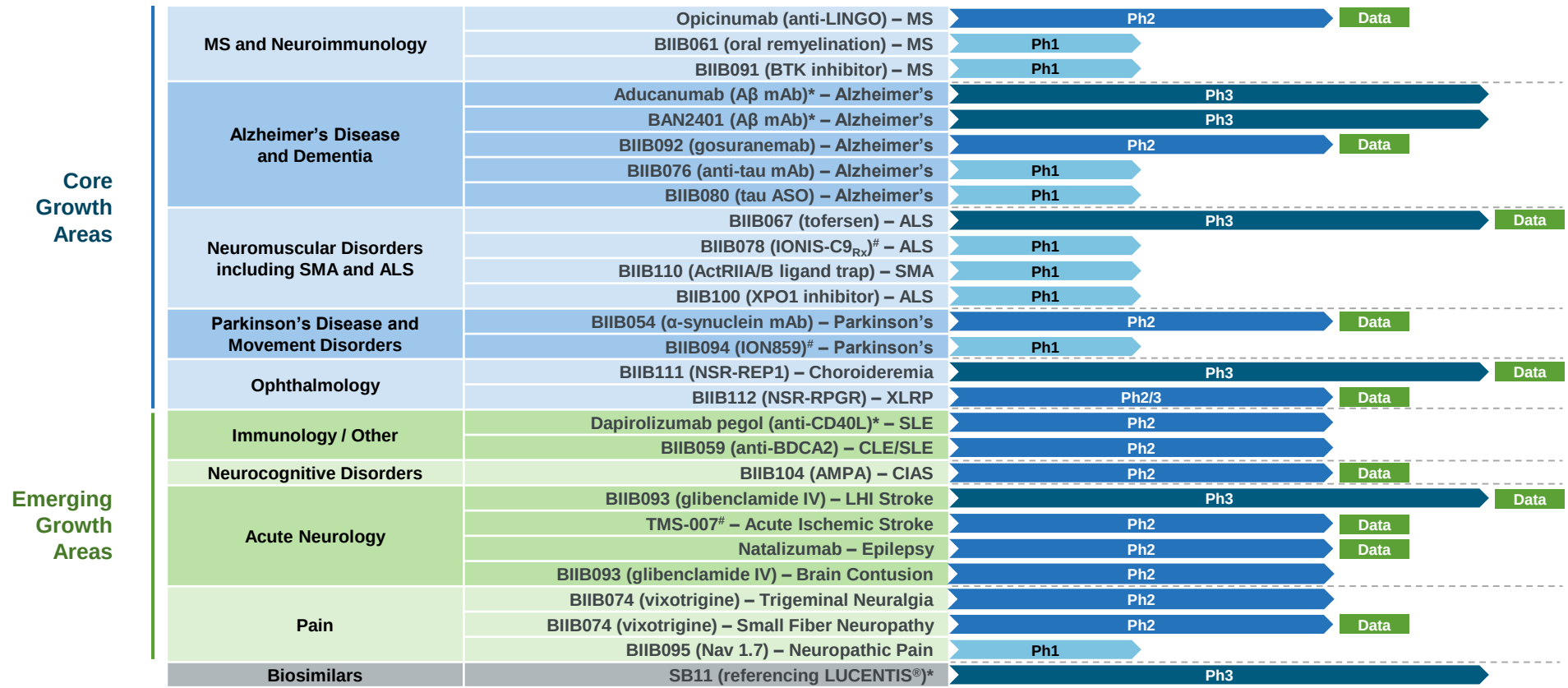
* CLASI-A = Cutaneous Lupus Erythematosus Disease Area and Severity Index Activity

Advancing a broad pipeline toward a multi-franchise portfolio



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Data: data readout expected by end of 2021

* Collaboration program; # Option agreement; MS = multiple sclerosis; ALS = amyotrophic lateral sclerosis; SMA = spinal muscular atrophy; XLRP = X-linked retinitis pigmentosa; SLE = systemic lupus erythematosus; CLE = cutaneous lupus erythematosus; CIAS = cognitive impairment associated with schizophrenia; LHI = large hemispheric infarction

Continuing to create value through pioneering science

Building breadth and depth across the pipeline → **Working to create multiple franchises**

10+ data readouts expected by end of 2021 → **Multiple value creation inflection points**

The leader in neuroscience → **Significant market opportunity with high unmet need**

Where science meets humanity

Pioneering science

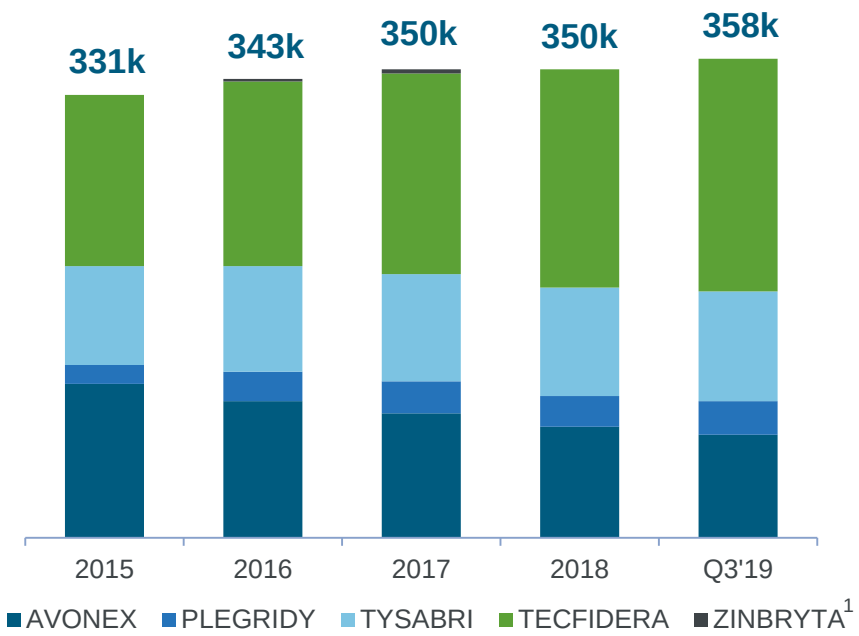
Diligent execution

Strong momentum

Biogen

Demonstrated resilience in our $9 billion MS franchise

Biogen MS patients



Highlights

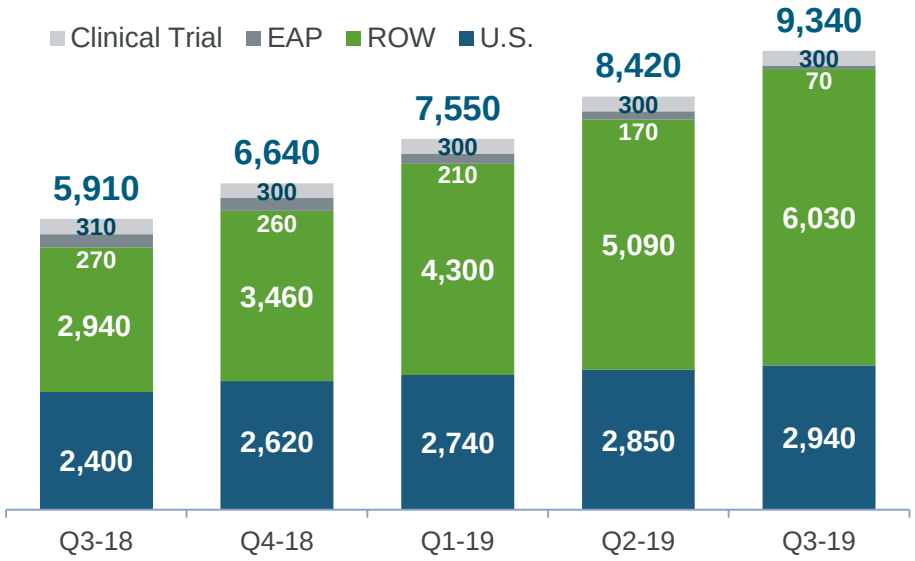
- > $20B market with ~ 1 million treated MS patients worldwide[2]
- Biogen products treat ~35% of all treated MS patients globally[2]
- **VUMERITY (diroximel fumarate)** launched in the U.S. as a novel oral option
- Continuing to invest in MS R&D, pursuing:
  - Extended interval dosing of TYSABRI
  - Opicinumab and BIIB061 for remyelination
  - BIIB091 (oral BTK inhibitor) in Phase 1
  - European label update for use of interferons during pregnancy

Note: Patient numbers represent estimated ending patient count as of December 31st of each year, except for 2019, which represents patients as of September 30, 2019.

1. ZINBRYTA was withdrawn from the market in March 2018.
2. Biogen data on file as of September 30, 2019.

Blockbuster global launch of SPINRAZA, driven by global expansion

SPINRAZA patients*



* Note: U.S. and Ex-US SPINRAZA patients represent the total number of patients on therapy in the post-marketing setting as of the end of each quarter, including free patients in the U.S. EAP patients represent patients actively enrolled in the Expanded Access Program (EAP) as of the end of each quarter.

Highlights

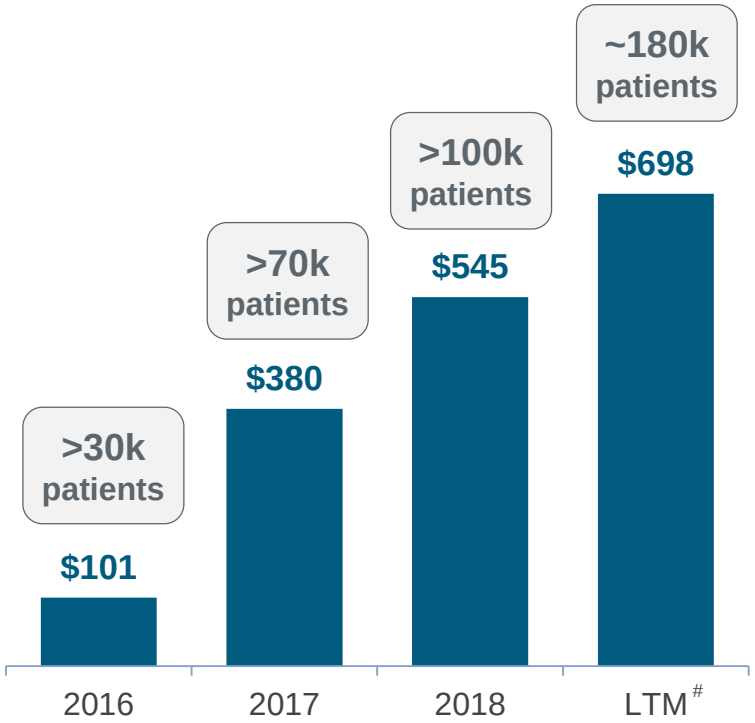
- LTM[1] revenue of **$2.0 billion**
- **Over 10,000 patients** on therapy[2]
  - Over 45,000 individuals with SMA in Biogen direct markets; significant opportunity in LATAM and APAC
  - Formal reimbursement in 40 countries
- Proven efficacy across all patient types and a well characterized safety profile
- **Broad label and largest body of data in SMA**
- **Investing in SMA beyond SPINRAZA, pursuing:**
  - Higher dose for even greater efficacy
  - Muscle enhancement (BIIB110, Phase 1)
  - Novel ASO drug candidates
  - Preclinical oral splicing modulator

1. LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.
2. Total patients across the post-marketing setting, the EAP, and clinical trials as of December 31, 2019.

Bolstering a growing biosimilars business

SAMSUNG BIOEPIS

Anti-TNF biosimilars revenues ($M)



Commercialization of anti-TNFs in Europe

- Biogen contributed ~ €1.8 billion of healthcare savings in 2019 across Europe*

New Commercialization Agreement

- Biogen to commercialize potential ophthalmology biosimilars referencing LUCENTIS and EYLEA across the U.S., Canada, Europe, Japan, and Australia
  - Global market of almost $11 billion in 2018^
- Commercialization rights to anti-TNFs in China

Samsung Bioepis Joint Venture

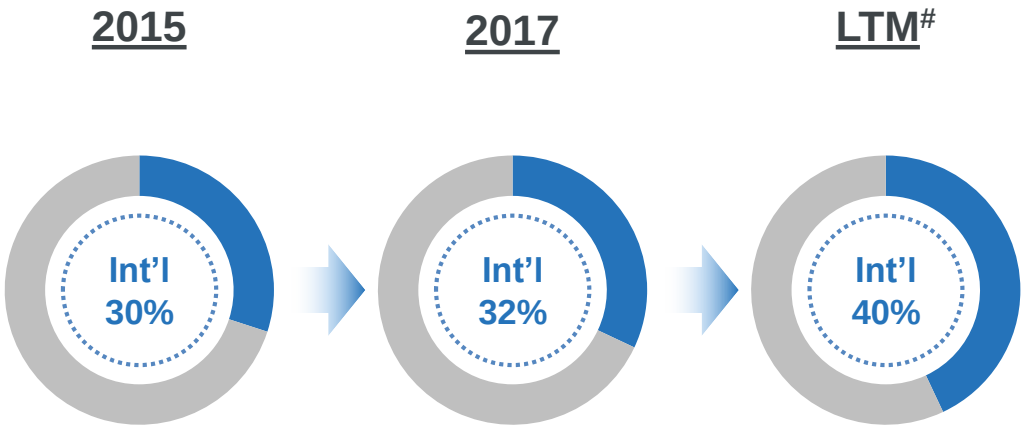
- Equity stake of ~49.9%

Biogen

* Biogen data on file.
# LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.
^ Company reported sales, EvaluatePharma.

Capitalizing on global growth opportunities

Biogen product revenues, net*



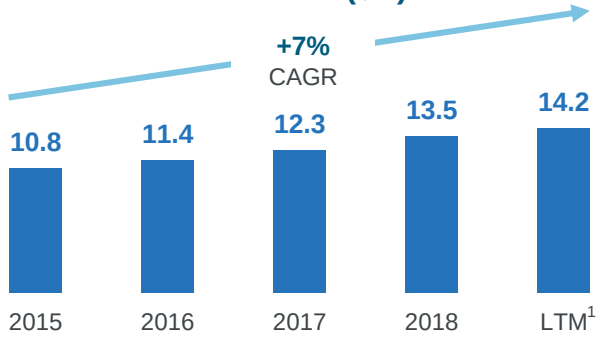
Expanding into new markets**

- Increasing footprint in Asia
  - China
  - Korea
  - Taiwan
  - Hong Kong
- Growing presence in LATAM
  - Colombia
  - Mexico

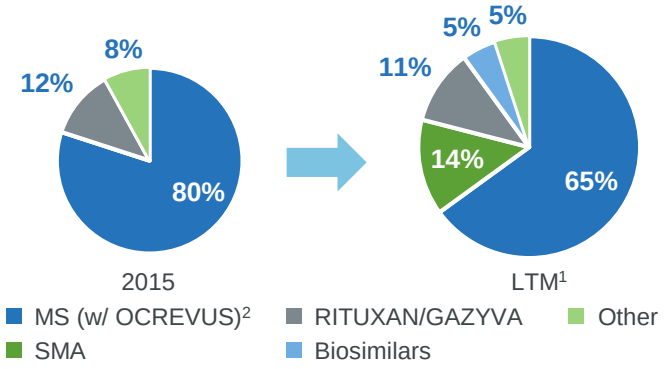
* Excludes hemophilia product revenues for 2015 and 2017.
** New affiliates after January 2017.
# LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.

Strong financial track record

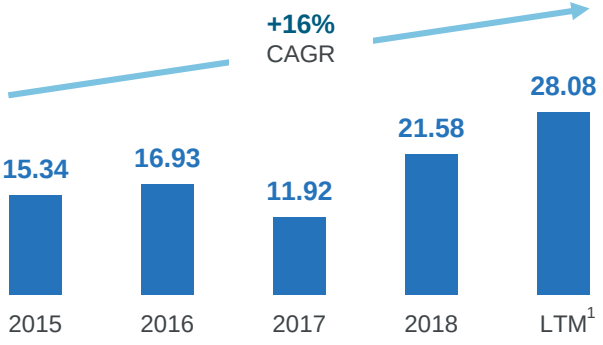
Revenues ($B)



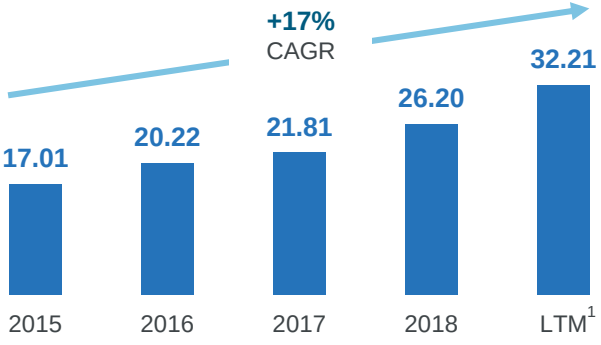
Revenues



GAAP diluted EPS ($)



Non-GAAP diluted EPS ($)



1. LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.
2. Includes royalties on the sales of OCREVUS, which began in 2017.
A reconciliation of our GAAP to non-GAAP financial results is at the end of this presentation.

Where science meets humanity

Pioneering science

Diligent execution

Strong momentum

Biogen

Strong core business and investing for future growth

Executing on the core business

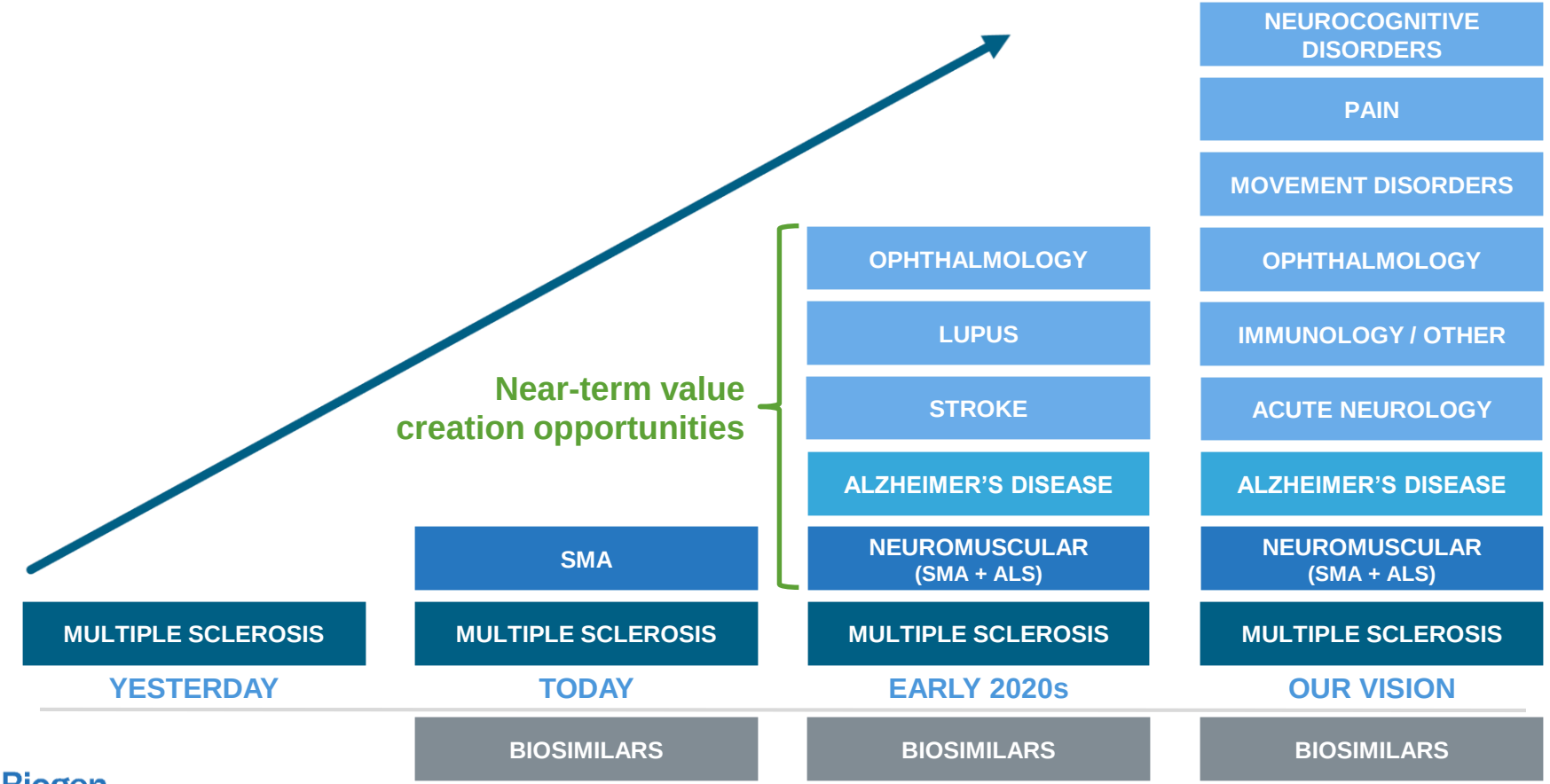
- Maximizing the resilience of our MS core business
- Accelerating our neuromuscular franchise
- Unlocking the potential of biosimilars

+

Creating new sources of value

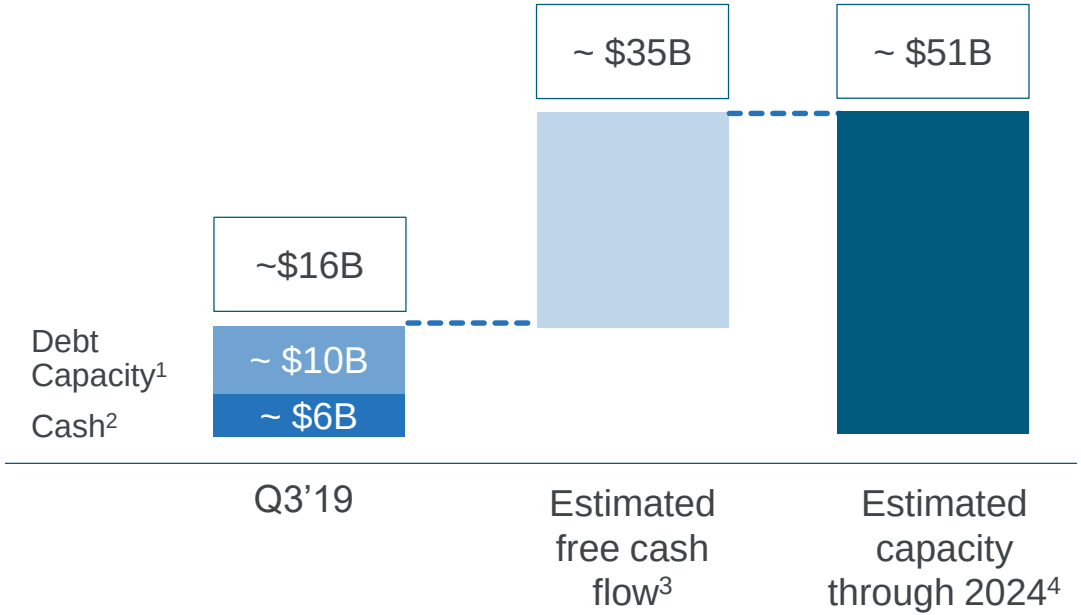
- Leading in Alzheimer's disease
- Developing and expanding our neuroscience portfolio and pursuing therapeutic adjacencies
- Continuous improvement and diligent capital allocation

Continuing to build a multi-franchise portfolio



Potential significant opportunity for capital allocation

For illustrative purposes only



Potential uses of cash

- Business development / M&A
- Share repurchases
  - $5.1B repurchased over LTM
  - $3.4B remaining authorization as of Q3'19

A reconciliation of our GAAP to non-GAAP financial results is at the end of this presentation.

LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.

1. Debt capacity estimate based on gross debt of 2x EBITDA, less current debt outstanding.
2. Cash, cash equivalents, and marketable securities.
3. Free cash flow is defined as cash flow from operations, less capital expenditures. Cash flow from operations is estimated by extrapolating LTM cash flows through 2024.
4. This estimated capacity is for illustrative purposes only, may not be predictive of future results, and assumes stability in our base business and free cash flows similar to the LTM.

Where science meets humanity

PATIENTS

PIONEERING SCIENCE TO TRANSFORM PEOPLE'S LIVES

Early Access Programs
in over 40 countries^

~180,000 Patients
treated with biosimilars^

100% HTAs#
pricing approval

Innovating Digital Tools
to help patients (Aby/CLEO)

EMPLOYEES

IGNITING THE WORLD'S LEADING SCIENTIFIC MINDS IN AN INCLUSIVE WORKPLACE

46% women in director-level positions and above^

25% ethnic or racial minorities in U.S. director-level roles and above^

'Best Place to Work for Disability Inclusion'
3 consecutive years

Driving Health Equity
in the disease areas we treat

ENVIRONMENT

FOLLOWING THE SCIENCE TO OPERATE SUSTAINABLY AND SET BOLD TARGETS

#1 Biotech Company
on Dow Jones Sustainability Index*

Carbon neutral
company since 2014

100% renewable
power commitment

Green chemistry
principles adopted

COMMUNITY

INSPIRING THE NEXT GENERATION OF SCIENTISTS IN OUR COMMUNITIES

$10M 4-year STEM commitment
from Biogen Foundation

53k+ students engaged in Community Lab since inception^

54% summer Community Lab students from underrepresented and/or low-income household groups^

3k+ employees volunteered
in 30+ countries
for Care Deeply Day

Biogen

^Biogen data on file as of September 30, 2019 #Health Technology Assessment *DJSI World and DJSI North America

Significant opportunity for value creation

Near-Term Opportunities

~50M patients with dementia

<5 years average life expectancy for patients with ALS

~800,000 patients with lupus*

Stroke: **5th leading cause of death** in the U.S.

Up to 200,000 patients with inherited retinal disorders in the U.S.

Pioneering science ✓

- Filing for approval of aducanumab#
- Advancing a broad pipeline
- Significant opportunity remains in neuroscience

Diligent execution ✓

- Core business in MS, SMA, and biosimilars
- Capitalizing on global growth opportunities
- Commercial and launch excellence

Strong momentum ✓

- Working to build multiple franchises
- 10+ readouts expected by end of 2021
- Significant financial capacity

Biogen

Source: World Health Organization; The ALS Association; American Heart Association; Biogen, data on file.
* Represents patients with CLE and/or SLE in the G7

Aducanumab is being developed in collaboration with Eisai.

GAAP to non-GAAP reconciliation

Diluted EPS and Net Income to Biogen Inc.
(Unaudited, $ in millions, except per share amounts)

	FY 2015	FY 2016	FY 2017	FY 2018	LTM
GAAP EPS - Diluted	$ 15.34	$ 16.93	$ 11.92	$ 21.58	$ 28.08
Adjustment to net income attributable to Biogen Inc. (see below)	167	3.29	9.89	4.62	4.13
Non-GAAP EPS - Diluted	$ 17.01	$ 20.22	$ 21.81	$ 26.20	$ 32.21
GAAP Net Income Attributable to Biogen Inc.	$ 3,547	$ 3,703	$ 2,539	$ 4,431	$ 5,396
Amortization of acquired intangible assets [A,B]	365	374	815	747	676
TECFIDERA litigation settlement charge [A]	-	455	-	-	-
Acquired in-process research and development	-	-	120	113	-
Research and development	-	-	-	10	-
(Gain) loss on fair value remeasurement of contingent consideration [C]	31	15	63	(12)	13
Loss on divestiture of Hillerød, Denmark manufacturing operations [D]	-	-	-	-	96
Premium paid on purchase of Ionis common stock [E]	-	-	-	162	-
(Gain) loss on equity security investments	-	-	-	(128)	(185)
Net distribution to noncontrolling interests [F]	-	-	132	44	(2)
(Gain) loss on deconsolidation of variable interest entities	-	(4)	-	-	-
Restructuring, business transformation and other cost saving initiatives					-
2017 corporate strategy implementation [G]	-	-	19	11	3
Restructuring charges [H]	93	33	1	12	4
Cambridge manufacturing facility rationalization costs [I]	-	55	-	-	-
Hemophilia business separation costs	-	18	19	-	
Acquisition-related transaction and integration costs	-	-	-	-	23
Stock option expense and other [J]	-	-	-	-	33
Income tax effect related to reconciling items	(104)	(225)	(236)	(147)	(12)
Elimination of deferred tax asset	-	-	-	11	11
Swiss tax reform [K]	-	-	-	-	(54)
U.S. tax reform [L]	-	-	1,174	125	136
Amortization included in equity in loss of investee, net of tax [M]	-	-	-	-	58
Non-GAAP Net Income Attributable to Biogen Inc.	$ 3,932	$ 4,423	$ 4,645	$ 5,378	$ 6,205

(unaudited, $ in millions)

	LTM	Q4 2019 - 2024
Net cash flows provided by operating activities	$ 7,014	$ 36,822
Purchases of property, plant and equipment (Capital Expenditures)	630	1,943
Contingent consideration paid related to Fumapharm AG acquisition	600	-
Free Cash Flow	$ 5,784	$ 34,880

Use of Non-GAAP Financial Measures

We supplement our consolidated financial statements presented on a GAAP basis by providing additional measures which may be considered "Non-GAAP" financial measures under applicable SEC rules. We believe that the disclosure of these Non-GAAP financial measures provides additional insight into the ongoing economics of our business and reflects how we manage our business internally, set operational goals and form the basis of our management incentive programs. These Non-GAAP financial measures are not in accordance with generally accepted accounting principles in the United States and should not be viewed in isolation or as a substitute for reported, or GAAP, net income attributable to Biogen Inc. and diluted earnings per share.

Our "Non-GAAP net income attributable to Biogen Inc." and "Non-GAAP earnings per share - Diluted" financial measures exclude the following items from "GAAP net income attributable to Biogen Inc." and "GAAP earnings per share - Diluted":

1. Acquisition and divestiture related costs
We exclude transaction, integration and certain other costs related to the acquisition and divestiture of businesses. We exclude certain purchase accounting related items associated with the acquisition of assets and amounts in relation to the consolidation or deconsolidation of variable interest entities. These adjustments include, but are not limited to, charges for in-process research and development and certain milestones, the amortization and impairment of intangible assets, and charges or credits from the fair value remeasurement of our contingent consideration obligations and losses on assets and liabilities held for sale.

2. Hemophilia business separation costs
We have excluded costs that are directly associated with the set up and spin-off of our hemophilia business on February 1, 2017. These costs represent incremental third-party costs attributable solely to hemophilia separation and set up activities.

3. Restructuring, business transformation and other cost saving initiatives
We exclude costs associated with our execution of certain strategies and initiatives to streamline operations, achieve targeted cost reductions, rationalize manufacturing facilities, or refocus R&D activities. These costs may include employee separation costs, retention bonuses, facility closing and exit costs, asset impairment charges or additional depreciation when the expected useful life of certain assets have been shortened due to changes in anticipated usage and other costs or credits that management believes do not have a direct correlation to our ongoing or future business operations.

4. (Gain) loss on equity security investments
We exclude unrealized and realized gains and losses and discounts or premiums on our equity security investments as we do not believe that these components of income or expense have a direct correlation to our ongoing or future business operations.

5. Other items
We evaluate other items of income and expense on an individual basis and consider both the quantitative and qualitative aspects of the item, including (i) its size and nature, (ii) whether or not it relates to our ongoing business operations, and (iii) whether or not we expect it to occur as part of our normal business on a regular basis. We also include an adjustment to reflect the related tax effect of all reconciling items within our reconciliation of our GAAP to Non-GAAP net income attributable to Biogen Inc. and earnings per share - diluted.

Free Cash Flow

Free cash flow is defined as cash flow from operations, less capital expenditures and, for the LTM period, less remaining contingent consideration related to the Fumapharm AG acquisition. During the first quarter of 2019 we made our final contingent payment related to the Fumapharm AG acquisition and we no longer have any payment obligations to the former shareholders of Fumapharm AG and holders of their rights. Net cash flows provided by operating activities for the period Q4 2019 – 2024 were estimated by extrapolating LTM cash flows through 2024.

Numbers may not foot due to rounding.

LTM = last 12 months prepared based upon the sum of reported amounts for the nine months ended September 30, 2019, and three months ended December 31, 2018.

GAAP to non-GAAP reconciliation

A In January 2017 we entered into a settlement and license agreement with Forward Pharma A/S (Forward Pharma), which was effective February 1, 2017. Pursuant to this agreement, we obtained U.S. and rest of world licenses to Forward Pharma's intellectual property, including Forward Pharma's intellectual property related to TECFIDERA. In exchange, we paid Forward Pharma $1.25 billion in cash.

During the fourth quarter of 2016 we recognized a pre-tax charge of $454.8 million and in the first quarter of 2017 we recognized an intangible asset of $795.2 million related to this agreement. The pre-tax charge recognized in the fourth quarter of 2016 represented the fair value of our licenses to Forward Pharma's intellectual property for the period April 2014, when we started selling TECFIDERA, through December 31, 2016. The intangible asset represented the fair value of the U.S. and rest of world licenses to Forward Pharma's intellectual property related to TECFIDERA revenues for the period January 2017, the month in which we entered into this agreement, through December 2020, the last month before royalty payments could first commence pursuant to this agreement.

We had an intellectual property dispute with Forward Pharma in the U.S. concerning intellectual property related to TECFIDERA. In March 2017 the U.S. intellectual property dispute was decided in our favor. Forward Pharma appealed to the U.S. Court of Appeals for the Federal Circuit. We evaluated the recoverability of the U.S. asset acquired from Forward Pharma and recorded a $328.2 million impairment charge in the first quarter of 2017 to adjust the carrying value of the acquired U.S. asset to fair value reflecting the impact of the developments in the U.S. legal dispute and continued to amortize the remaining net book value of the U.S. intangible asset in our consolidated statements of income utilizing an economic consumption model. The U.S. Court of Appeals for the Federal Circuit upheld the U.S. Patent and Trademark Office's March 2017 ruling and in January 2019 denied Forward Pharma's petition for rehearing. We evaluated the recoverability of the U.S. asset based upon these most recent developments and recorded a $176.8 million impairment charge in the fourth quarter of 2018 to reduce the remaining net book value of the U.S. asset to zero.

We have an intellectual property dispute with Forward Pharma in the E.U. concerning intellectual property related to TECFIDERA. In March 2018 the European Patent Office (EPO) revoked Forward Pharma's European Patent No. 2 801 355. Forward Pharma has filed an appeal to the Technical Boards of Appeal of the EPO and the appeal is pending. Based upon our assessment of this ruling, we continue to amortize the remaining net book value of the rest of world intangible asset in our consolidated statements of income utilizing an economic consumption model.

Amortization of acquired intangible assets for the twelve months ended December 31, 2017, also includes a $31.2 million pre-tax impairment charge recognized in the fourth quarter of 2017 related to our acquired and in-licensed rights and patents intangible asset related to ZINBRYTA after the initiation of an European Medicines Agency review (referred to as an Article 20 Procedure) of ZINBRYTA following the report of a case of fatal fulminant liver failure, as well as four cases of serious liver injury.

Amortization of acquired intangible assets for the twelve months ended December 31, 2018, also includes the impact of impairment charges related to certain in-process research and development (IPR&D) assets associated with our vixotrigine (BIIB074) program totaling $189.3 million that were recognized during the third quarter of 2018. During the third quarter of 2018 we completed a Phase 2b study of vixotrigine for the potential treatment of painful lumbosacral radiculopathy (PLSR). The study did not meet its primary or secondary efficacy endpoints and we discontinued development of vixotrigine for the potential treatment of PLSR. As a result, we recognized an impairment charge of approximately $60.0 million during the third quarter of 2018 to reduce the fair value of the related IPR&D intangible asset to zero. In addition, we delayed the initiation of the Phase 3 studies of vixotrigine for the potential treatment of trigeminal neuralgia (TGN) as we awaited the outcome of ongoing interactions with the U.S. Food and Drug Administration (FDA) regarding the design of the Phase 3 studies, a more detailed review of the data from the Phase 2b study of vixotrigine for the potential treatment of PLSR and insights from the Phase 2 study of vixotrigine for the potential treatment of small fiber neuropathy. We reassessed the fair value of the TGN program using reduced expected lifetime revenues, higher expected clinical development costs and a lower cumulative probability of success. As a result of that assessment, we recognized an impairment charge of $129.3 million during the third quarter of 2018 to reduce the fair value of the TGN IPR&D intangible asset to $41.8 million at that date.

B Amortization of acquired intangible assets for the LTM period includes a $215.9 million impairment charge related to certain IPR&D assets associated with the Phase 2b study of BG00011 (STX-100) for the potential treatment of idiopathic pulmonary fibrosis, which was discontinued during the third quarter of 2019.

C (Gain) loss on fair value remeasurement of contingent consideration for the LTM period reflects a loss recorded in the three months ended December 31, 2018, related to our vixotrigine program for the potential treatment of TGN to reflect increased probabilities of success following feedback received from the FDA regarding the design of the Phase 3 studies of vixotrigine for the potential treatment of TGN. This loss was partially offset by our adjustment of the value of our contingent consideration obligations related to the BG00011 IPR&D asset, resulting in a gain of $61.2 million during the nine months ended September 30, 2019.

GAAP to non-GAAP reconciliation

D On August 1, 2019, we completed the sale of all of the outstanding shares of our subsidiary that owned our biologics manufacturing operations in Hillerød, Denmark to FUJIFILM Corporation (FUJIFILM). Upon the closing of this transaction, we received approximately $881.9 million in cash, which is subject to the finalization of certain working capital adjustments and may be further adjusted based on other contractual terms, which are discussed below. We determined that the operations disposed of in this transaction did not meet the criteria to be classified as discontinued operations under the applicable guidance.

As part of this transaction, we have provided FUJIFILM with certain minimum batch production commitment guarantees. There is a risk that the minimum contractual batch production commitments will not be met. Based upon estimates as of September 30, 2019, we expect to incur an adverse commitment obligation of approximately $114.0 million associated with such guarantees. We may adjust this estimate based upon changes in business conditions, which may result in the recognition of additional losses. We also may be obligated to indemnify FUJIFILM for liabilities that existed relating to certain business activities incurred prior to the closing of this transaction.

In addition, we may earn certain contingent payments based on future manufacturing activities at the Hillerød facility. For the disposition of a business, our policy is to recognize contingent consideration when the consideration is realizable. As of September 30, 2019, we believe the probability of earning these payments is remote and therefore we did not include these contingent payments in our calculation of the fair value of the operations.

As part of this transaction, we entered into certain manufacturing services agreements with FUJIFILM pursuant to which FUJIFILM will use the Hillerød facility to produce commercial products for us, such as TYSABRI, as well as other third-party products.

In connection with this transaction we recognized a total net loss of approximately $160.2 million in our condensed consolidated statements of income. This loss included a pre-tax loss of $95.5 million. The loss recognized was based on exchange rates and business conditions on the closing date of this transaction, and included costs to sell our Hillerød, Denmark manufacturing operations of approximately $11.2 million and our estimate of the fair value of an adverse commitment of $114.0 million associated with the guarantee of future minimum batch production at the Hillerød facility. The value of this adverse commitment was determined using a probability-weighted estimate of future manufacturing activity. We also recorded a tax expense of $64.7 million related to this transaction.

E In June 2018 we closed a new ten-year exclusive agreement with Ionis Pharmaceuticals, Inc. (Ionis) to develop novel antisense oligonucleotide drug candidates for a broad range of neurological diseases for a total payment of $1.0 billion consisting of an upfront payment of $375.0 million and the purchase of approximately 11.5 million shares of Ionis common stock at a cost of $625.0 million.

The 11.5 million shares of Ionis common stock were purchased at a premium to their fair value at the transaction closing date. The premium consisted of acquiring the shares at a price above the fair value based on the trailing 10-day weighted-average close price prior to entering into the agreement in April 2018 and the effect of certain holding period restrictions. We recorded an asset of $462.9 million in investments and other assets in our condensed consolidated balance sheets reflecting the fair value of the common stock and a charge of $162.1 million to research and development expense in our condensed consolidated statements of income during the second quarter of 2018, reflecting the premium paid for the common stock.

F In October 2017 we amended the terms of our collaboration and license agreement with Neurimmune SubOne AG (Neurimmune). Under the amended agreement, we made a $150.0 million payment to Neurimmune in exchange for a 15% reduction in royalty rates payable on products developed under this agreement, including on potential commercial sales of aducanumab, our anti-amyloid beta antibody candidate for the treatment of Alzheimer's disease. In May 2018 we made an additional $50.0 million payment to Neurimmune to further reduce the previously negotiated royalty rates payable on products developed under this agreement, including on potential commercial sales of aducanumab, by an additional 5%.

Net distribution to noncontrolling interest for the LTM period reflects the $150.0 million and $50.0 million payments made to Neurimmune, net of Neurimmune's tax, in October 2017 and May 2018, respectively.

Net distribution to noncontrolling interest for the twelve months ended December 31, 2017, reflects the $150.0 million payment made to Neurimmune, net of Neurimmune's tax, in October 2017.

G 2017 corporate strategy implementation charges are related to our efforts to create a leaner and simpler operating model.

H Restructuring charges for the twelve months ended December 31, 2018 and 2017, are related to our efforts to create a leaner and simpler operating model in connection with our 2017 corporate strategy.

Restructuring charges for the twelve months ended December 31, 2016, reflect $8.0 million of costs incurred in connection with our 2015 corporate restructuring and charges of $17.7 million incurred in connection with additional cost savings measures primarily intended to realign our organizational structure in anticipation of the changes in roles and workforce resulting from our decision to spin-off our hemophilia business and to achieve further targeted cost reductions. Restructuring charges for the twelve months ended December 31, 2016, also include severance charges of $7.4 million related to employee separation costs as a result of our decision to vacate and cease manufacturing in Cambridge, MA and vacate our warehouse in Somerville, MA.

Restructuring charges for the twelve months ended December 31, 2015, reflect $93.4 million of costs incurred in connection with our 2015 corporate restructuring.

GAAP to non-GAAP reconciliation

I Cambridge manufacturing facility rationalization costs for the twelve months ended December 31, 2016, reflect charges to cost of sales, excluding amortization of acquired intangible assets of $45.5 million for additional depreciation and $6.9 million for the write-down of excess inventory incurred in connection with our decision to vacate and cease manufacturing in Cambridge, MA and vacate our warehouse in Somerville, MA.

J Stock option expense and other for the LTM period primarily reflects the accelerated vesting of stock options previously granted to Nightstar Therapeutics plc (NST) employees as a result of our acquisition of NST in the second quarter of 2019.

K During the third quarter of 2019 a new taxing regime in the country and certain cantons of Switzerland was enacted and we refer to this as Swiss Tax Reform. As a result of the impact of Swiss Tax Reform, we recorded an income tax benefit of approximately $54.3 million resulting from a remeasurement of our deferred tax assets and liabilities during the nine months ended September 30, 2019.

L The Tax Cuts and Jobs Act of 2017 (2017 Tax Act) resulted in significant changes to the U.S. corporate income tax system. These changes include a federal statutory rate reduction from 35% to 21%, the elimination or reduction of certain domestic deductions and credits and limitations on the deductibility of interest expense and executive compensation. The 2017 Tax Act also transitions international taxation from a worldwide system to a modified territorial system and includes base erosion prevention measures on non-U.S. earnings, which has the effect of subjecting certain earnings of our foreign subsidiaries to U.S. taxation as global intangible low-taxed income (GILTI). During the fourth quarter of 2018 we elected to recognize deferred taxes for the basis differences expected to reverse as GILTI is incurred and have established initial deferred tax balances, as of the enactment date of the 2017 Tax Act.

During the fourth quarter of 2017 we recognized within our provision for income taxes a $1.2 billion provisional estimate pursuant to the U.S. Securities and Exchange Commission Staff Accounting Bulletin No. 118. Our provisional estimate included an amount of $989.6 million associated with a one-time mandatory deemed repatriation tax on accumulated foreign subsidiaries' previously untaxed foreign earnings (the Transition Toll Tax) and $184.0 million related to the impact of remeasuring our deferred tax balances to reflect the new federal statutory rate and other changes to U.S. tax law.

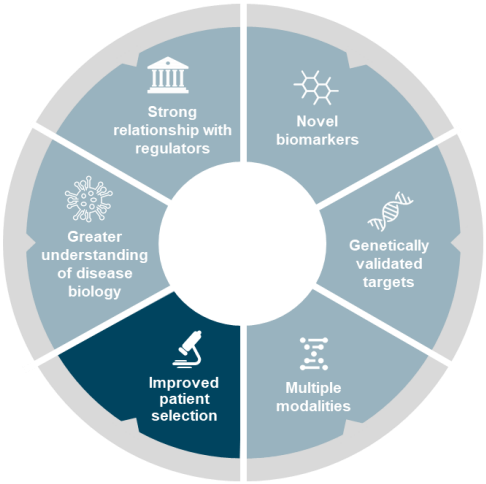
Tax reform amounts for the twelve months ended December 31, 2018, also reflects the effect of a net reduction of $34.6 million to our 2017 preliminary Transition Toll Tax estimate, an expense of $12.7 million for the remeasurement of our deferred tax balances and an $11.0 million expense to reflect other aspects of the 2017 Tax Act.

Tax reform amounts for the LTM period and the twelve months ended December 31, 2018, also reflects the effect of an expense of $135.8 million related to the establishment of GILTI deferred taxes.

M Amortization included in equity in loss of investee, net of tax for the LTM period reflects the amortization of the differences between the fair value of our investment in Samsung Bioepis Co., Ltd. and the carrying value of our interest in the underlying net assets of the investee. These basis differences are amortized over their economic life.

Appendix

Pioneering science across broad pipeline



Parkinson's disease
BIIB054, BIIB094#

Alzheimer's disease
Aducanumab*, BAN2401*, gosuranemab, BIIB076, BIIB080

Amyotrophic lateral sclerosis (ALS)
Tofersen, BIIB078#

Inherited retinal disorders
BIIB111, BIIB112

Stroke
Glibenclamide IV

Multiple Sclerosis
Opicinumab

Biogen

* Collaboration program
\# Option agreement

Improved patient selection to increase probability of success

Aducanumab* (Aβ mAb) – Alzheimer's

- Amyloid PET biomarker to screen for pathology
- Prodromal and mild patients

BIIB111 (gene therapy) – Choroideremia

- Patients must have mutation in CHM gene, the sole cause of choroideremia

BIIB094# (ION859) – Parkinson's

- Evaluating in patients with or without mutations in LRRK2, the most common genetic cause of Parkinson's disease

Pioneering science across broad pipeline

Alzheimer's disease

BAN2401*

Aducanumab*

BIIB080

BIIB076

Gosuranemab

Role of aggregated forms of amyloid beta and linkage to tau

Aducanumab* – Alzheimer's

- Antibody selective for aggregated forms of Aβ

BAN2401* – Alzheimer's

- Antibody selective for aggregated forms of Aβ, currently in Phase 3

Programs targeting tau – Alzheimer's

- Gosuranemab and BIIB076 targeting extracellular tau
- BIIB080 to reduce production of all forms of tau

Preclinical targets – Alzheimer's

- Multiple programs targeting novel mechanisms of disease, including neuroinflammation

Biogen

*Collaboration program