

# PRECISION THAT MOVES™

Staying one step ahead of disease

J.P. Morgan Healthcare Conference  
JANUARY 13-16, 2020



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R.T., living  
with GIST

# Forward-looking statements

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This presentation contains forward-looking statements as defined in the Private Securities Litigation Reform Act of 1995, as amended. The words “may,” “will,” “could,” “would,” “should,” “expect,” “plan,” “anticipate,” “intend,” “believe,” “estimate,” “predict,” “project,” “potential,” “continue,” “target” and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words. In this presentation, forward-looking statements include, without limitation, statements regarding Blueprint Medicines’ 2020 key milestones; Blueprint Medicines’ plans, strategies, timelines and expectations for the preclinical and clinical development and commercialization of AYYAKIT™ (avapritinib), pralsetinib, fisogatinib, and BLU-263; plans and timelines for submitting marketing applications for avapritinib and pralsetinib and, if approved, commercializing avapritinib for additional indications or pralsetinib; the potential benefits of Blueprint Medicines’ current and future drug candidates in treating patients; expectations regarding Blueprint Medicines’ existing cash, cash equivalents and investments; and Blueprint Medicines’ strategy, goals and anticipated milestones, business plans and focus. Blueprint Medicines has based these forward-looking statements on management’s current expectations, assumptions, estimates and projections. While Blueprint Medicines believes these expectations, assumptions, estimates and projections are reasonable, such forward-looking statements are only predictions and involve known and unknown risks, uncertainties and other important factors, many of which are beyond Blueprint Medicines’ control and may cause actual results, performance or achievements to differ materially from those expressed or implied by any forward-looking statements. These risks and uncertainties include, without limitation, risks and uncertainties related to the delay of any current or planned clinical trials or the development of Blueprint Medicines’ drug candidates, including avapritinib, pralsetinib, fisogatinib and BLU-263, or the licensed products, including BLU-782; Blueprint Medicines’ advancement of multiple early-stage efforts; Blueprint Medicines’ ability to successfully demonstrate the efficacy and safety of its drug candidates and gain approval of its drug candidates on a timely basis, if at all; the preclinical and clinical results for Blueprint Medicines’ drug candidates, which may not support further development of such drug candidates; actions or decisions of regulatory agencies or authorities, which may affect the initiation, timing and progress of clinical trials or marketing applications; Blueprint Medicines’ ability to obtain, maintain and enforce patent and other intellectual property protection for any drug candidates it is developing; Blueprint Medicines’ ability and plans for establishing a commercial infrastructure, and successfully launching, marketing and selling its current or future approved products; Blueprint Medicines’ ability to successfully expand the indications for AYYAKIT in the future; Blueprint Medicines’ ability to develop and commercialize companion diagnostic tests for its current and future drug candidates; and the success of Blueprint Medicines’ current and future collaborations, partnerships, and license, including its collaborations with F. Hoffmann-La Roche Ltd and Hoffmann-La Roche Inc. (collectively, “Roche”) and CStone Pharmaceuticals (“CStone”) and its license agreement with Clementia Pharmaceuticals Inc. (“Clementia”).

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# 2020 Blueprint: three key themes



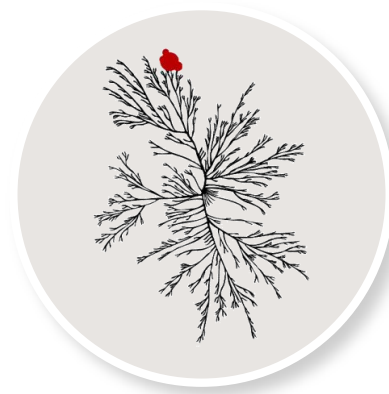
Now approved in the U.S.

Fully integrated commercial-stage company, with multiple planned global regulatory submissions for avapritinib and pralsetinib



R.S., living with SM

Expanded strategic focus on systemic mastocytosis and related mast cell disorders

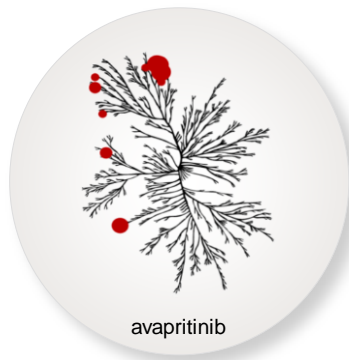


Continuous strengthening of pipeline, with plans to nominate up to 3 development candidates this year

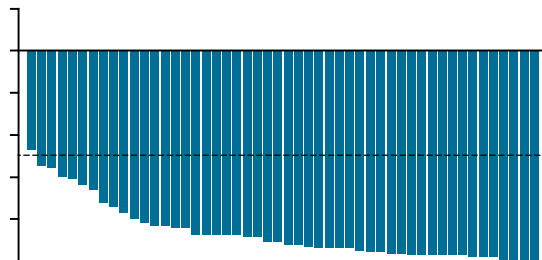
# The rapid evolution of Blueprint Medicines



## HIGHLY SELECTIVE KINASE MEDICINE DISCOVERY PLATFORM



## RAPID CLINICAL PROOF-OF-CONCEPT ACROSS MULTIPLE PROGRAMS



Avapritinib in advanced systemic mastocytosis: change in serum tryptase<sup>1</sup>

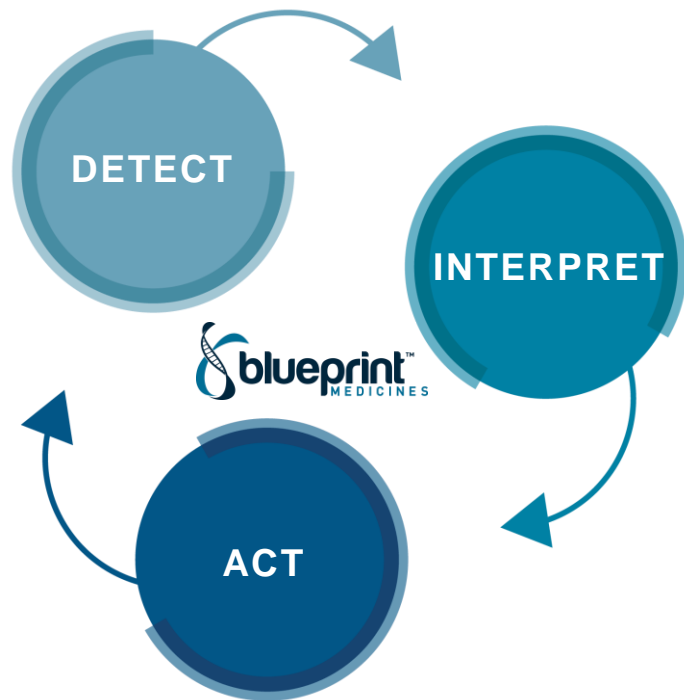
Integrated commercialization

Indication expansion

Therapeutic area leadership

Innovative kinase biology

# A powerful vision for delivering durable benefit with targeted therapy



## HIGHLY SELECTIVE INHIBITORS

Potent inhibition of genetic drivers leads to rapid, deep and durable responses



## PATIENT SELECTION

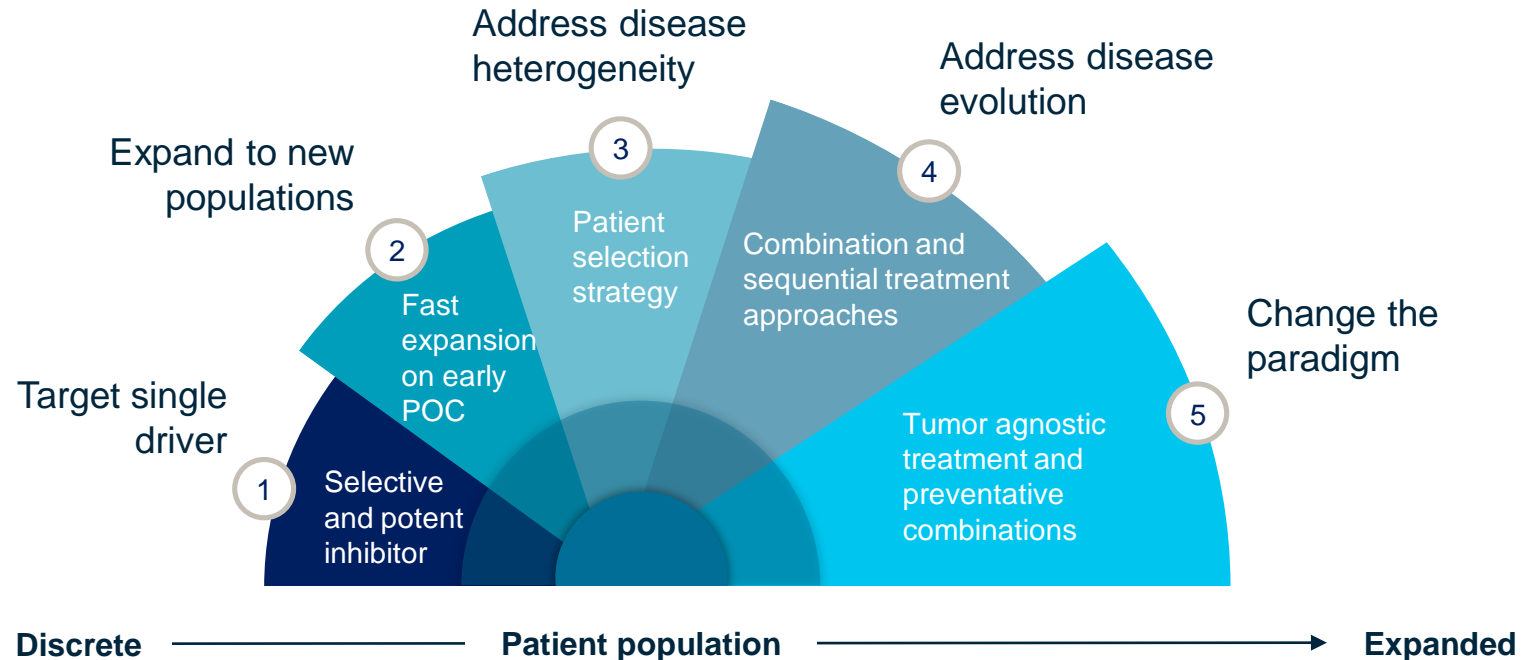
Understanding of disease heterogeneity enables responder hypotheses



## ADAPTIVE ABILITY

Research engine rapidly empowers solutions for acquired resistance

# Expand applications to reach broader patient populations



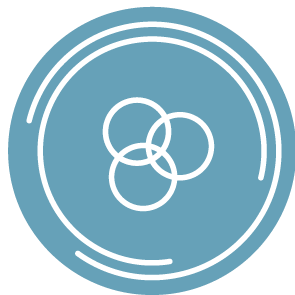
# Build therapeutic leadership by leveraging insights and efficiencies

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Next-generation  
inhibitors



Combination  
strategies



Enhanced  
patient selection



CLINICAL  
AND  
COMMERCIAL  
SCALE

TRANSLATIONAL INSIGHTS

# Seek to deliver a portfolio of new medicines to patients globally

## MULTIPLE ANTICIPATED COMMERCIAL LAUNCHES THROUGH 2021

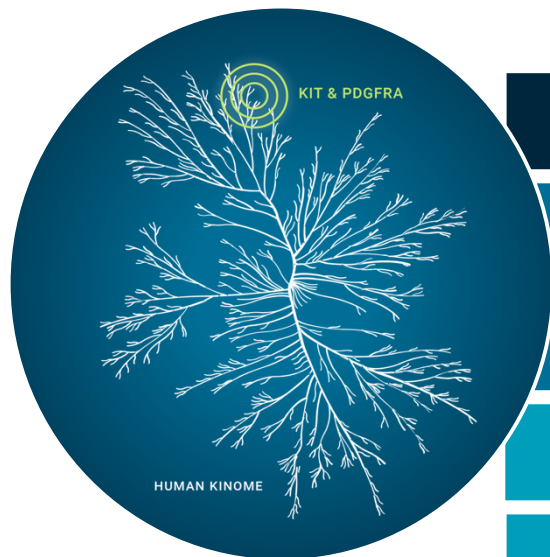


1. Approved in the U.S. for unresectable or metastatic GIST harboring a PDGFRA exon 18 mutant, including PDGFRA D842V mutations. 2. The proposed MAA indication is unresectable or metastatic GIST harboring a PDGFRA D842V mutation. 3. Represents planned NDA/MAA submissions. GIST, gastrointestinal stromal tumor; MAA, marketing authorization application; MTC, medullary thyroid cancer; NDA, new drug application; NSCLC, non-small cell lung cancer; SM, systemic mastocytosis; 2L, second-line; 3L, third-line; 4L, fourth-line

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# Avapritinib: a precision therapy with broad potential



## Avapritinib

Potent and highly selective  
KIT and PDGFRA inhibitor

LATE CLINICAL  
DEVELOPMENT

U.S. REGULATORY  
SUBMISSION STATUS

PDGFRA exon 18 mutant GIST

APPROVED<sup>1</sup>

4L GIST

SUBMITTED

3L GIST

2H 2020

Advanced SM

2H 2020

Indolent and smoldering SM



1. Approved in the U.S. for the treatment of adults with unresectable or metastatic GIST harboring a PDGFRA exon 18 mutation, including PDGFRA D842V mutations. Kinome illustration reproduced courtesy of Cell Signaling Technology, Inc. ([www.cellsignal.com](http://www.cellsignal.com)) (CSTI). The foregoing website is maintained by CSTI, and Blueprint Medicines is not responsible for its content.

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# AYVAKIT™ (avapritinib) is now approved in the United States



## INDICATION

AYVAKIT is indicated for the treatment of adults with unresectable or metastatic GIST harboring a PDGFRA exon 18 mutation, including PDGFRA D842V mutations

## AVAILABLE DOSE STRENGTHS

100, 200 and 300 mg tablets

First precision therapy for GIST • Approved regardless of line of therapy  
Only highly effective treatment for PDGFRA exon 18 mutant GIST

# Full approval of AYVAKIT based on Phase 1 NAVIGATOR trial

EFFICACY PARAMETER	PDGFRA EXON 18 (N=43)	PDGFRA D842V (N=38)
<b>Overall response rate (95% CI)</b>	84% (69%, 93%)	89% (75%, 97%)
Complete response, n (%)	3 (7%)	3 (8%)
Partial response, n (%)	33 (77%)	31 (82%)
<b>Duration of response</b>	n=36	N=34
Median in months (range)	Not reached (1.9+, 20.3+)	Not reached (1.9+, 20.3+)

# Safety highlights from AYVAKIT prescribing information

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## **MOST COMMON ADVERSE REACTIONS (≥20%; ANY GRADE):<sup>1</sup>**

- Edema, nausea, fatigue/asthenia, cognitive impairment, vomiting, decreased appetite, diarrhea, hair color changes, increased lacrimation, abdominal pain, constipation, rash, and dizziness

## **WARNINGS AND PRECAUTIONS:**

- Intracranial hemorrhage
  - Occurred in 1% of 267 patients with GIST who received AYVAKIT
- CNS adverse reactions
  - Occurred in 58% of 335 patients who received AYVAKIT
    - Cognitive impairment: 41% (3.6% Grade 3 or 4)
  - Overall, 3.9% of patients required treatment discontinuation due to a CNS adverse reaction
- Embryo-fetal toxicity



Important safety information and full prescribing information are available at [www.AYVAKIT.com](http://www.AYVAKIT.com). 1. Adverse reactions in 204 patients with unresectable or metastatic GIST who received 300-400 mg once daily of AYVAKIT. CNS, central nervous system.

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# Strategic imperatives for the AYVAKIT launch

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J.D., living  
with GIST

Be recognized as the leader in precision medicine  
by hematology/oncology centers of excellence

Drive positive first experiences with AYVAKIT  
among GIST prescribers

Provide best-in-class patient support to optimize  
patient access and adherence

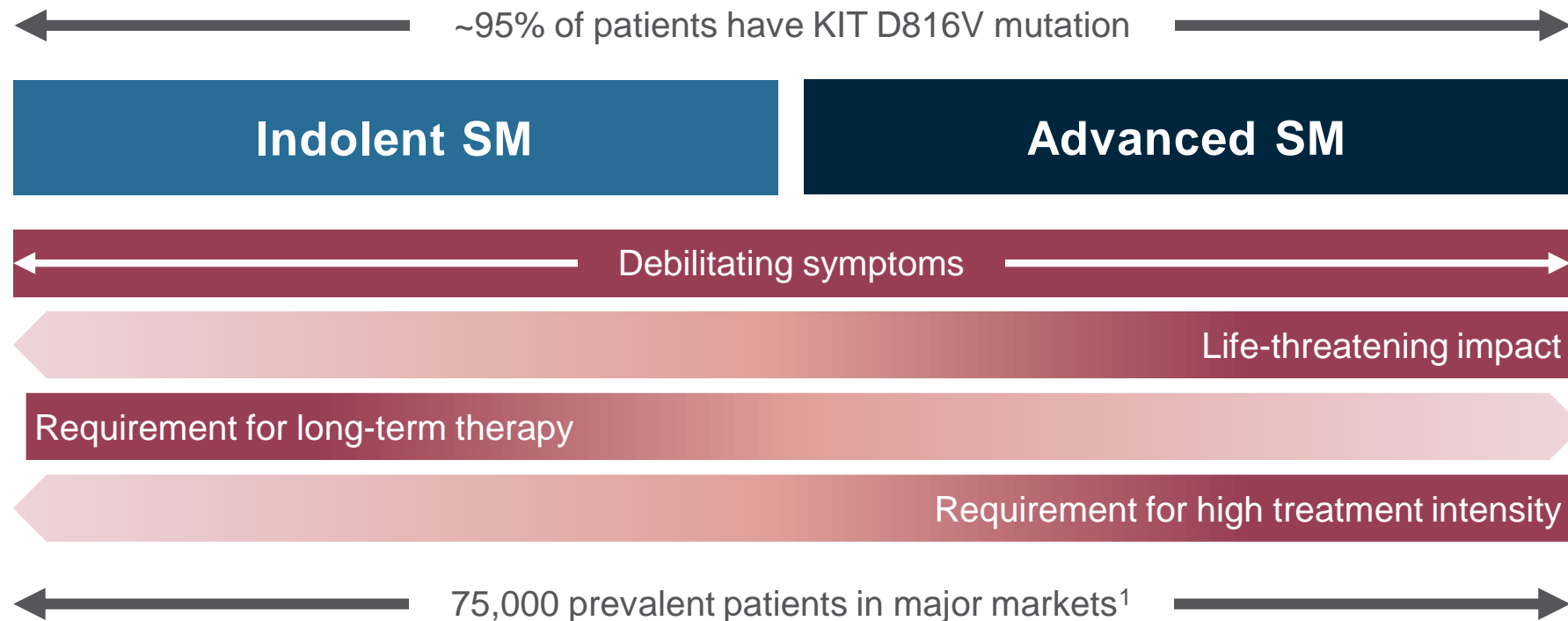
Catalyze patient identification in GIST and across  
portfolio therapeutic areas

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Focused portfolio field footprint with ~40 area business managers

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# Systemic mastocytosis is one disease with a common genetic driver



# Comprehensive systemic mastocytosis clinical trial program

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## EXPLORER

Advanced SM

Phase 1 dose-escalation trial  
with open-label expansion

## PATHFINDER

Advanced SM

Phase 2 single-arm trial

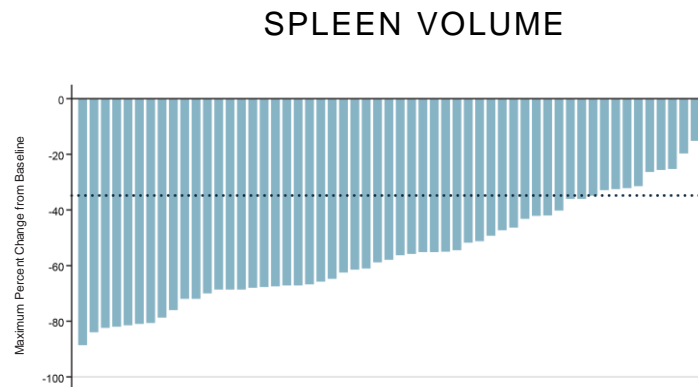
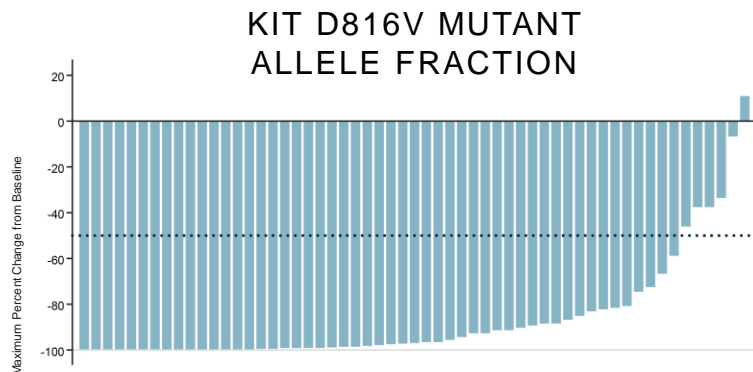
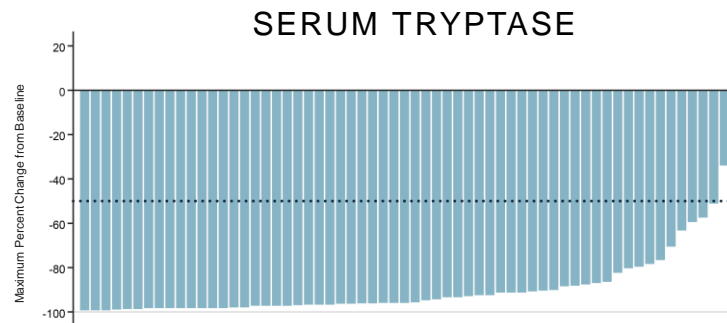
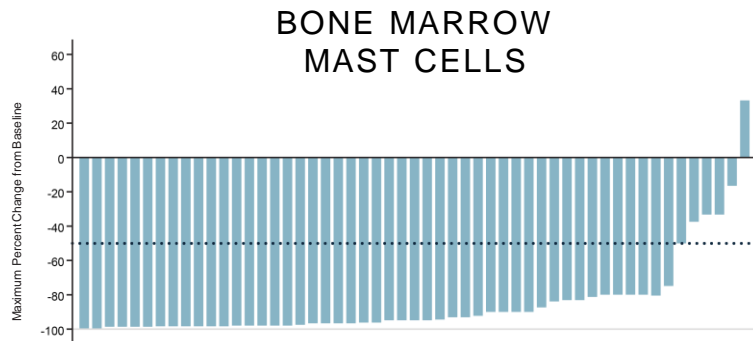
## PIONEER

Indolent SM

Phase 2 randomized, double-blind,  
placebo-controlled trial

# EXPLORER trial data for patients with advanced SM:

## *Profound activity on all measures of mast burden in nearly all patients*





# EXPLORER trial data for patients with advanced SM:

## *Remarkable response rate and prolonged duration of response*

BEST RESPONSE PER IWG-MRT-ECNM CRITERIA  
ALL DOSES (N=48)<sup>1</sup>

- FDA breakthrough therapy designation<sup>3</sup>
- Robust activity across all disease subtypes
- Median follow up of 21 months with ongoing treatment up to ~3.5 years<sup>1</sup>

**77%**  
Confirmed  
ORR<sup>2</sup>

**Median  
DOR and OS  
not reached**

**SAFETY**  
**ALL DOSES (N=80)<sup>1</sup>**

- Avapritinib was generally well-tolerated, and most AEs were grade 1 or 2<sup>4</sup>
- Most common treatment-emergent AEs were periorbital edema, anemia, diarrhea, fatigue, peripheral edema, nausea, thrombocytopenia, vomiting and cognitive effects
- Across all doses, 6 patients discontinued treatment due to treatment-related AEs

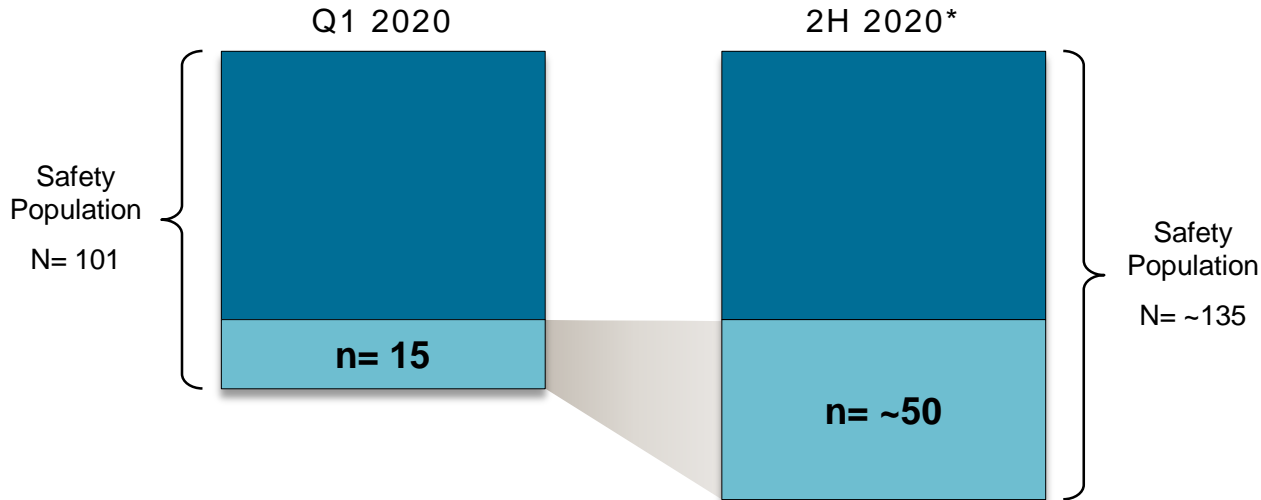


1. EXPLORER trial data reported on December 8, 2019. Data cutoff: August 30, 2019. 2. ORR defined as complete remission with full or partial recovery of peripheral blood counts, partial remission or clinical improvement. 3. Avapritinib granted Breakthrough Therapy Designation for the treatment of advanced SM, including the subtypes of aggressive SM, SM with an associated hematologic neoplasm and mast cell leukemia. 4. After the data cutoff date, one patient with SM and an associated hematologic neoplasm (SM-AHN) of myelodysplastic syndrome had a Grade 5 intracranial bleed. At the time of the bleeding event, the patient had severe thrombocytopenia and experienced a serious injury involving head trauma. AE, adverse events. DOR, duration of response; ORR, overall response rate; OS, overall survival.

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# Adjustment of NDA submission timing for avapritinib for advanced SM enhances dataset at 200 mg QD dose and increases probability of success

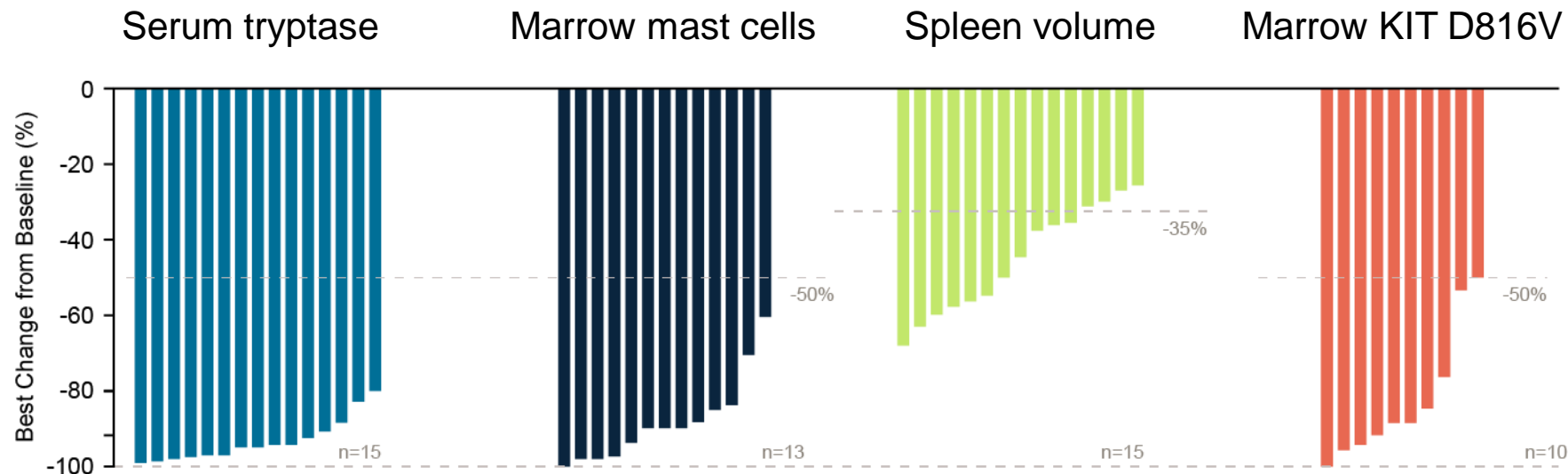
## COMBINED EXPLORER AND PATHFINDER TRIAL DATASET



- Based on ongoing discussions with FDA, now plan to submit supplemental NDA for avapritinib for advanced SM in 2H 2020
- Plan to include additional patients treated with a starting dose of 200 mg QD, the proposed indicated dose
- Target enrollment for efficacy in PATHFINDER trial is complete and follow-up is ongoing

- Patients with starting dose of 200 mg QD and IWG evaluable
- Patients with all other starting doses or not IWG evaluable

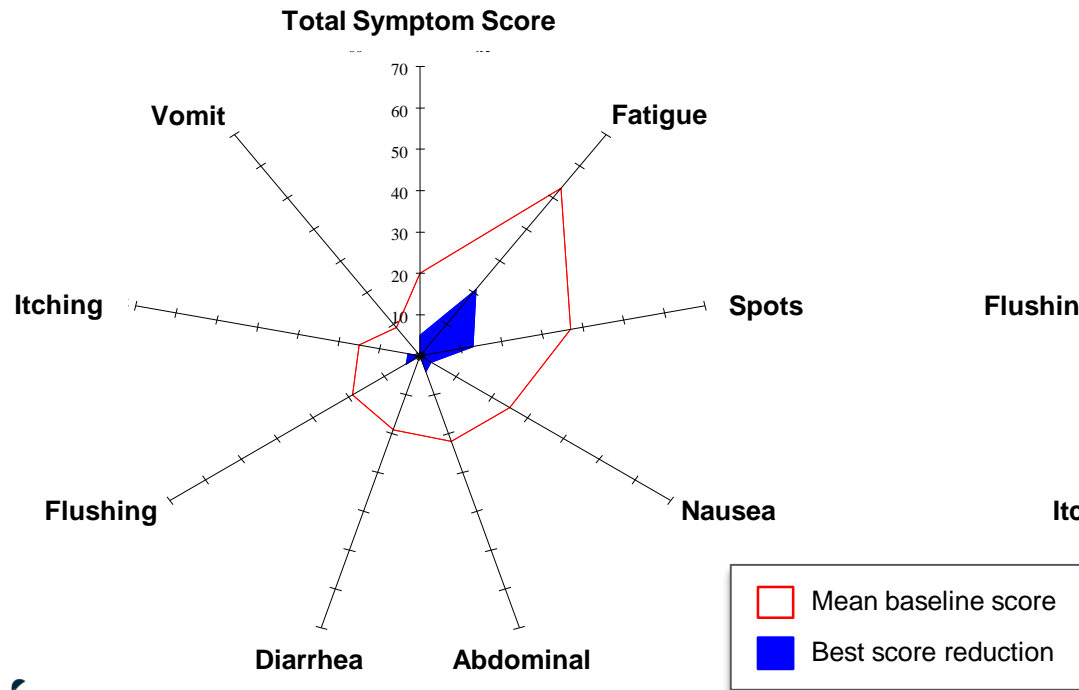
# EXPLORER trial data for patients with indolent SM: *Robust reductions on measures of mast cell burden*



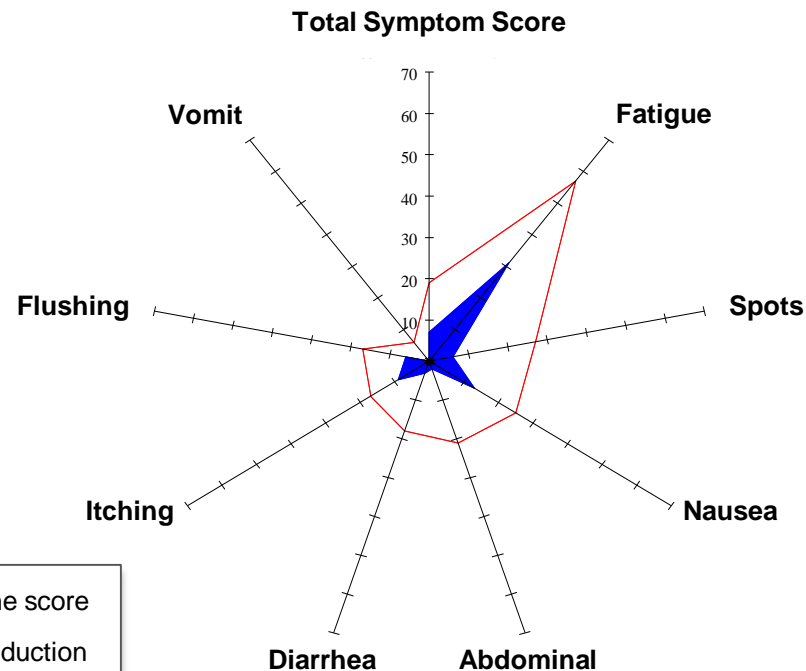
# EXPLORER trial data for patients with indolent SM:

## *Improvement in disease symptoms and PRO survey total symptom score*

INDOLENT SM PATIENTS (N=5)



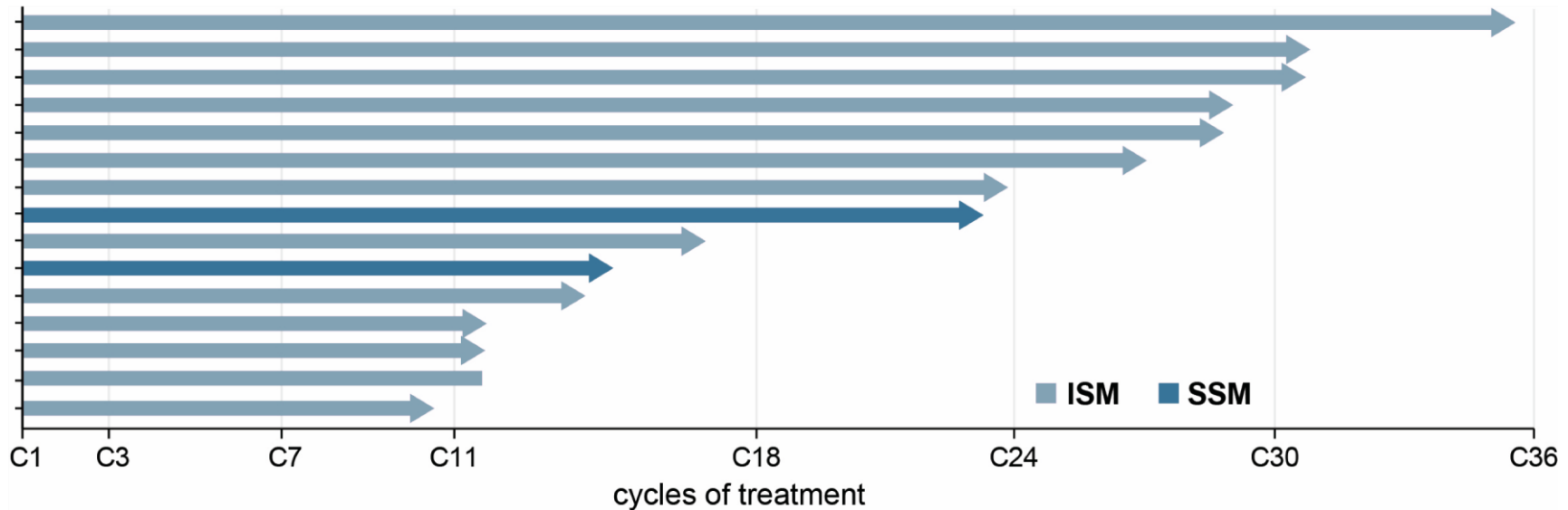
ALL PATIENTS (N=39)



# EXPLORER trial data for patients with indolent SM:

## *Prolonged durations of therapy at low doses*

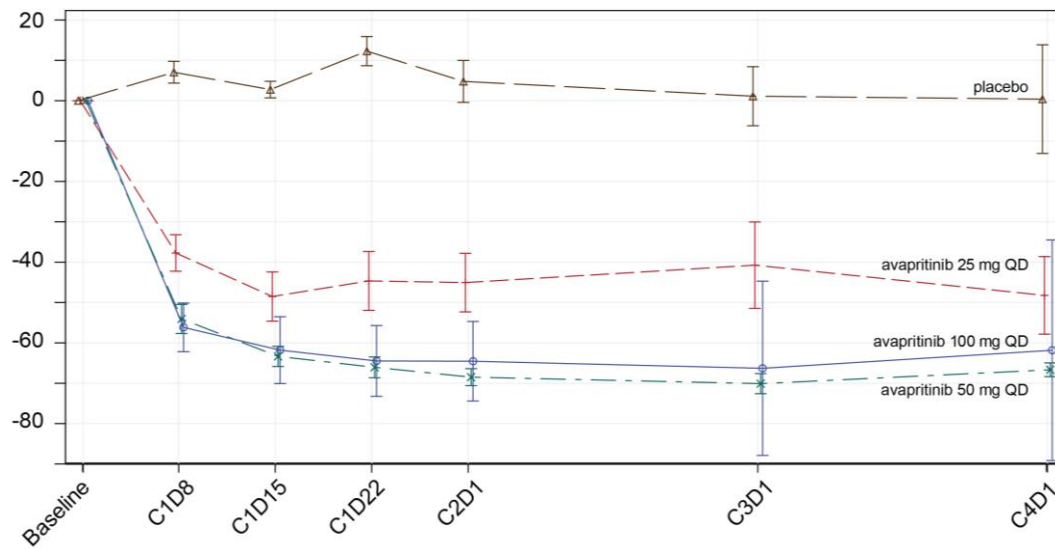
- 14 of 15 (93%) remained on treatment up to nearly 3 years (cycle 36)
- Average dose was 126 mg with 73% treated at 100 mg QD



# PIONEER trial data for patients with indolent SM:

*All avapritinib doses showed rapid and robust reductions in serum tryptase*

## MEAN PERCENT CHANGE IN SERUM TRYPTASE



## BASELINE CHARACTERISTICS

- Significant symptom burden in every patient enrolled
- 84% of screened patients met minimum symptom burden eligibility requirement
- Baseline median Total Symptom Score was 52 (range: 19–100)

## SAFETY (N=30) ALL DOSES

- Most reported AEs were grade 1 or 2
- No intracranial bleeding, thrombocytopenia or anemia reported
- No patients discontinued treatment due to an AE

# Next steps for the PIONEER trial of avapritinib in indolent SM



- ✓ Complete enrollment of dose-finding Part 1
- ✓ Report initial safety and serum tryptase data at ASH 2019 Annual Meeting
- Plan to report additional Part 1 data in late-breaking oral abstract at AAAAI 2020 on March 14, 2020
- Complete enrollment of the registration-enabling Part 2 by the end of 2020

# BLU-263 was advanced based on insights from avapritinib

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## POTENT

Sub-nanomolar potency  
against KIT D816V



## SELECTIVE

Highly selective for KIT,  
with low off-target activity



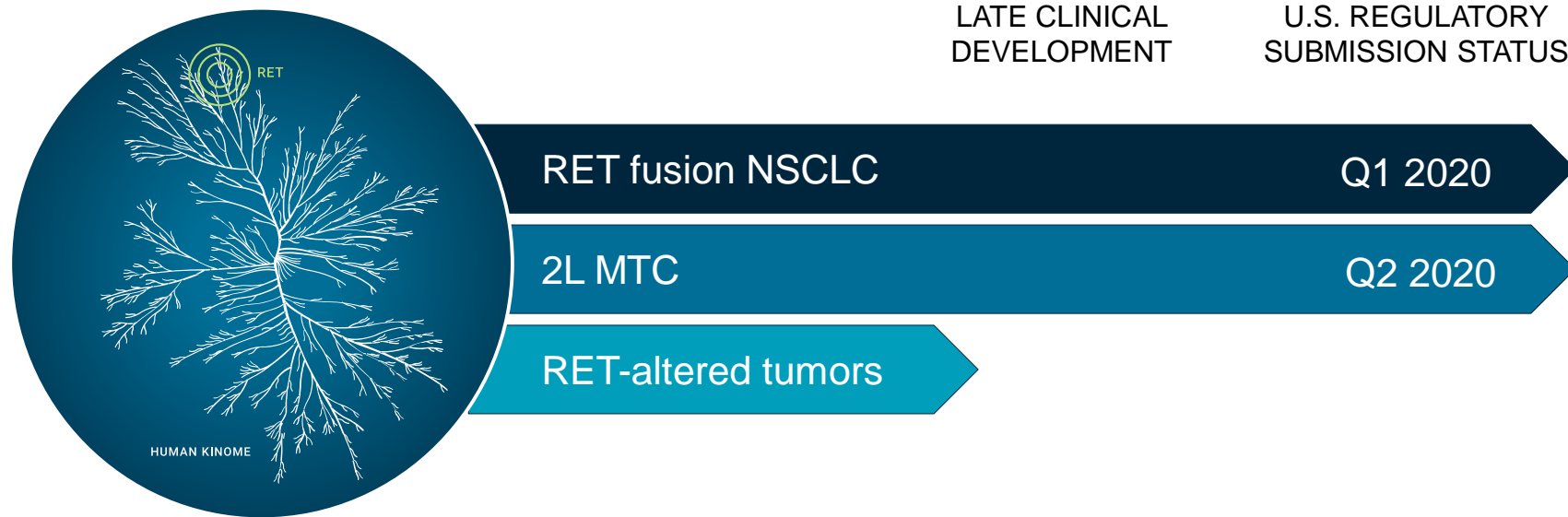
## CNS PROFILE

Designed to not cross  
blood-brain barrier

PLAN TO INITIATE PHASE 1 TRIAL IN HEALTHY VOLUNTEERS IN 1H 2020



# Pralsetinib: an investigational precision therapy for RET-altered cancers



## Pralsetinib

Potent and highly selective  
RET inhibitor

INITIATED ROLLING NDA SUBMISSION TO FDA  
FOR RET FUSION NSCLC IN JANUARY 2020

# RET alterations: oncogenic drivers lacking a targeted therapeutic approach

## **Non-small cell lung cancer:**

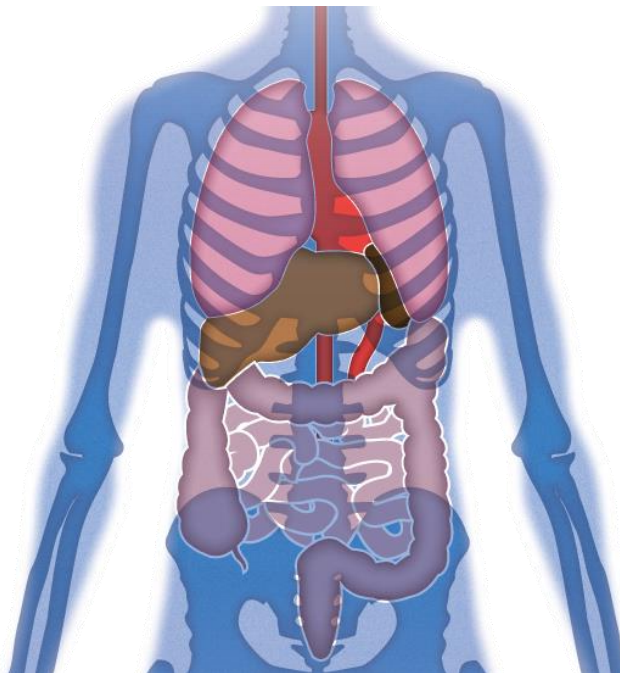
~1-2% RET fusions<sup>1,2</sup>

## **Advanced medullary thyroid cancer:**

~90% RET mutations<sup>3</sup>

## **Papillary thyroid cancer:**

~20% RET fusions<sup>4</sup>



## **Multiple other tumor types <1% RET-altered, including:<sup>5,6</sup>**

esophageal  
pancreatic  
breast  
melanoma  
colorectal  
leukemia

# Pralsetinib is a potential best-in-class selective RET inhibitor and the cornerstone of our lung cancer portfolio



## **EQUIPOTENT INHIBITION**

of RET fusions and mutations, including predicted gatekeeper resistance mutations



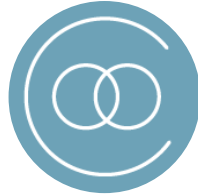
## **CLINICAL RESPONSES**

in 2 of 4 patients previously treated with selpercatinib<sup>2</sup>



## **HIGH RESPONSE RATES AND DURABLE ACTIVITY**

in RET+ NSCLC<sup>1</sup> and MTC<sup>2</sup> patients



## **FDA BREAKTHROUGH THERAPY DESIGNATIONS**

for RET+ NSCLC and MTC<sup>3</sup>



## **STRONG ACTIVITY AGAINST BRAIN METASTASES**

in patients with RET+ NSCLC<sup>2</sup>



**WELL-TOLERATED WITH LOW DISCONTINUATION RATES** in advanced cancer populations<sup>1,2</sup>

# NSCLC patients with RET fusions have no highly effective treatment options

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- **Chemotherapy:** nonspecific, low response rates, significant toxicity
- **Checkpoint inhibition:** Preliminary evidence for lack of benefit in RET-altered NSCLC<sup>1</sup>
- **Multi-kinase inhibitors:** ↓ activity, ↑ off-target toxicity<sup>2,3</sup>
- Growing understanding of RET-driven resistance
- No selective RET inhibitors are approved

# Centrally reviewed top-line ARROW trial data showed robust and durable clinical activity for pralsetinib in RET fusion NSCLC

61%

ORR<sup>1</sup>

**RET-fusion NSCLC  
with prior platinum  
chemotherapy**

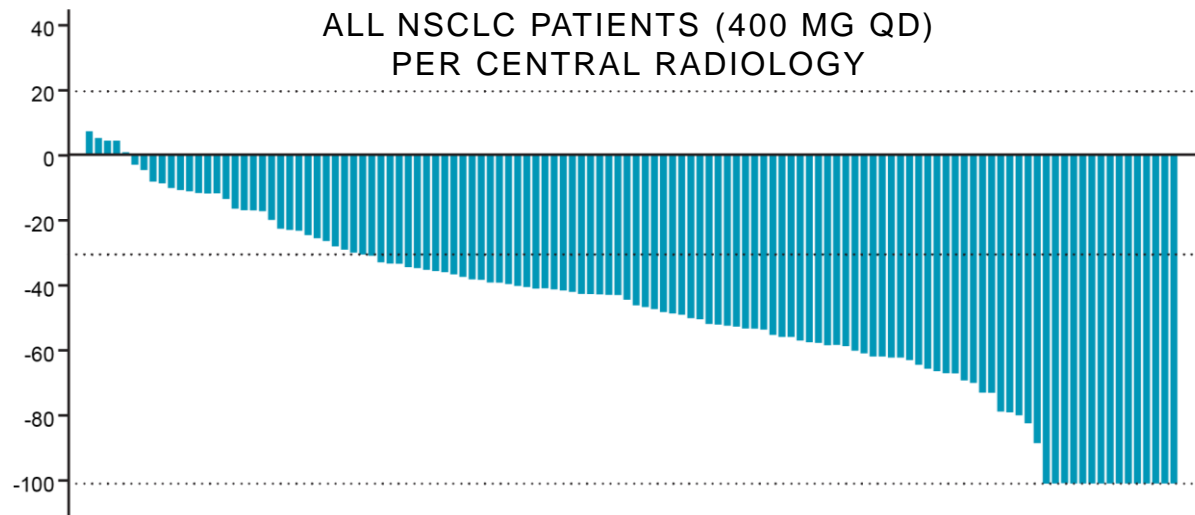
400 mg QD, N=80

73%

ORR<sup>2</sup>

**RET-fusion NSCLC  
with no prior  
systemic therapy**

400 mg QD, N=26



- Median DOR not reached (95% CI: 11.3 months, NE) in patients treated with 400 mg QD
- Safety results (N=354; 400 mg QD) were consistent with prior data; most reported AEs were grade 1 or 2
- Overall, 4% of patients discontinued treatment due a treatment-related AE

# RET-altered thyroid cancer patients may benefit from highly targeted therapy

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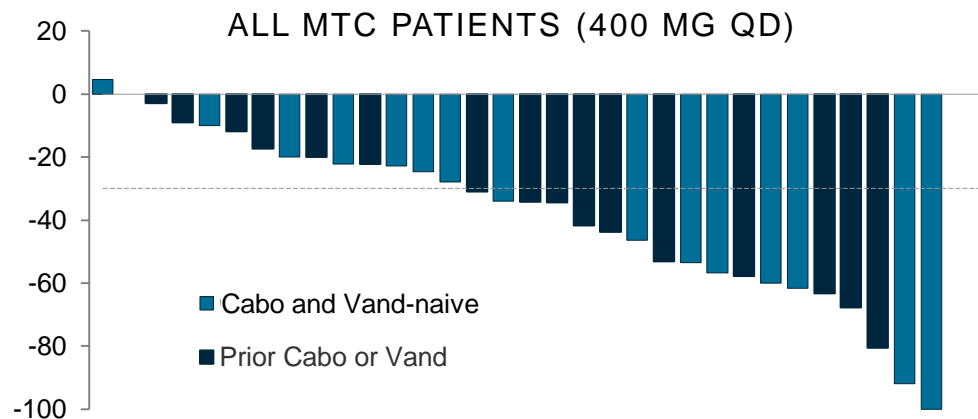
- **Multi-kinase inhibitors** are approved for MTC, but have important limitations:<sup>1</sup>
  - 25-44% ORR
  - Off-target toxicity often requiring dose modification or discontinuation
  - Emergence of resistance
- No selective RET inhibitors are approved

# ARROW trial data presented at ASCO 2019 showed robust and durable clinical activity for pralsetinib in MTC and other RET-altered cancers



**RET-mutant MTC  
previously treated  
with an MKI**

400 mg QD, n=16



## ADDITIONAL RESULTS

- Across all MTC patients, 97% disease control rate
- Median duration of response not reached; all responders remain on treatment with durations up to 15.6 months
- 83% ORR in papillary thyroid cancer<sup>3</sup>
- Additional clinical responses observed in pancreatic cancer and intrahepatic bile duct carcinoma



Data presented at ASCO Annual Meeting in June 2019. Includes MTC patients treated at the recommended Phase 2 dose of 400 mg QD and enrolled as of November 14, 2018 with follow-up through a data cutoff date of April 28, 2019. All responses were investigator assessed. <sup>1</sup> Two responses pending confirmation. <sup>3</sup> Six patients were evaluable for response assessment (3 confirmed PRs, 2 PRs pending confirmation). Cabo, cabozantinib; Vand, vandetanib.

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# A powerful scientific platform with a focused research strategy

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## **Difficult-to-drug**

Kinase targets that are difficult to drug with existing technologies



## **Treatment-resistant**

Kinase targets characterized by alterations promoting resistance to existing therapies



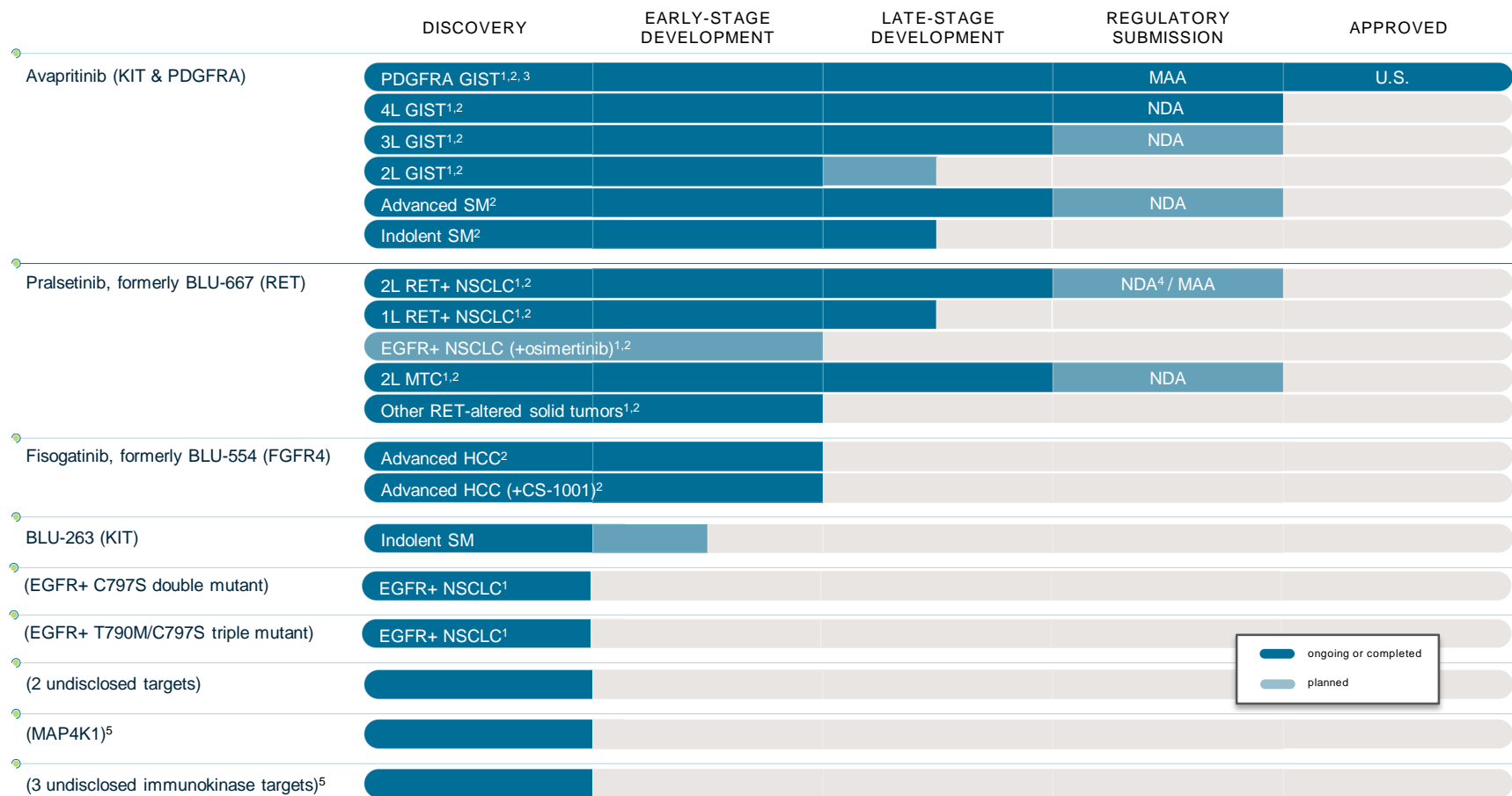
## **Novel biology**

New kinase targets identified via computational and cell biology

Nominated potential first-in-class development candidate for resistant EGFR+ triple mutant NSCLC

Plan to nominate up to 2 additional development candidates in 2020





# Strong financial position entering 2020

## Balance Sheet

Cash, Cash Equivalents and Investments

September 30, 2019\*

\$594.5M

December 31, 2018

\$494.0M

## Statement of Operations

Collaboration Revenue

Research & Development Expenses

General & Administrative Expenses

Net Loss

Three Months Ended September 30,

2019\*

2018\*

\$9.1M

\$1.1M

\$81.5M

\$64.6M

\$25.6M

\$12.0M

\$(94.3)M

\$(72.7)M

Based on current operating plans, expect existing cash balance will fund operations into 2H 2021\*\*

# Anticipated 2020 milestones

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## REGULATORY APPROVALS

Avapritinib in fourth-line GIST in the U.S. in Q2 2020  
Avapritinib in PDGFRA D842V GIST in the EU in Q3 2020  
Pralsetinib in RET+ NSCLC in the U.S. by the end of 2020

## REGULATORY SUBMISSIONS

Pralsetinib NDA to FDA for RET+ NSCLC in Q1 2020  
Pralsetinib NDA to FDA for 2L RET+ MTC in Q2 2020  
Avapritinib sNDA to FDA for advSM in 2H 2020  
Avapritinib sNDA to FDA for 3L GIST in 2H 2020  
Pralsetinib MAA to EMA for RET+ NSCLC in Q2 2020

## TOP-LINE REGISTRATION DATA

Avapritinib VOYAGER trial in 3L GIST in Q2 2020

## MEDICAL MEETING PRESENTATIONS

Avapritinib PIONEER trial Part 1 in ISM in Q1 2020  
Pralsetinib ARROW trial in RET+ NSCLC in 2020  
Pralsetinib ARROW trial in RET+ MTC in 2020  
Avapritinib VOYAGER trial in 3L GIST in 2020  
Avapritinib EXPLORER and PATHFINDER trials in advSM in 2H 2020

## COMPLETE TRIAL ENROLLMENT

Avapritinib PIONEER trial Part 2 in ISM by the end of 2020

## TRIAL INITIATIONS

BLU-263 Phase 1 trial in healthy volunteers in 1H 2020  
Pralsetinib Phase 3 trial in 1L MTC in 2H 2020

## RESEARCH PIPELINE

Nominate up to 3 development candidates in 2020



advSM, advanced systemic mastocytosis; sNDA, supplemental new drug application.

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