decīphera

Defeating Cancer: The Challenge. Our Mission.

May 2019

Disclaimer

This presentation has been prepared by Deciphera Pharmaceuticals, Inc. for informational purposes only and not for any other purpose. Nothing contained in this presentation is, or should be construed as, a recommendation, promise or representation by Deciphera Pharmaceuticals, Inc. or any director, employee, agent, or adviser of Deciphera Pharmaceuticals, Inc. This presentation does not purport to be all-inclusive or to contain all of the information you may desire.

Certain information contained in this presentation relates to or is based on studies, publications, surveys and other data obtained from third-party sources and Deciphera Pharmaceuticals, Inc.'s own internal estimates and research. While Deciphera Pharmaceuticals, Inc. believes these third-party sources to be reliable as of the date of this presentation, it has not independently verified, and makes no representation as to the adequacy, fairness, accuracy or completeness of, any information obtained from third-party sources. While Deciphera Pharmaceuticals, Inc. believes its internal research is reliable, such research has not been verified by any independent source.

Forward-Looking Statements

This presentation may contain forward-looking statements that are based on our current expectations, estimates and projections about our industry as well as management's beliefs and assumptions. Words such as "anticipates," "expects," "intends," "plans," "believes," "seeks," "estimates," "may," "will," and variations of these words or similar expressions are intended to identify forward-looking statements. These statements include statements regarding our business strategy, prospective products, clinical trial results, product approvals and regulatory pathways, timing and likelihood of success, plans and objectives of management for future operations, expectation of designating future clinical candidates, future results of anticipated products, commercial readiness planning, and the market opportunity for our drug candidates, and speak only at the time this presentation was prepared. Such statements are based upon the information available to us now and are subject to change. We will not necessarily inform you of such changes. These statements are not guarantees of future performance and are subject to certain risks, uncertainties and assumptions that are difficult to predict. Therefore actual results could differ materially and adversely from those expressed in any forward-looking statements as a result of various factors. Factors which could cause actual results to differ materially from those in the forward-looking statements include, among others, our history of significant losses since inception, our ability to obtain necessary capital when needed on acceptable terms, the timing and results from ongoing or future clinical and nonclinical trials, our ability to obtain regulatory approval or clearance of our drug candidates, our ability to plan for potential commercialization, competition from other products or procedures, our reliance on third-parties to conduct our clinical and non-clinical trials, our reliance on single-source third-party suppliers to manufacture clinical, non-clinical and any future commercial supplies of our drug candidates and our ability to obtain, maintain and enforce our intellectual property rights for our drug candidates. New risk factors and uncertainties may emerge from time to time, and it is not possible to predict all risk factors and uncertainties. There can be no assurance that the opportunity will meet your investment objectives, that you will receive a return of all or part of such investment. Investment results may vary significantly over any given time period. The appropriateness of a particular investment or strategy will depend on an investor's individual circumstances and objectives. Deciphera recommends that investors independently evaluate specific investments and strategies. For further information regarding these risks, uncertainties and other factors, you should read the “Risk Factors” section of Deciphera’s Quarterly Report on Form 10-Q for March 31, 2019 filed with the Securities and Exchange Commission (the "SEC"), and Deciphera’s other SEC filings.

Addressing Unmet Needs for Patients

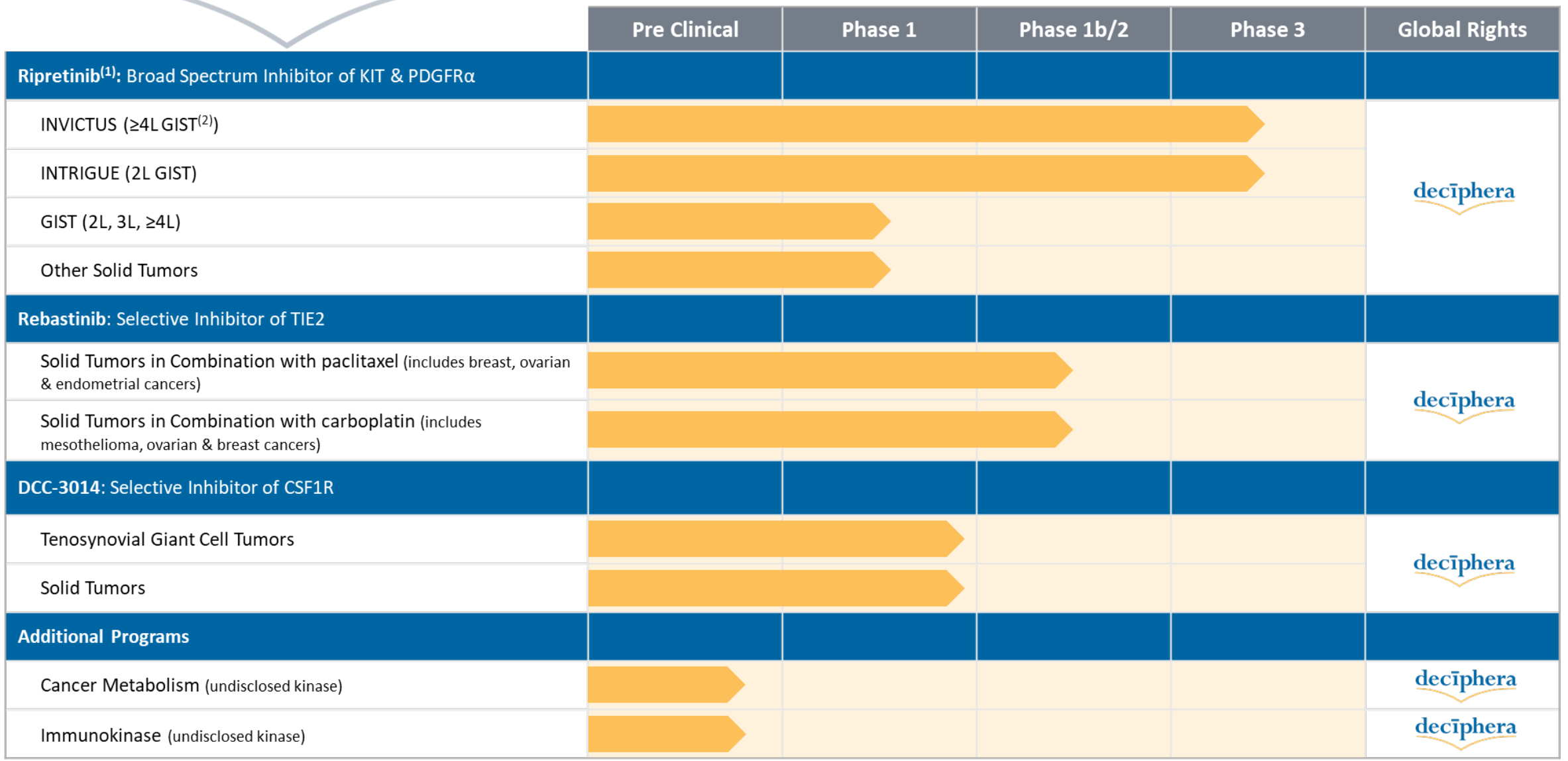
Three Clinical-Stage Programs

Two Randomized Phase 3 Trials Ongoing

Commercial Preparations Underway to Support First Potential Approval

Proprietary Kinase Switch Control Inhibitor Platform

Strong Clinical Stage Oncology Pipeline of Novel Kinase Inhibitors



Notes: (1) DCC-2618; (2) GIST = gastrointestinal stromal tumors

Ripretinib: Designed to Address Relevant Mutations in GIST

Highly potent small molecule KIT and PDGFRα inhibitor

- Designed to inhibit the full spectrum of known KIT and PDGFRα mutations

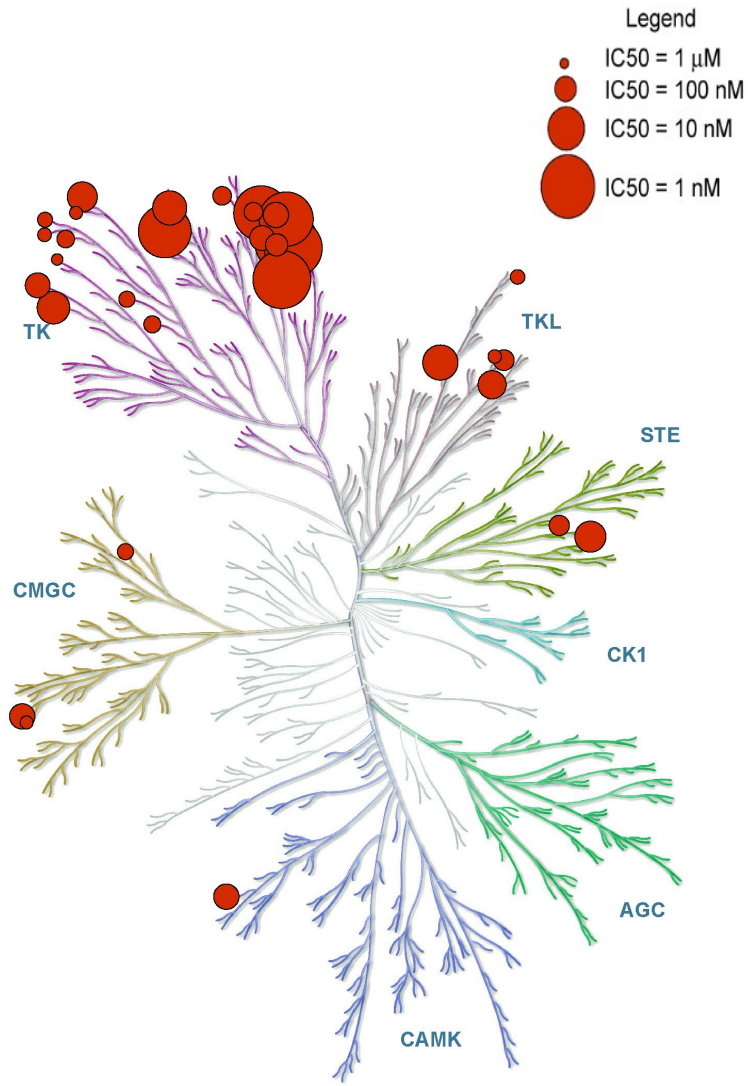
Two Randomized Phase 3 Clinical Trials Ongoing

- INVICTUS: Placebo-controlled, pivotal trial in ≥4th line GIST
  - PFS primary endpoint
  - Top-line data read-out expected mid-2019
- INTRIGUE: Compared to sunitinib, pivotal trial in 2nd line GIST
  - PFS primary endpoint
  - Initiated December 2018
- Phase 1 expansion study ongoing

Clinical proof-of-concept demonstrated in 178 GIST patients in Phase 1

Favorable tolerability profile

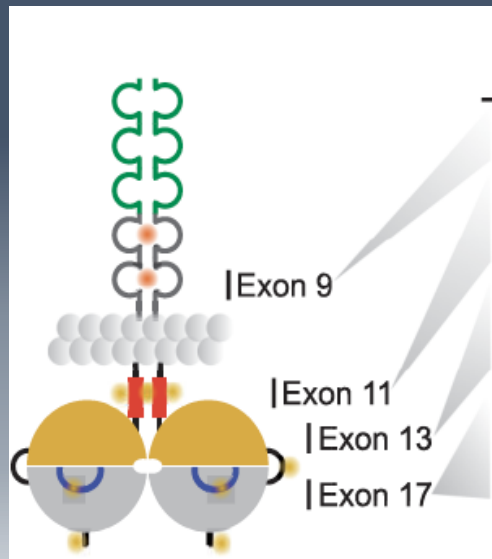
IP: Composition and method of use (2032)



Source and notes: Smith et al. Cancer Cell 35, 738-751, May 13, 2019; Composite of enzyme and cellular kinase phosphorylation data was used. The size of the red circle corresponds to the IC_{50} value obtained. No circles are plotted for kinases with IC_{50} > 1 µM; Illustration reproduced courtesy of Cell Signaling Technology, Inc. (www.cellsignal.com).

Mutations in KIT Drive ~80% of GIST

- Majority of patients with KIT primary mutations respond to 1st line imatinib
  - Resistance develops most commonly due to secondary mutations in KIT
- Approved 2nd and 3rd line agents (sunitinib and regorafenib) confer modest clinical benefit compared to imatinib
  - Multiple drug-resistant mutations often arise in individual tumors
- Unmet medical need for agents that can address relevant primary/secondary KIT mutations across all lines of therapy



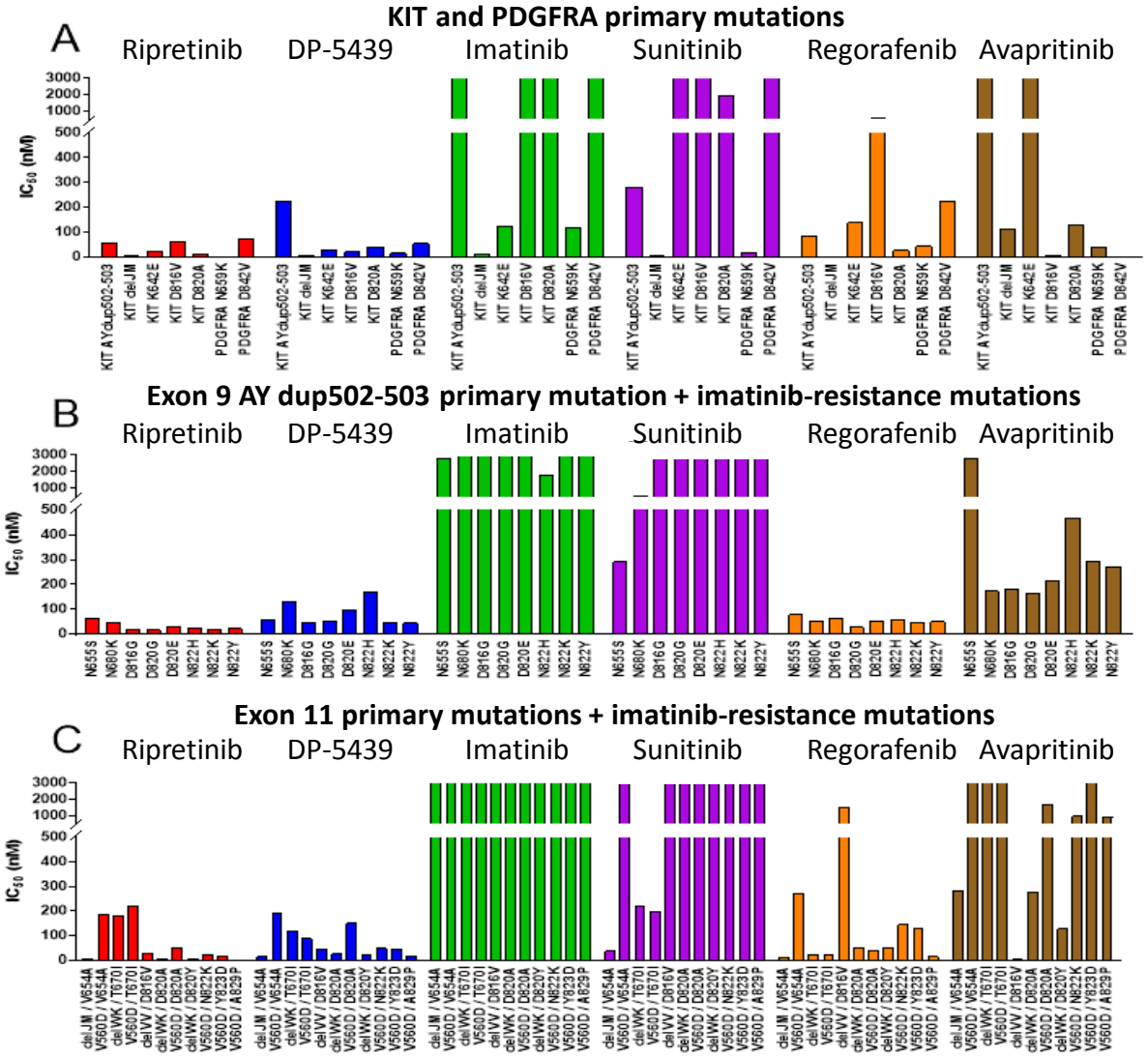
Domain	Gene	1° Mutation Frequency	2° Mutation Frequency
D5	*KIT*	10%	
JM	*KIT*	67	
	PDGFRA	1	
TK1	*KIT*	1	56
	PDGFRA	1	
A-Loop	*KIT*	1	41
	PDGFRA D842V	5	
	PDGFRA	1	3

Source: Hemming M et al. Translational insights into gastrointestinal stromal tumors and current clinical advances. Annals of Oncology; 0:1-9, 2018.

Ripretinib: Broad Mutational Coverage in KIT and PDGFRα (In Vitro Data)

- Broadly inhibits relevant GIST mutations
  - KIT mutations: Exons 9, 11, 13, 14, 17, 18
  - PDGFRA mutation: Exon 18
- Type I inhibitors exhibit weak activity in relevant GIST mutations
  - Primary KIT mutations: Exon 9, exon 11 V560D and exon 13 K642E
  - Secondary KIT mutations: Exon 13 and exon 14

Ripretinib Inhibits Phosphorylation of KIT and PDGFRα in Cellular Assays



Notes: (A) GIST primary mutations; or imatinib-resistant KIT mutations with (B) exon 9 or (C) exon 11 primary mutations.

Source: AACR 2018

deciphera™

Approved Therapies for GIST: Clinical Goal is Disease Control

	First Line	Second Line	Third Line
	imatinib (n=147) (Blanke et al. 2008)	sunitinib (n=243) (Demetri et al. 2012)	regorafenib (n=133) (Demetri et al. 2013)
Progression Free Survival[1] (weeks)	104.0	26.6	20.8
Objective Response Rate (%)	68.1%	7.0%	4.5%
Stable Disease (%)	15.6%	53.0%	48.1%
Disease Control Rate ("DCR") (%)	**83.7%[2]**	**60.0%[2]**	**52.6%[3]**

No approved therapy for 4th line patients

Notes: (1) Includes progression free survival and time to progression converted to weeks; (2) Time point not disclosed; (3) Time point at 12 weeks.

Ripretinib: Phase 1 Trial Summary

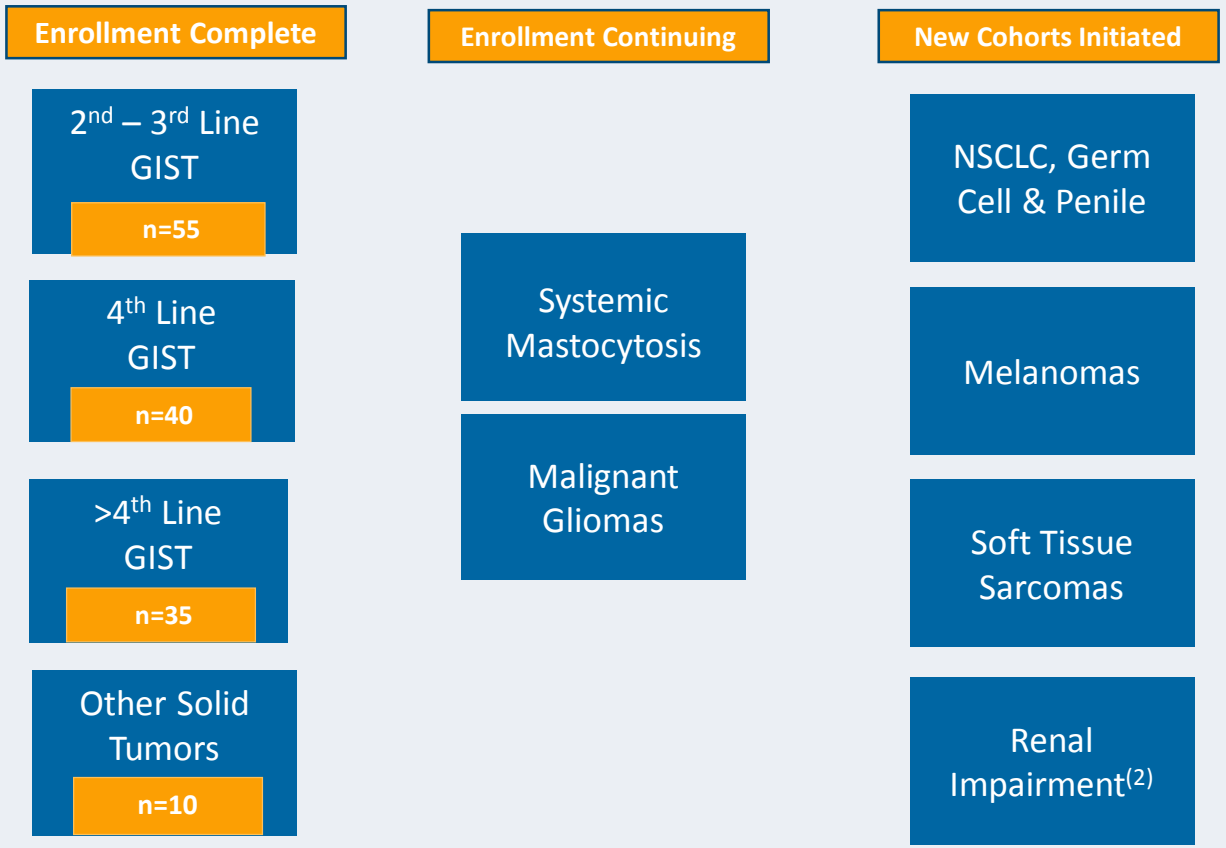
Part 1: Dose Escalation

- Key Objectives: MTD, recommended Phase 2 dose, safety, tolerability, pharmacokinetics and anti-tumor activity
- Design: 3+3 design with enrichment of targeted patients
- Dose Levels: 20, 30, 50, 100, 150, and 200 mg BID; and 100, 150 and 250 mg QD
- MTD: not determined

Advanced Malignancies (n=68) → **Recommended Dose 150 mg QD(1)**

Part 2: Dose Expansion

- **10 cohorts up to 270 pts; 4 cohorts fully enrolled**



Notes: (1) 150 mg BID dosing also available for dose escalation for GIST patients and for SM patients; (2) Includes patients with GIST and other solid tumors with renal impairment.

Ripretinib: Phase 1 Demography and Baseline Characteristics

ESMO 2018				
GIST Patients at >100 mg/d	**2nd Line (n=38)**	**3rd Line (n=29)**	**≥ 4th Line (n=111)(4)**	**Total (n=178)**
Age Median (min, max)	60 (32, 80)	64 (48, 82)	60 (27, 87)	61 (27, 87)
Primary Mutation(1) n (%)				
KIT Exon 9	4 (11%)	8 (28%)	22 (20%)	34 (19%)
KIT Exon 11	31 (82%)	20 (69%)	71 (64%)	122 (69%)
Other KIT(2)	0 (0%)	1 (3%)	12 (11%)(3)	13 (7%)(3)
PDGFRα	3 (8%)	0 (%)	6 (5%)	9 (5%)
Pts at RP2D(5) (150 mg QD)	32 (84%)	27 (93%)	83 (75%)	142 (80%)

Notes: (1) Primary mutation per local assessment; (2) KIT exon 13 (4), KIT exon 17 (5), not done (3); (3) Includes one SDH deficient patient; (4) Mean # of prior therapies is 4.63 (range 4-7); (5) RP2D = Recommended Phase 2 Dose.

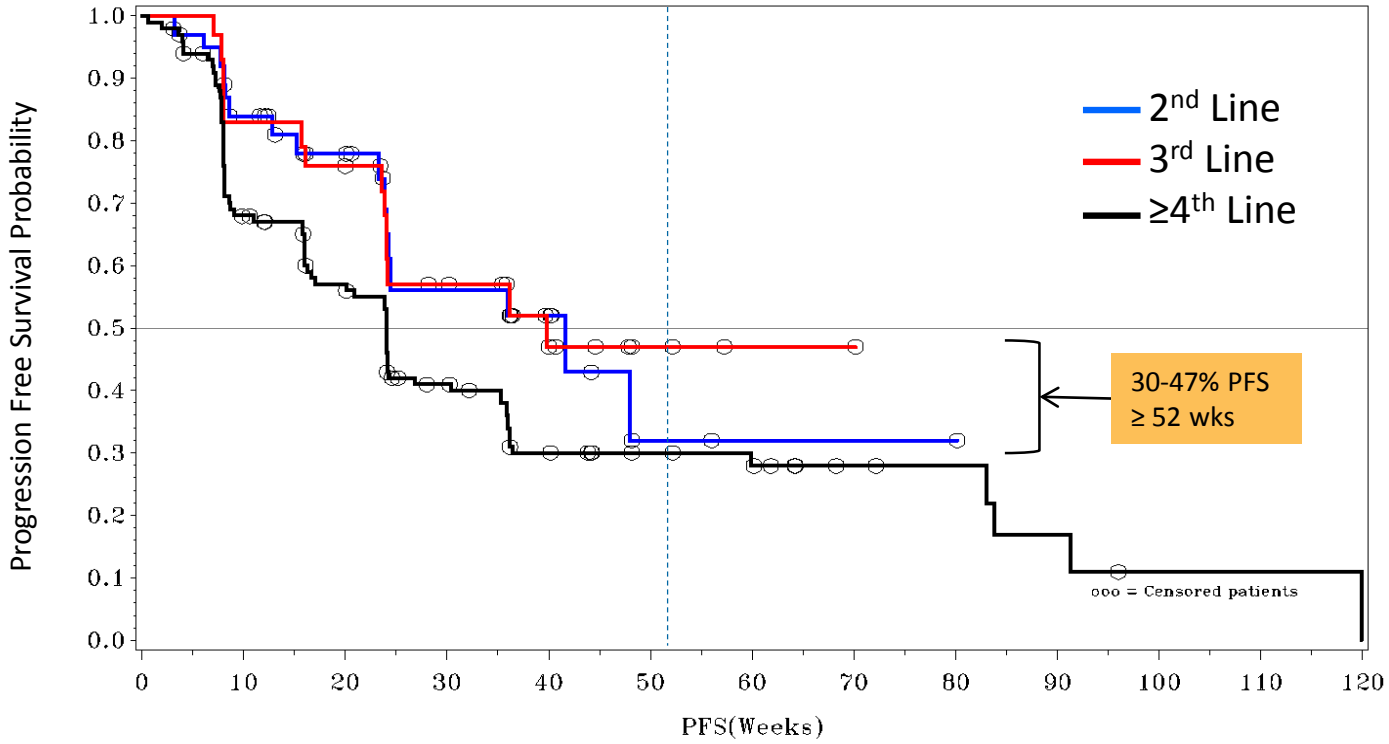
Ripretinib: Preliminary Phase 1 Results Provided Encouraging Efficacy Measures Across All Lines of Treatment >100 mg/d (n=178)

Line of Therapy	Objective Response Rate[1][2]	Disease Control Rate @ 3 Months[1]	Median Progression Free Survival (mPFS)[1]	Censored Patients for mPFS[1]	Median Treatment Duration[5]
2nd Line (n=38)	18%[3]	79%	42 weeks	58%	48 weeks
3rd Line (n=29)	24%	83%	40 weeks	52%	NR
≥4th Line (n=111)	9%[4]	66%	24 weeks	35%	28 weeks
2nd & 3rd Line (n=67)	21%[3]	81%	40 weeks	55%	52 weeks

Notes: (1) Based on cut off date of August 31, 2018; RECIST data per investigator assessment; *(2)* ORR by Best Response includes nine unconfirmed responses in 2nd line (n=1), 3rd line (n=3) and ≥4th line (n=5)*; (3)* Does not reflect one PR reported after cut off date; *(4)* Excludes five patients due to missing data at the time of data cut off (n=2), lack of first tumor assessment (n=1), withdrawal of consent prior to first assessment (n=1) and unrelated death at C1D4 prior to first assessment*; (5) Includes 14 patients who elected for intra-patient dose escalation.*

Ripretinib Phase 1 Data Demonstrated Prolonged Progression Free Survival in a Meaningful Subset of Patients Across All Lines of Treatment

Tumor Control per RECIST(1)
KIT & PDGFRα @ ≥ 100 mg/d (n=178)



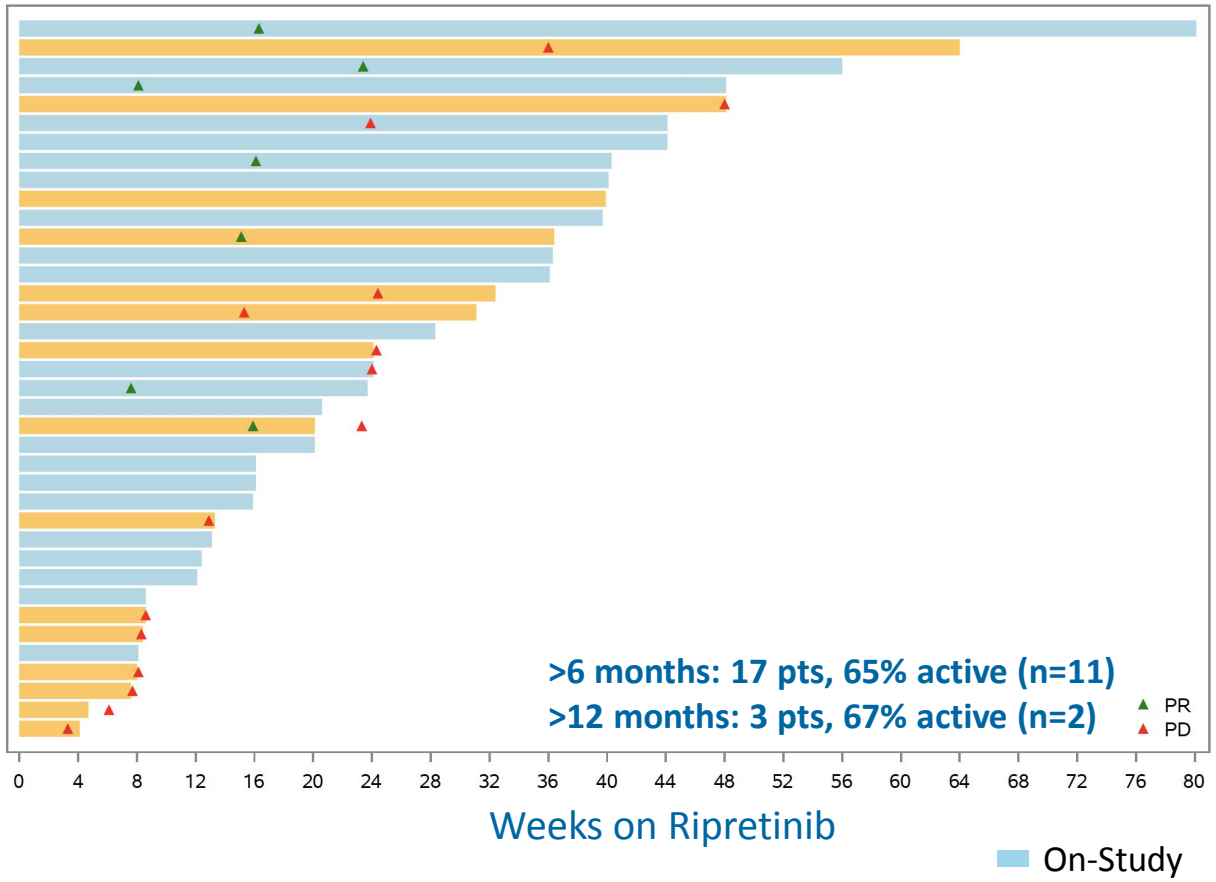
2nd Line	**38**	**30**	**21**	**13**	**8**	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**0**
3rd Line	**29**	**24**	**21**	**14**	**8**	**4**	**1**	**1**	**0**	**0**	**0**	**0**	**0**
≥4th Line	**111**	**71**	**53**	**32**	**20**	**14**	**12**	**6**	**5**	**3**	**1**	**1**	**0**

Notes: (1) Based on cutoff date of August 31, 2018; RECIST data per investigator assessment; (2) RECIST data per central review in registration trial; (3) mPFS of 4.8 months converted to weeks.

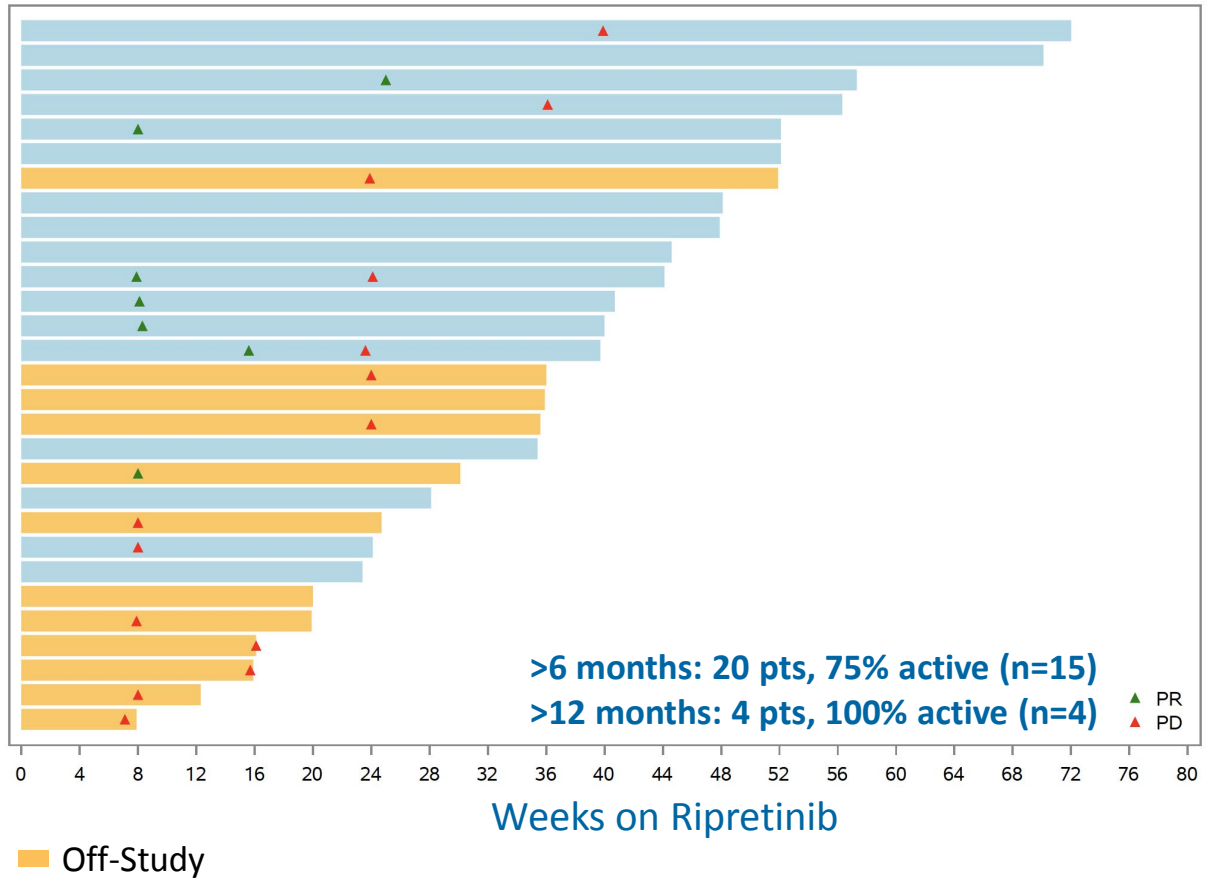
deciphera™

Ripretinib: Generally Well-tolerated in Phase 1 Data; Allowed for Prolonged Treatment Duration in 2nd & 3rd Line GIST Patients at ≥100 mg/d (n=67)

2nd Line KIT and PDGFRα Patients (n=38)(1)(2)



3rd Line KIT and PDGFRα Patients (n=29)(1)(2)



On-Study Off-Study

Notes: (1) Based on cutoff date of August 31, 2018; RECIST data per investigator assessment; (2) Includes unconfirmed responses in 2nd line (n=1) and 3rd line (n=3). Does not reflect one PR in 2nd line reported after cutoff date. Includes 14 patients who elected for intra-patient dose escalation.

deciphera™

Ripretinib: Favorable Tolerability Profile @ ≥100mg Daily

Treatment-emergent Adverse Events (TEAE) in >10% GIST Patients (n=178) @ ≥100 mg Daily

- 14% (24 of 178) patients experienced dose reductions due to TEAEs
- 11% (19 of 178) patients experienced treatment discontinuations due to TEAEs
- Clinically asymptomatic lipase elevations most frequent G3 TEAE

GIST PATIENTS @ ≥100 MG DAILY			
ADVERSE EVENT	GRADE 1-2 (N=178)	GRADE 3-4 (N=178)	GRADE 1-4 TOTAL (N=178)
Alopecia	89 (50%)	0 (0%)	89 (50%)
Myalgia	79 (44%)	0 (0%)	79 (44%)
Fatigue	74 (42%)	2 (1%)	76 (43%)
Constipation	60 (34%)	0 (0%)	60 (34%)
Hand-Foot Skin Reaction[1]	56 (32%)	1 (1%)	57 (32%)
Nausea	53 (30%)	0 (0%)	53 (30%)
Decreased appetite	47 (26%)	2 (1%)	49 (28%)
Weight decreased	43 (24%)	0 (0%)	43 (24%)
Abdominal pain	33 (19%)	8 (5%)	41 (23%)
Diarrhea	38 (21%)	3 (2%)	41 (23%)
Lipase increased	21 (12%)	20 (11%)	41 (23%)
Vomiting	32 (18%)	1 (1%)	33 (19%)
Arthralgia	32 (18%)	0 (0%)	32 (18%)
Hypertension	22 (12%)	10 (6%)	32 (18%)
Dry skin	31 (17%)	0 (0%)	31 (17%)
Rash	31 (17%)	0 (0%)	31 (17%)
Muscle spasms	30 (17%)	0 (0%)	30 (17%)
Anemia	14 (8%)	13 (7%)	27 (15%)
Dyspnea	25 (14%)	2 (1%)	27 (15%)
Cough	26 (15%)	0 (0%)	26 (15%)
Headache	25 (14%)	0 (0%)	25 (14%)
Dizziness	23 (13%)	0 (0%)	23 (13%)
Back pain	20 (11%)	2 (1%)	22 (12%)
Blood bilirubin increased	15 (8%)	6 (3%)	21 (12%)
Pain in extremity	21 (12%)	0 (0%)	21 (12%)
Dysgeusia	18 (10%)	0 (0%)	18 (10%)
Hypomagnesaemia	18 (10%)	0 (0%)	18 (10%)
Pruritus	18 (10%)	0 (0%)	18 (10%)

Notes: (1) Palmar-plantar erythrodysaesthesia syndrome reported in 19 patients; (2) Data presented at ESMO on October 19, 2018 based on cutoff as of August 31, 2018.

Ripretinib: INVICTUS Pivotal Phase 3 Top-line Data Expected Mid-2019

Global Pivotal Phase 3 GIST Programs

invictus

3 prior lines of therapy[1]

2:1 Randomization
Double Blind
n=129

- Ripretinib 150 mg QD
- Placebo N/A

Primary Endpoint for Approval = PFS

Following progression: (a) placebo patients can crossover to ripretinib and (b) ripretinib patients can continue on treatment or escalate to 150 mg BID

intrigue

Prior imatinib therapy[2]

1:1 Randomization
Open Label
n=358

- Ripretinib 150 mg QD n=179
- Sunitinib 50 mg QD n=179

Primary Endpoint for Approval = PFS

No cross-over option

Notes: (1) Phase 3 pivotal study in ≥4th line patients who previously received at least imatinib, sunitinib, and regorafenib; (2) Phase 3 pivotal study in 2nd line patients who previously received imatinib.

deciphera™

Ripretinib: Estimated GIST Market Opportunity: US, EU & Japan

	US	EU & Japan	Total (exc. ROW)
GIST KIT 4th Line[1&2]	~2,100	~4,100	~6,200
GIST KIT 2nd Line[1&2]	~2,600	~5,000	~7,600
GIST PDGFRα[1&2]	~400	~760	~1,160

Estimated Annual Incidence of New Patients by Indication

Sources: Internal Deciphera estimates based on applying epidemiology data reported in the following publications to population estimates for US, EU (28) and Japan:

[1] Zhao *et al.* J Gastrointest Oncol 2012;3(3):189-208

[2] Metaxas Y, *et al*. ESMO Open 2016

Expanding Clinical Stage Portfolio

Rebastinib

- Two ongoing Phase 1b/2 trials
- Data from Part 1 of the Phase 1b/2 paclitaxel study expected 2H 2019

DCC-3014

- Phase 1 trial ongoing
- TGCT(1) expansion cohort planned in 2Q 2019
- Phase 1 escalation data update expected 2H 2019

Discovery

- Select clinical candidate and initiate IND-enabling studies
- First disclosure of cancer metabolism target

Note: (1) TGCT = tenosynovial giant cell tumors

Rebastinib: A Highly Potent and Selective TIE2 Inhibitor

Potent, small molecule inhibitor of TIE2

Preclinical anti-tumor activity

- Single agent and I/O or chemo combination

TIE2 microenvironment mechanisms

- Tumor vascularization, dissemination, metastasis, immunotolerance

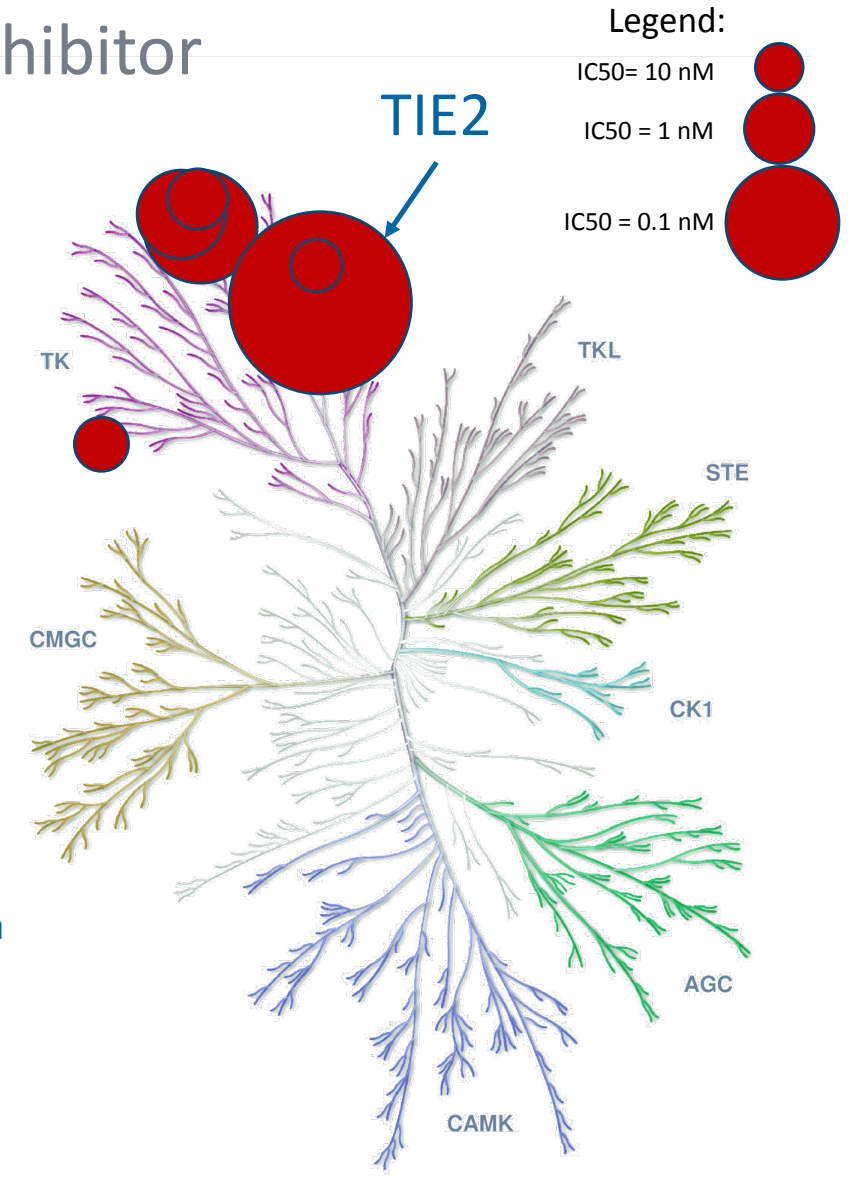
Phase 1 study completed

- Identified 150 mg BID dose as maximum tolerated dose

Development Status

- Two ongoing company-sponsored chemo combo trials with paclitaxel and carboplatin
- Data from Part 1 of the Phase 1b/2 study with paclitaxel expected 2H 2019

IP: Composition (2027) and method of use (2034)



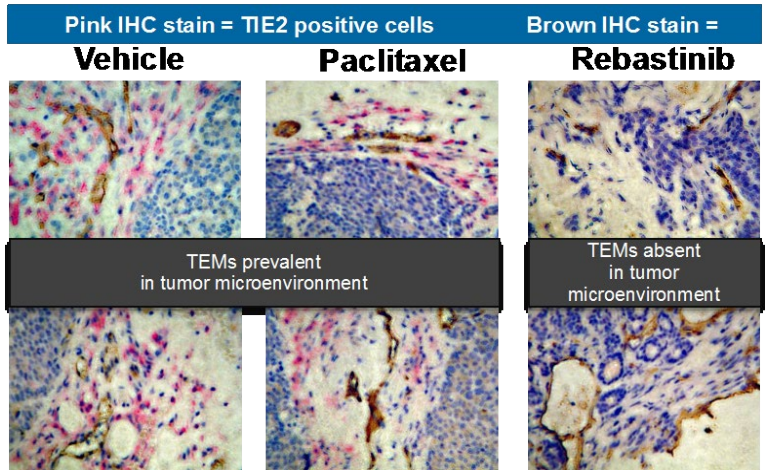
Notes: All kinases within 100-fold of TIE2 IC_{50} (0.058 nM) are shown. Includes enzyme data at low ATP and 4 mM ATP, and cellular data; Illustration reproduced courtesy of Cell Signaling Technology, Inc. (www.cellsignal.com).

decīphera™

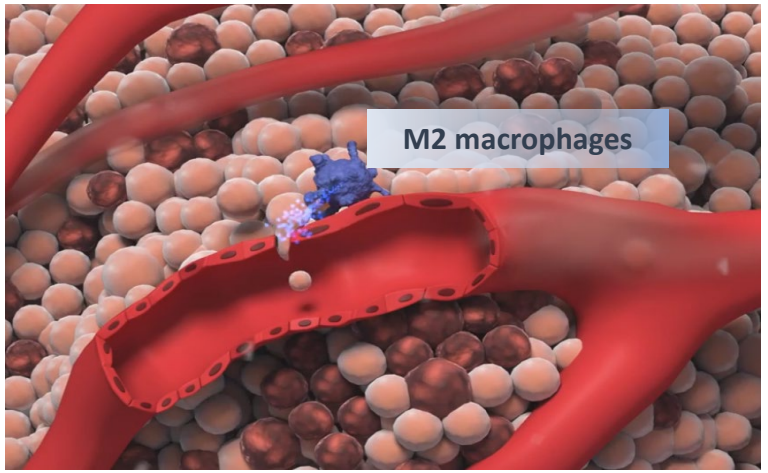
Rebastinib: Potential Benefits in Combination with Chemotherapy

Rebastinib targets TIE2 expressing macrophages (TEMs) and endothelial cells in tumor environment

Combination of rebastinib with chemotherapy may increase tumor killing through multiple mechanisms



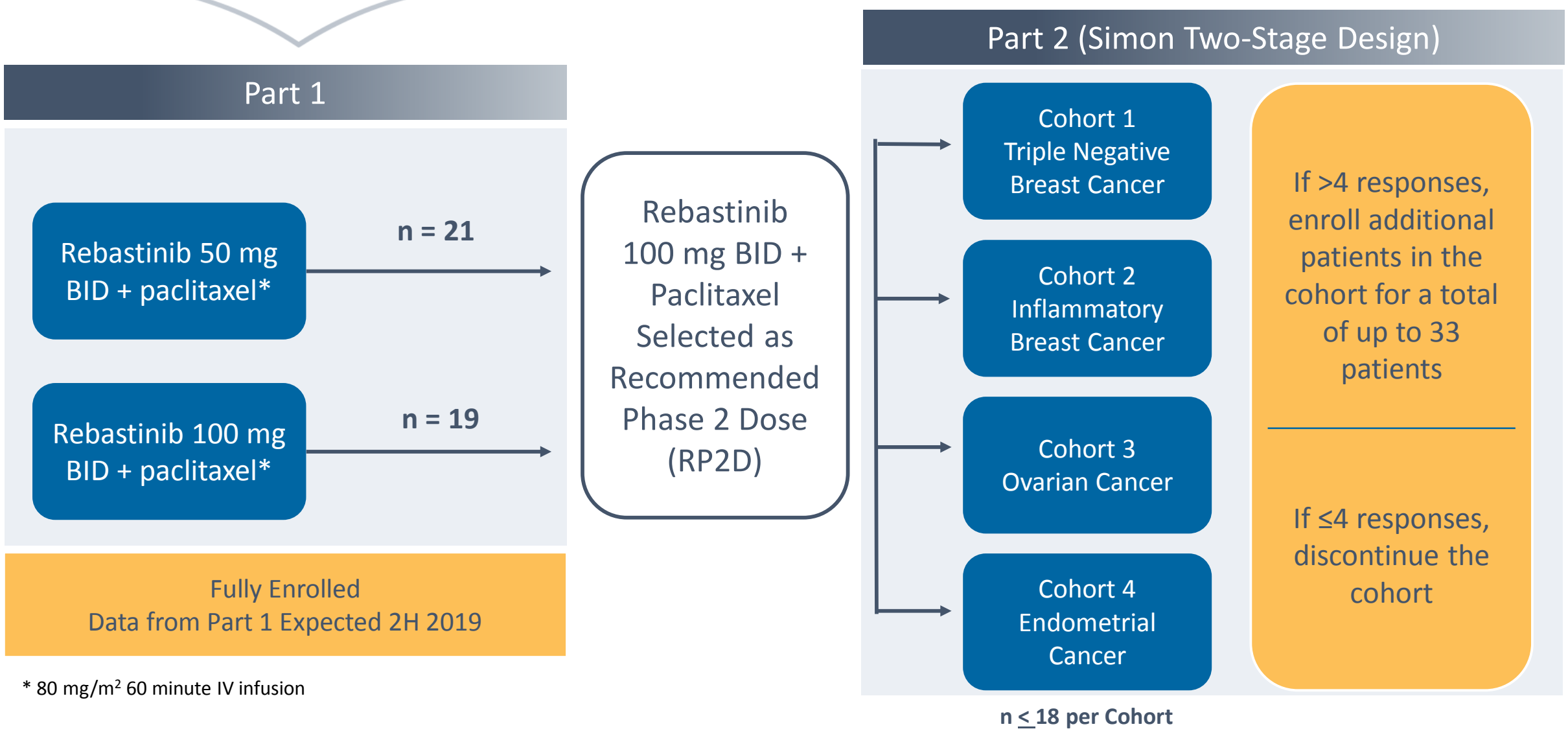
- Chemotherapy leads to recruitment of pro-tumoral M2 macrophages from the bone marrow
- Rebastinib is designed to inhibit chemotherapy-induced recruitment of M2 macrophages to tumors



- M2 macrophages serve as pumps for tumor cell intravasation and metastasis
- Rebastinib is designed to block rebound angiogenesis and inhibit M2 macrophages

deciphera™

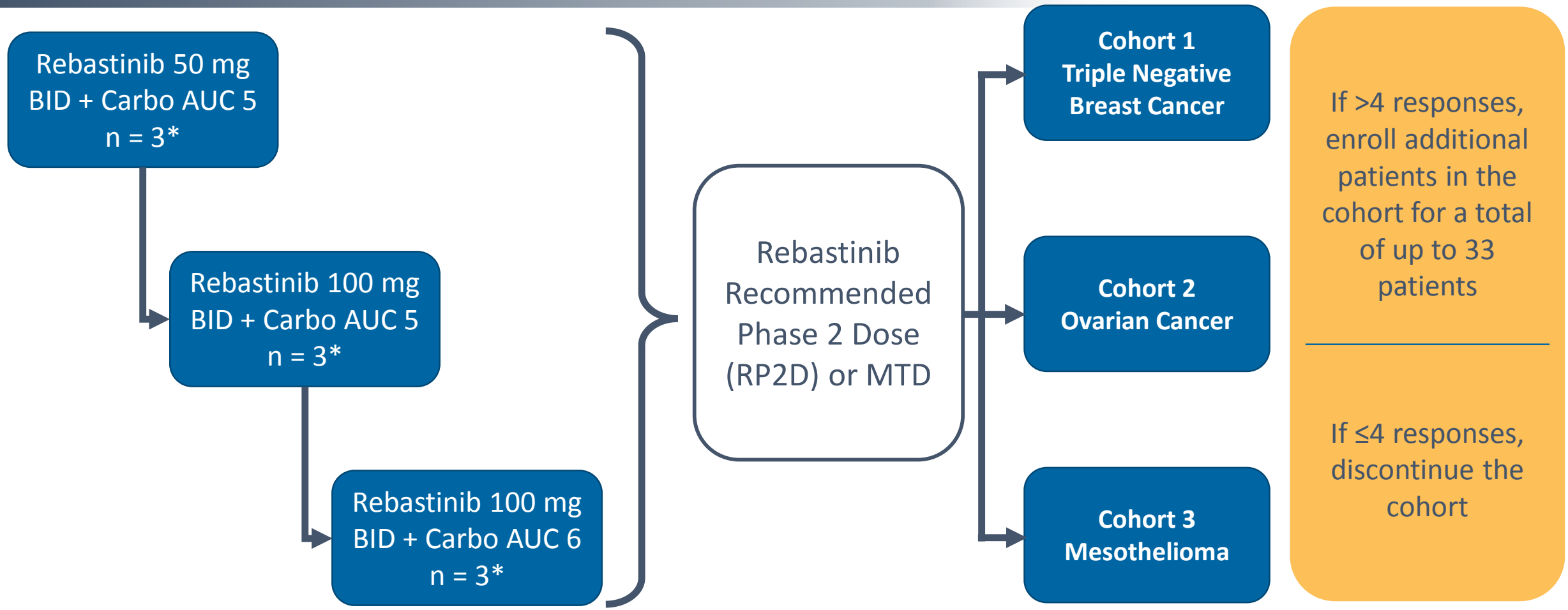
Rebastinib: Phase 1b/2 Study Combination with Paclitaxel



* 80 mg/m^2 60 minute IV infusion

Rebastinib Phase 1b/2 Study Combination with Carboplatin

Simon Two-Stage Design Applied at MTD or RP2D



* Requires at least 6 patients for MTD determination

DCC-3014: A Highly Selective and Potent CSF1R Inhibitor

Phase 1 escalation trial ongoing, with data update in 2H 2019

Mechanistic Proof of Concept (mPoC)[(1)] Achieved

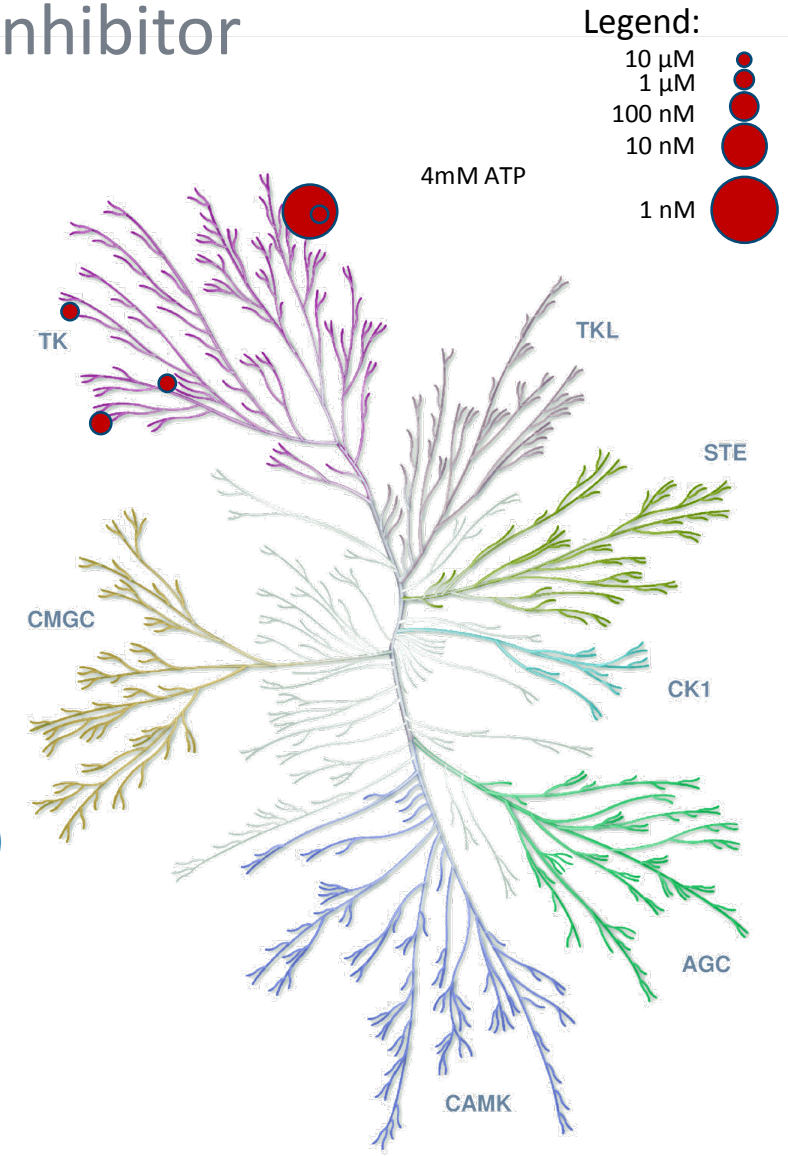
- Material reductions in circulating CSF1R+ macrophages

Generally well-tolerated at doses of up to 30mg in patients receiving five-day loading, followed by twice-weekly maintenance regimen

- No DLTs in loading and maintenance regimens
- No DCC-3014 related G3/4 TEAEs in ≥ 10% patients
- PK analysis demonstrated dose-proportional exposure for loading and maintenance regimen

Study expanded to include patients with tenosynovial giant cell tumors (TGCT)

IP: Composition and method of use (2034)



Notes: (1) Results from preliminary Phase 1 data reported in January 2019. Composite of enzyme and cellular kinase phosphorylation data was used. The size of the red circle corresponds to the IC_{50} value obtained. No circles are plotted for kinases with IC_{50} > 3 µM. Illustration reproduced courtesy of Cell Signaling Technology, Inc. (www.cellsignal.com).

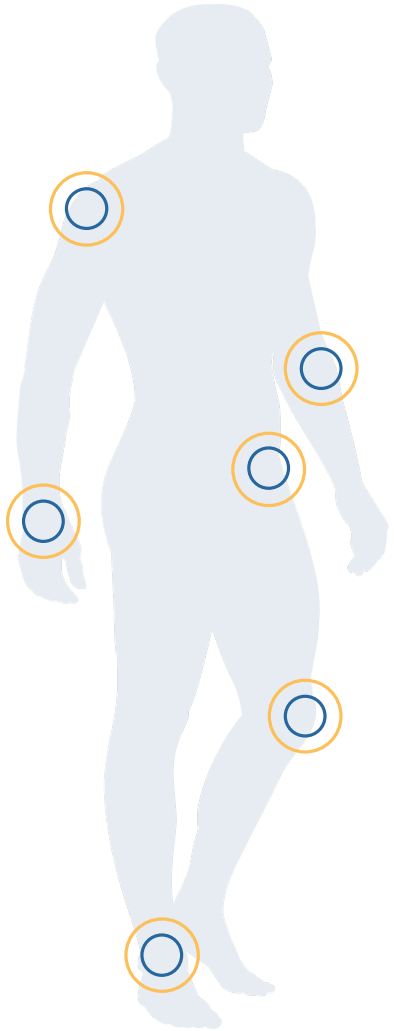
Single Agent Opportunity in Tenosynovial Giant Cell Tumor (TGCT)

Overview

- Rare, benign tumors involving the synovium, bursae and/or tendon sheath that damage surrounding tissues inducing pain, swelling, limitation of movement of the joint and cause severe disability
- Genetic translocation causes overproduction of CSF-1, the ligand for the CSF1R receptor, triggering migration of inflammatory cells to tumor sites

Two Types of TGCT

1. **Localized TGCT**
   - Affects knee, wrist and ankle
2. **Diffuse TGCT (also known as PVNS)**
   - Mostly commonly affects the knee, as well as hip, ankle, elbow and shoulder



Unmet Medical Need

- Surgical resection is standard treatment but with a high rate of recurrence in diffuse TGCT
- CSF1R inhibition has demonstrated clinical benefit in diffuse TGCT patients, but no currently approved systemic therapies
- Pexidartinib
  - 39% ORR VS. 0% for placebo in Phase 3 (n=120)
  - Hepatotoxicity concerns (off-target) may require a REMS and registry if approved
- Unmet medical need for effective CSF1R inhibitor with favorable safety/tolerability profile for diffuse TGCT patients

Sources: Mastboomet al. ActaOrthop. 2017; 88(6):688-694; Staals et al. Eur j Cancer. 2016; 63: 34-40.

Significant 2019 Milestones Across the Pipeline

Ripretinib	INVICTUS (≥4th Line GIST: Pivotal Phase 3 Results (Expected Mid-2019))
	Phase 1 Expansion Data
Rebastinib	✓ Phase 1b/2 Carboplatin Combination Initiated
	✓ Part 1 of the Phase 1b/2 Paclitaxel Combination Completed Enrollment
	Part 1 of the Phase 1b/2 Paclitaxel Combination Data
DCC-3014	✓ Phase 1 Dose Escalation Presentation
	Phase 1 Escalation Data Update
Discovery Platform	Select Clinical Candidate & Initiate IND-enabling Studies

NASDAQ:DCPH

Shares Outstanding (as of 3/31/19)

38.2 MM *(basic)*
45.0 MM *(fully-diluted)*

Cash, Cash Equivalents & Marketable Securities (as of 3/31/19)

$262 MM

Cash expected to fund operating expenses and cap ex into 2H 2020

decīphera

Thank you to patients, caregivers and healthcare professionals who have participated in our clinical trials

May 2019