Forward-looking statements

This presentation contains forward-looking statements as defined in the Private Securities Litigation Reform Act of 1995, as amended. The words “aim,” “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 the plans, strategies, timelines and expectations of Blueprint Medicines Corporation (the “Company”) for the preclinical and clinical development and commercialization of AYVAKIT™ (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 any of Company’s current or future approved drugs or drug candidates in treating patients; expectations regarding the Company’s existing cash, cash equivalents and investments and the future financial performance of the Company; and the Company’s strategy, goals, milestones, business plans and focus. The Company has based these forward-looking statements on management’s current expectations, assumptions, estimates and projections. While the Company 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 the Company’s 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 the Company’s drug candidates, including avapritinib for additional indications, pralsetinib, fisogatinib and BLU-263, or the licensed drug candidate; the Company’s advancement of multiple early-stage efforts; the Company’s 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 the Company’s 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; the Company’s ability to obtain, maintain and enforce patent and other intellectual property protection for any drug candidates it is developing or AYVAKIT; the Company’s ability and plans for maintaining a commercial infrastructure, and successfully launching, marketing and selling its current or future approved drugs; the Company’s ability to successfully expand the approved indications for AYVAKIT or obtain marketing approval for AYVAKIT in additional geographies; the Company’s ability to develop and commercialize companion diagnostic tests for any of Company’s current or future approved drugs or drug candidate; and the success of the Company’s current and future collaborations, partnerships and licenses.

These and other risks and uncertainties are described in greater detail under “Risk Factors” in the Company’s filings with the Securities and Exchange Commission (“SEC”), including its most recent Annual Report on Form 10-K, as supplemented by its most recent Quarterly Report on Form 10-Q and any other filings it has made or may make with the SEC in the future. The Company cannot guarantee future results, outcomes, levels of activity, performance, developments, or achievements, and there can be no assurance that its expectations, intentions, anticipations, beliefs, or projections will result or be achieved or accomplished. The forward-looking statements in this presentation are made only as of the date hereof, except as required by law. The Company undertakes no obligation to update any forward-looking statements contained in this presentation as a result of new information, future events or otherwise.

This presentation also contains estimates, projections and other statistical data made by independent parties and by the Company relating to market size and growth and other data about the Company’s industry. These data involve a number of assumptions and limitations, and you are cautioned not to give undue weight to such estimates. In addition, projections, assumptions and estimates of the Company’s future performance and the future performance of the markets in which the Company operates are necessarily subject to a high degree of uncertainty and risk.
Key 2020 themes for Blueprint Medicines

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

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

IMAGINING A NEW PLATFORM | BUILDING THE PIPELINE | REALIZING THE VISION
---|---|---

HIGHLY SELECTIVE KINASE MEDICINE DISCOVERY PLATFORM

RAPID CLINICAL PROOF-OF-CONCEPT ACROSS MULTIPLE PROGRAMS

Integrated commercialization

Indication expansion

Therapeutic area leadership

Innovative kinase biology

Avapritinib in advanced systemic mastocytosis: change in serum tryptase


Not for promotional use.
## Anticipate multiple commercial launches through 2021

<table>
<thead>
<tr>
<th>Quarter</th>
<th>2021</th>
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<tr>
<td>Q1 2020</td>
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<td><strong>US - 4L GIST</strong></td>
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<tr>
<td></td>
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<td>2021</td>
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<tr>
<td></td>
<td><strong>US - Advanced SM</strong></td>
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<td>US - 2L MTC</td>
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¹Approved in the U.S. for the treatment of adults with unresectable or metastatic GIST harboring a PDGFRA exon 18 mutant, including PDGFRA D842V mutations. ²Proposed MAA indication is unresectable or metastatic GIST harboring a PDGFRA D842V mutation. ³Planned NDA or MAA submissions. GIST, gastrointestinal stromal tumor; MAA, marketing authorization application; NDA, new drug application; MTC, medullary thyroid cancer; NSCLC, non-small cell lung cancer; SM, systemic mastocytosis; 2L, second-line; 3L, third-line; 4L, fourth-line. *All planned commercial launches are subject to regulatory review and approval of marketing applications currently under review or planned.

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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
APPROVED¹

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. * Planned NDA submission. Kinome illustration reproduced courtesy of Cell Signaling Technology, Inc. (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 prescribing information is available at [www.AYVAKIT.com](http://www.AYVAKIT.com).
Systemic mastocytosis is one disease with a common genetic driver

~95% of patients have KIT D816V mutation

Indolent SM | Advanced SM

Debilitating symptoms
Life-threatening impact
Requirement for long-term therapy
Requirement for high treatment intensity

75,000 prevalent patients in major markets \(^1\)


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Comprehensive systemic mastocytosis clinical trial program

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

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EXPLORER trial data for patients with advanced SM:
Profound activity on all measures of mast burden in nearly all patients

EXPLORER trial data reported on December 8, 2019. Data cutoff: August 30, 2019.
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EXPLORER trial data for patients with advanced SM: Remarkable response rate and prolonged duration of response

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

EXPLORER trial data reported on December 8, 2019. Data cutoff: August 30, 2019.

1. 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. 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.

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

- 77% Confirmed ORR²
- Median DOR and OS not reached

SAFETY
ALL DOSES (N=80)¹

- Avapritinib was generally well-tolerated, and most AEs were grade 1 or 2
- 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.

Not for promotional use.
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**

- **Q1 2020**
  - Safety Population
    - N= 101
  - n= 15

- **2H 2020***
  - Safety Population
    - N= ~135
  - n= ~50

* 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

* Estimated based on Blueprint Medicines’ clinical trial plan. QD, once daily.

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PIioneer trial data for patients with indolent SM: 
All avapritinib doses showed rapid and robust reductions 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


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


Serum tryptase
Marrow mast cells
Spleen volume
Marrow KIT D816V


Not for promotional use.
EXPLORER trial data for patients with indolent SM:
Improvement in disease symptoms and PRO survey total symptom score

EXPLORER trial data analysis. Data cutoff date: August 30, 2019. PRO, patient reported outcomes.

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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
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

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

AAAII, American Academy of Allergy, Asthma & Immunology; RP2D, recommended part 2 dose.

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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

* Planned NDA submission. Kinome illustration reproduced courtesy of Cell Signaling Technology, Inc. (www.cellsignal.com) (CSTI). The foregoing website is maintained by CSTI, and Blueprint Medicines is not responsible for its content.

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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

**HIGH RESPONSE RATES AND DURABLE ACTIVITY**

in RET+ NSCLC and MTC patients

**STRONG ACTIVITY AGAINST BRAIN METASTASES**

in patients with RET+ NSCLC

**CLINICAL RESPONSES**

in 2 of 4 patients previously treated with selpercatinib

**FDA BREAKTHROUGH THERAPY DESIGNATIONS**

for RET+ NSCLC and MTC

**WELL-TOLERATED WITH LOW DISCONTINUATION RATES**

in advanced cancer populations

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1. Top-line NSCLC data reported on January 8, 2020. Data cutoff date: November 18, 2020. 2. Data presented at ASCO Annual Meeting in June 2019. Data cutoff date: April 28, 2019. 3. FDA has granted breakthrough therapy designations to pralsetinib for the treatment of RET fusion-positive NSCLC that has progressed following platinum-based chemotherapy and RET-mutant MTC that requires systemic treatment and for which there are no acceptable alternative treatments.

Not for promotional use.
Centrally reviewed top-line ARROW trial data showed robust and durable clinical activity for pralsetinib in RET fusion NSCLC

- 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 to a treatment-related AE

RET-fusion NSCLC with prior platinum chemotherapy
400 mg QD, N=80

61% ORR<sup>1</sup>

RET-fusion NSCLC with no prior systemic therapy
400 mg QD, N=26

73% ORR<sup>2</sup>

Top-line data from the Phase 1/2 ARROW trial in patients with RET fusion NSCLC. Data cutoff date: November 18, 2019.

1. Two responses pending confirmation.
2. All responses confirmed. CR, complete response; NE, not estimable.

Not for promotional use.
ARROW trial data presented at ASCO 2019 showed robust and durable clinical activity for pralsetinib in MTC and other RET-altered cancers

**63% ORR¹**

**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
- Additional clinical responses observed in pancreatic cancer and intrahepatic bile duct carcinoma

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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. ¹ Two responses pending confirmation. ² Six patients were evaluable for response assessment (3 confirmed PRs, 2 PRs pending confirmation). Cabo, cabozantinib; Vand, vandetinib; PR, partial response.

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Fourth quarter & full year 2019 financial results

### Balance Sheet (unaudited)

<table>
<thead>
<tr>
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<th>FY ‘19</th>
<th>FY ‘18</th>
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<tbody>
<tr>
<td>Cash, Cash Equivalents</td>
<td>$548.0M</td>
<td>$494.0M</td>
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<td>and Investments</td>
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### Statement of Operations (unaudited)

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<tr>
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<td>Collaboration Revenue</td>
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<td>Research &amp; Development Expenses</td>
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<tr>
<td>General &amp; Administrative Expenses</td>
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<tr>
<td>Net Loss</td>
<td>$(66.3)M</td>
<td>$(80.3)M</td>
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</tbody>
</table>

Based on current operating plans, expect existing cash balance will fund operations into the 2H of 2022*

* Includes estimated net proceeds of $308.2M from January 2020 follow-on public offering and anticipated product revenues. Excludes any potential option fees, milestone payments or other payments under collaboration or license agreements.
1. Unresectable or metastatic disease. 2. CStone Pharmaceuticals has exclusive rights to develop and commercialize avapritinib, pralsetinib and fisogatinib in Mainland China, Hong Kong, Macau and Taiwan. Blueprint Medicines retains all rights in the rest of the world. 3. 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. The proposed MAA indication is unresectable or metastatic GIST harboring a PDGFRA D842V mutation. 4. Expect to complete rolling NDA in Q1 2020. 5. In collaboration with Roche. Blueprint Medicines has U.S. commercial rights for up to two programs. Roche has worldwide commercialization rights for up to two programs and ex-U.S. commercialization rights for up to two programs. 1L, first-line; HCC, hepatocellular carcinoma.

![Diagram of drug development pipeline](image-url)

### Avapritinib (KIT & PDGFRA)
- **PDGFRA GIST**
  - 1, 2, 3
- **4L GIST**
  - 1, 2
- **3L GIST**
  - 1, 2
- **2L GIST**
  - 1, 2
- **Advanced SM**
  - 2
- **Indolent SM**
  - 2

### Pralsetinib (RET)
- **2L RET+ NSCLC**
  - 1, 2
- **1L RET+ NSCLC**
  - 1, 2
- **EGFR+ NSCLC (+osimertinib)**
  - 1, 2
- **2L MTC**
  - 1, 2
- **1L MTC**
  - 1, 2
- **Other RET-altered solid tumors**
  - 1, 2

### Fisogatinib (FGFR4)
- **Advanced HCC**
  - 2
- **Advanced HCC (+CS-1001)**
  - 2

### BLU-263 (KIT)
- **Indolent SM**

### (EGFR+ C797S double mutant)
- **EGFR+ NSCLC**
  - 1

### (EGFR+ T790M/C797S triple mutant)
- **EGFR+ NSCLC**
  - 1

### (2 undisclosed targets)
- **(MAP4K1)**
  - 5

### (3 undisclosed immunokinase targets)

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1. Unresectable or metastatic disease. 2. CStone Pharmaceuticals has exclusive rights to develop and commercialize avapritinib, pralsetinib and fisogatinib in Mainland China, Hong Kong, Macau and Taiwan. Blueprint Medicines retains all rights in the rest of the world. 3. 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. The proposed MAA indication is unresectable or metastatic GIST harboring a PDGFRA D842V mutation. 4. Expect to complete rolling NDA in Q1 2020. 5. In collaboration with Roche. Blueprint Medicines has U.S. commercial rights for up to two programs. Roche has worldwide commercialization rights for up to two programs and ex-U.S. commercialization rights for up to two programs. 1L, first-line; HCC, hepatocellular carcinoma.

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Anticipated 2020 milestones

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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