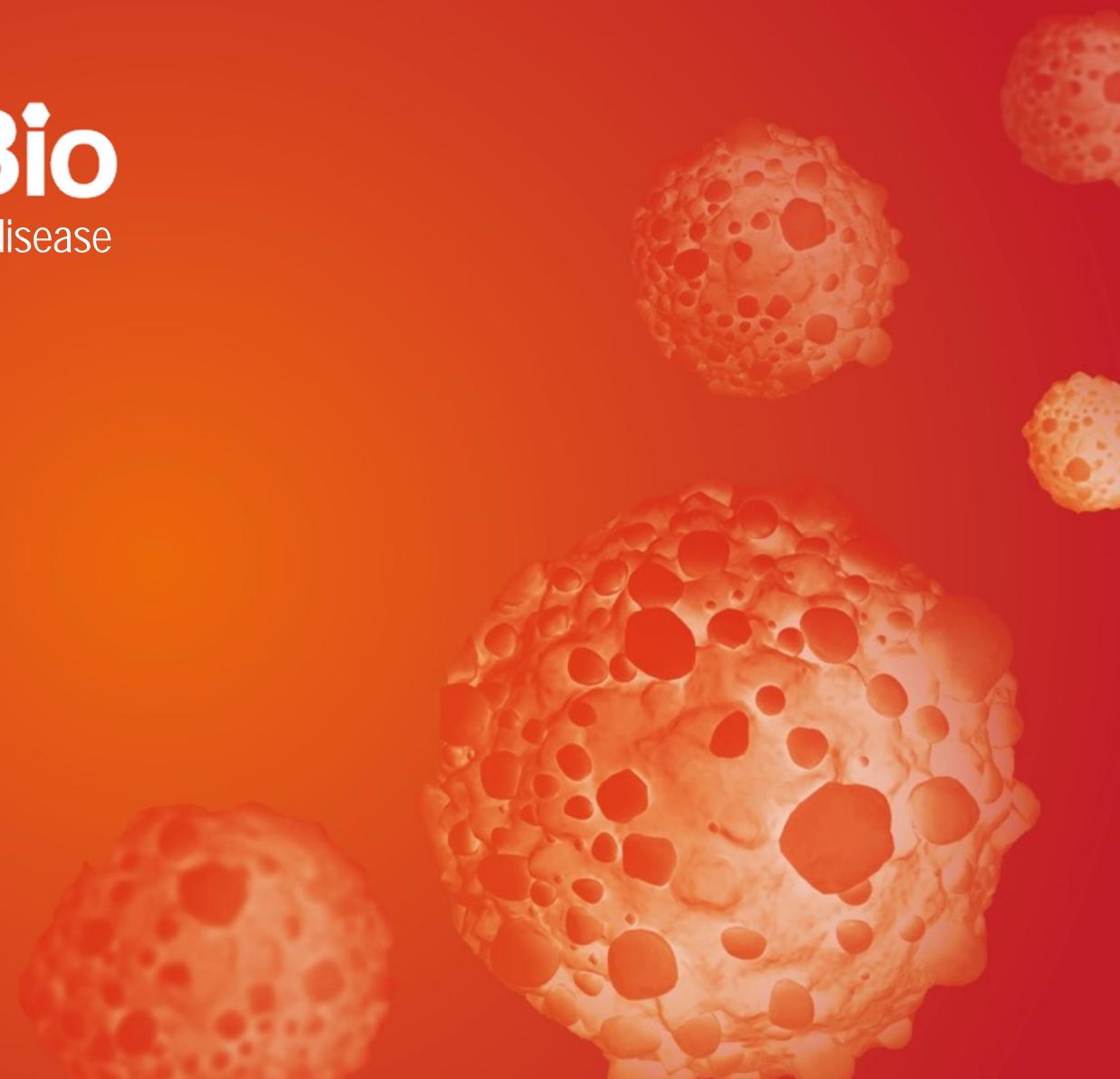




BerGenBio

Axl inhibitors for aggressive disease

Corporate Presentation
May 2020



Forward Looking statements

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BerGenBio corporate overview



World leaders in understanding AXL biology

AXL tyrosine kinase mediates aggressive disease: immune evasion, therapy resistance & metastatic cancer, fibrosis and viral infection

Selective AXL inhibitors have the potential to treat many serious unmet medical needs

Pipeline opportunities in multiple cancers and fibrosis



3 selective AXL inhibitors in clinical development

Bemcentinib (oral once a day pill)
Tilvestamab (mAb), ADCT601* (ADC)

Phase II: Monotherapy and combos with, CPI, targeted & chemo

Biomarker correlation, parallel CDx development

Bemcentinib phase II trials:
AML (monotherapy), **AML** (chemo-combo)
NSCLC (KEYTRUDA combo) **COVID19** (mono)



Resourced to deliver milestones

Listed on Oslo Børs: BGBIO

Clinical trial collaborations with Merck and leading academic centres EU & USA

38 staff at two locations:
HQ & R&D in Bergen, Norway;
Clinical Development in Oxford, UK

Senior Management Team



Richard S. Godfrey, Chief Executive Officer

- Pharmacist / MBA – joined BerGenBio in 2008 as CEO
- Formerly CEO Aenova Inc., USA
- Previously Managing Director DCC Healthcare, earlier Eli Lilly, Reckitt Benckiser, Catalent
- 28 years industry experience, led and managed multiple international drug development and commercialization partnerships



Prof. James Lorens, Founder and Chief Scientific Officer

- Professor University of Bergen Medical School
- 30 years biotech research experience, academic biomedical research positions at Stanford University and University of Bergen
- Former Director Oncology R&D, Rigel Inc. (San Francisco, CA)
- The first to recognize that Axl kinase is an essential mediator of cancer development (EMT)



Prof. Hani Gabra MD, PhD, Chief Medical Officer

- MD Oncologist – joined BerGenBio in 2019
- Former VP Clinical Development Astra Zeneca UK.
- Professor of Medical Oncology at Imperial College London and Honorary Consultant in Medical Oncology at Imperial College Healthcare NHS Trust
- 20 years clinical / cancer biology research at Imperial College London.



Rune Skeie, Chief Financial Officer

- 20 years of financial management, corporate development, corporate governance and advisory experience across multiple industry sectors. – Joined BerGenBio in 2018
- Previously Executive Director at EY and CFO of REMA Franchise Norge AS, the multinational supermarket business.
- Registered Accountant and a State Authorized Public Auditors

Recent highlights

Oct
2019

FDA Fast Track designation received for bemcentinib in relapse AML

Nov
2019

Primary & Secondary endpoint of ORR met in Phase II 2L NSCLC (cohort A) in combination with KEYTRUDA®
Four-fold improvement over Keytruda monotherapy**

Nov
2019

CDX: Proprietary composite AXL tumor-immune (cAXL) score developed to diagnose patients with clinical benefit
Five-fold improvement in ORR and four-fold mPFS improvement for cAXL +ve patients

Dec
2020

Presented preliminary clinical data from Ph II combination trial of bemcentinib and LDAC in AML patients at ASH conference
Durable responses reported with long duration

Jan
2020

Met Primary end point of ORR in phase II clinical trial in NSCLC (cohort B) in 2L IO refractory patients
Bemcentinib in combination with KEYTRUDA® meets primary end point and progress to stage 2 of the study cohort

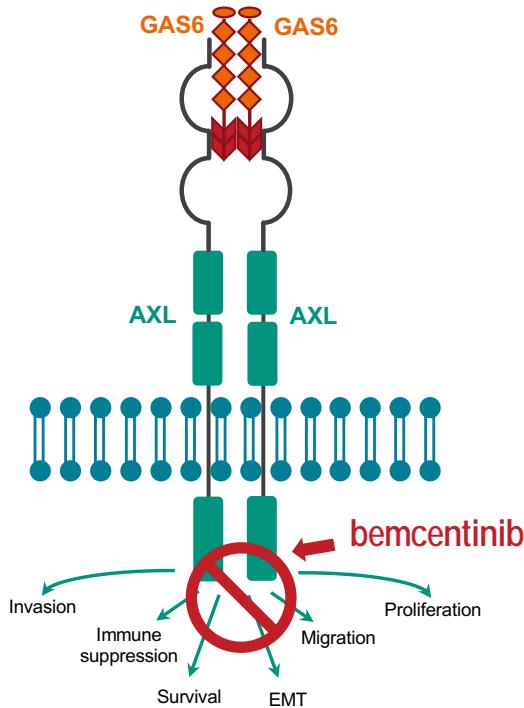
May
2020

FPI COVID19 rPhII ACCORD trial
Uk Govt selected bemcentinib as first experimental compound to enter fully funded seamless platform trial for efficacy and safety



AXL drives aggressive disease

AXL Biology



- AXL a receptor tyrosine kinase that is important for regulating innate immune cells.¹
- AXL levels are elevated by cellular stress and is strongly associated with inflammatory diseases including cancer and fibrosis.²
- It functions as a homeostatic regulator in adult tissues and organ systems that are subject to continuous challenge and renewal throughout life – immune, nervous, vascular and reproductive
- AXL drives cancer progression, immune evasion, and resistance to targeted therapies.³
- AXL is a key suppressor of the type I interferon response and is targeted by viruses to block the anti-viral immunity.⁴
- AXL is used by several different enveloped viruses (e.g. Ebola, Zika) to enter cells.⁵
- Bemcentinib potently inhibits SARS-CoV-2 infection of cells.⁶
- A lung cancer patient currently under treatment with bemcentinib who was high risk for COVID19 reported a mild Covid-19 infection.⁷

Very low expression under healthy physiological conditions

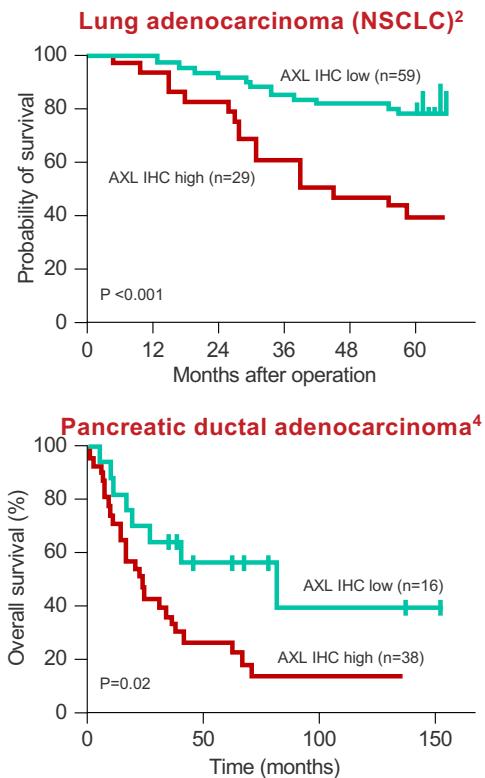
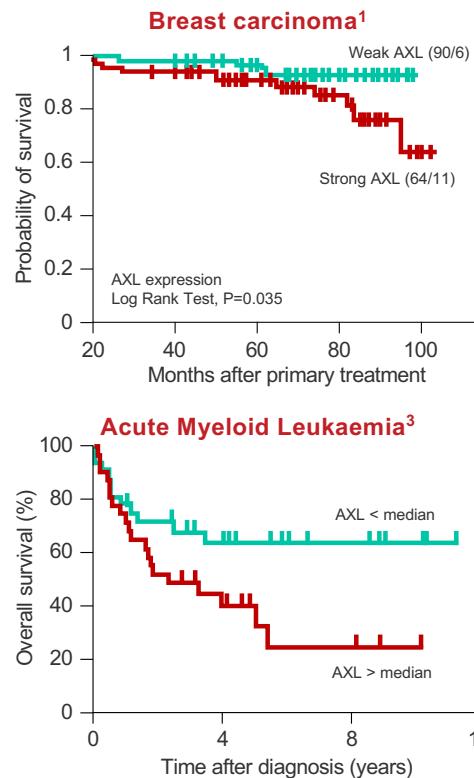
Elevated AXL signaling strongly associated with cancer progression, immune evasion, drug resistance and metastasis

AXL mediates viral entry to cells and dampening of viral immune response

¹Lemke Cold Spring Harb Perspect Biol 2013; ²Zagórska Nat Immunol 2014, Ludwig Cancer Res 2018, Espindola, Am J Respir Crit Care Med. 2018; ³Gay, Br J Cancer 2013; ⁴Chen Nat Microbiol 2018; ⁵Moller-Tank Virology 2014; ⁶W.Maury, unpublished; ⁷BerGenBio, unpublished

AXL is independent negative prognostic factor in a broad variety of cancers

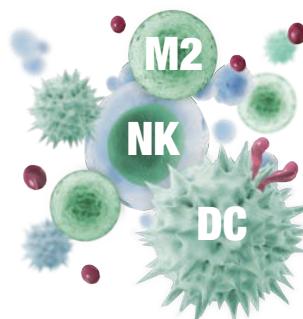
Strong AXL expression correlates with poor survival rate



Broad evidence of AXL linked with poor prognosis⁵

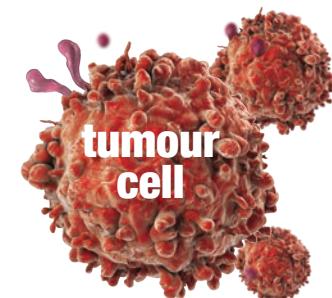
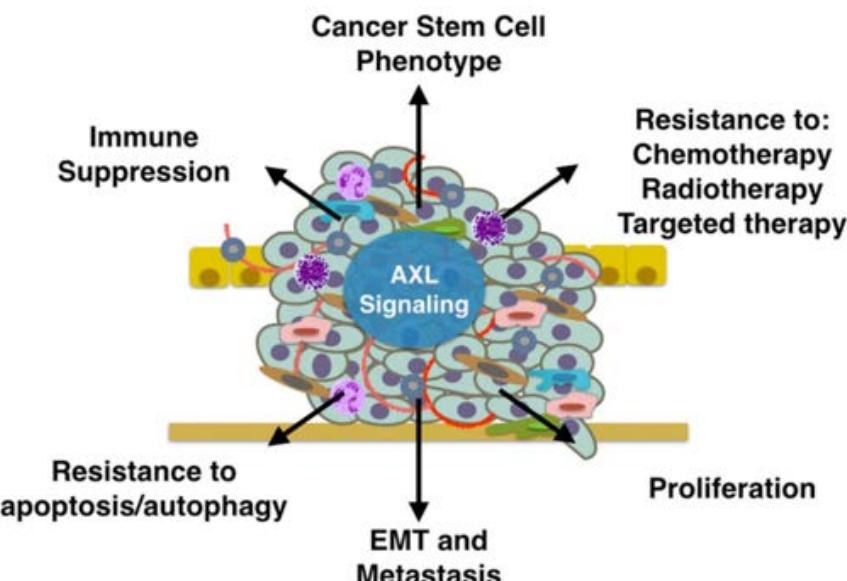
Astrocytic brain tumours
Breast cancer
Gallbladder cancer
GI
• Colon cancer
• Oesophageal cancer
• Gastric cancer
Gynaecological
• Ovarian cancer
• Uterine cancer
HCC
HNC
Haematological
• AML
• CLL
• CML
Melanoma
Mesothelioma
NSCLC
Pancreatic cancer
Sarcomas
• Ewing Sarcoma
• Kaposi's sarcoma
• Liposarcoma
• Osteosarcoma
Skin SCC
Thyroid cancer
Urological
• Bladder cancer
• Prostate cancer
• RCC

AXL is a key survival mechanism 'hijacked' by aggressive cancers and drives drug resistance, immune-suppression & metastasis



AXL increases on immune cells and suppresses the innate immune response

- M1 to M2 macrophage polarisation¹
- Decreased antigen presentation by DCs²
- Prevent CD8+ T cell mediated cell death³
- Activates Treg cells



AXL increases on the tumor cell and causes cancer escape and survival

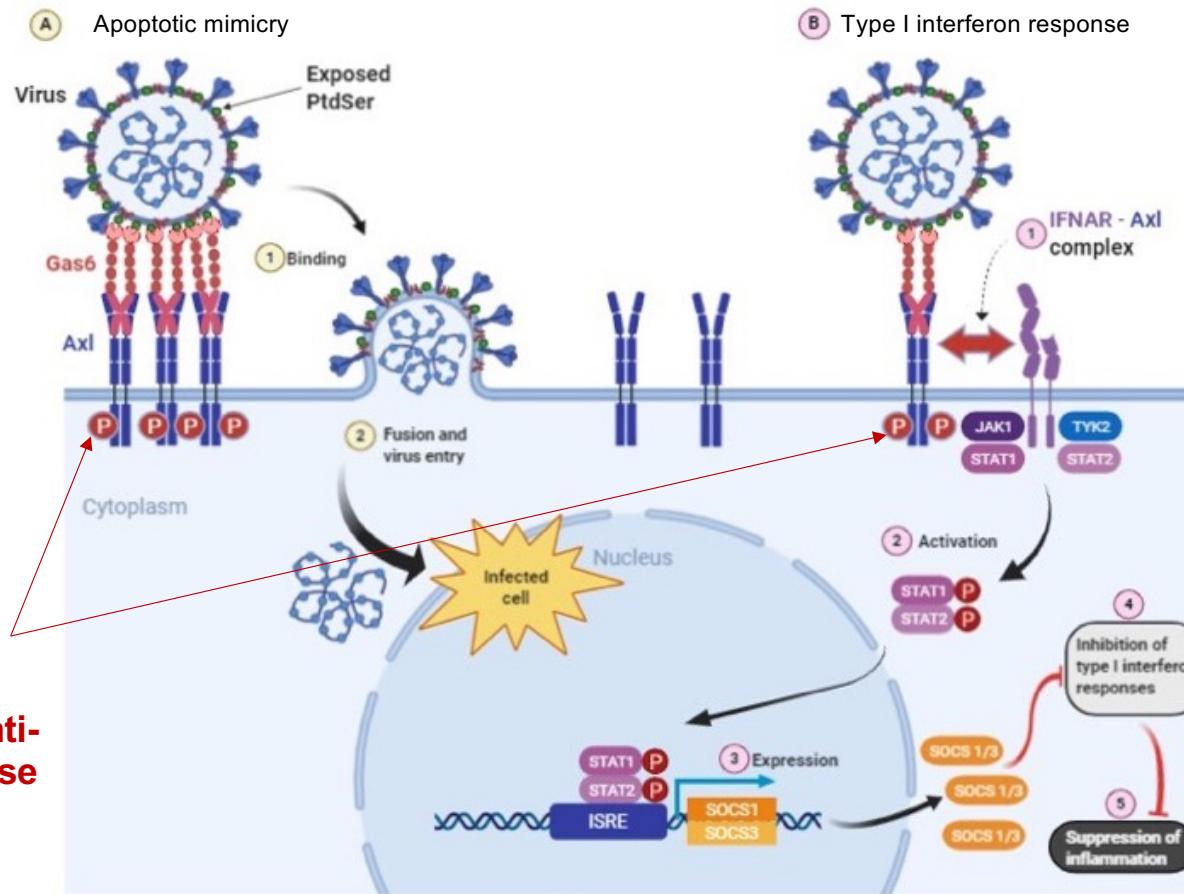
- AXL is a unique type I interferon (IFN) response checkpoint
- Acquired drug resistance
- Immune cell death resistant
- Metastasis

¹ DC- dendritic cells Treg – Regulatory T Cell

²1.Ludvig et al Can Res, 2018; Davidsen et al., submitted 2.Kurowska-Stolarska et al Nature Comm 2017; Rothlin et al Cell 2007 3.Ludvig et al Can Res, 2018; Davidsen et al., submitted

AXL is targeted by enveloped viruses to enter cells and dampen the viral immune response

Enveloped viruses display phosphatidylserine that is recognized by GAS6, the AXL receptor ligand, that mediates viral entry through "apoptotic mimicry".



bemcentinib blocks AXL-dependent viral entry and enhances anti-viral interferon response

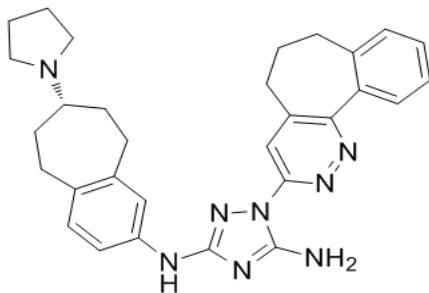
Viral-mediated AXL receptor activation dampens type I interferon responses, a key anti-viral defence mechanism for all cells

Bemcentinib



BerGenBio

Bemcentinib, a first-in-class, potent, oral, highly selective AXL inhibitor



- ✓ $IC_{50} = 14$ nM
- ✓ Uniquely selective for AXL
 - ✓ 50-100 fold selective *cf.* TAM kinases



- ✓ CMC scaled for regulatory filing
- ✓ Size 0 100mg HPMC capsules
- ✓ 3 years stability confirmed

- ✓ Once daily oral dosing
- ✓ Already trailed in >300 patients
- ✓ Favourable safety profile supports use in first line, high risk fragile patients
- ✓ Safety and tolerability profile supports use in combination with other drugs
- ✓ MOA is synergistic with other therapies enhancing response
- ✓ Global regulatory exposure with Fast Track Designation by FDA
- ✓ IMP available in stock for immediate clinical trial use

BerGenBio pipeline - 3 selective AXL inhibitors in clinical development

Multiple attractive opportunities in cancer and viral infection

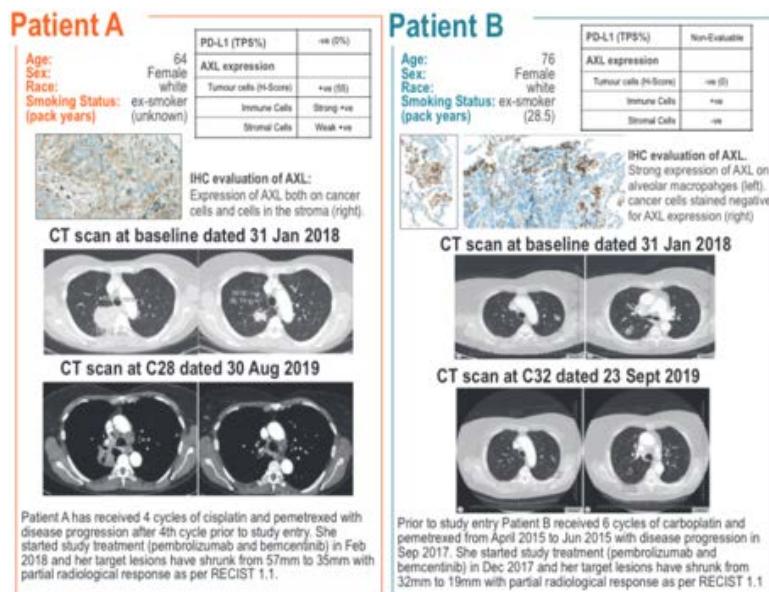
Candidate	Targeted Indication	Discovery	Preclinical	Phase I	Phase II	Phase III.
Bemcentinib	>2L AML	► Ph II safety and POC efficacy demonstrated in 39 patient trial				
Bemcentinib (combination with LDAC)	2L AML	► Ph Ib Safety demonstrated, efficacy POC expansion study- 28 pts.				
Bemcentinib (combination with Keytruda)	2L NSCLC. (chemo refractory)	► Ph II safety and POC efficacy demonstrated in 50 patient trial, end points met				
	2L NSCLC (CPI refractory)	► Ph II POC study on going 29 pts – stage 1 met end point				
	2L NSCLC (CPI+chemo refractory)	► Ph II POC study ongoing 29 pts				
Bemcentinib	COVID19	► Ph II Efficacy & Safety study ongoing 120 pts				
Tilvestamab (BGB149)	TBA	► Ph I Healthy volunteer study ongoing				
BGB601	Various solid tumors	► Ph I safety study ongoing				

Broad phase II clinical development plan with bemcentinib

		Clinical Proof-of-concept	Late stage Opportunities
Monotherapy Selected, biomarker directed patients	AML / MDS	Completed	
	Glioblastoma (IIT)	Ongoing	
	COVID19	Ongoing	
Chemotherapy Combinations Improve responses in hard to treat settings	AML + LDCT (LDAC)	Complete. -EXPANSION	
	Pancreatic, (IIT)	Ongoing	
	NSCLC (IIT)	Ongoing	
Immunotherapy Combinations Target resistance, enlarge addressable patient population	NSCLC (PD-L1 / AXL all comers)	Cohort A Complete Cohort B ongoing - EXPANSION Cohort C ongoing	
	Melanoma, (IIT)	Ongoing	
	Mesothelioma (IIT)	In set-up	
Targeted Therapy Combinations Target resistance, enlarge addressable patient population	NSCLC + EGFRi	Completed	
	Melanoma, (IIT)	Ongoing	

Companion Diagnostic (CDx)

- Developed a proprietary duplex IHC method with composite AXL tumor-immune Score (cAXL)
- A proprietary diagnostic algorithm using IHC scoring of AXL on tumor cells and on immune cells to identify solid tumour (NSCLC) patients that will respond / benefit from bemcentinib + CPI



Patient A: RESPONDER

- AXL stained +ve on tumor cells
- 61% tumor shrinkage

Patient B: RESPONDER

- AXL stained -ve on tumor cells
- AXL stained +ve on alveolar macrophages
- 59% tumor shrinkage

AXL mediates aggressive cancer traits through EMT and Immune suppression in the tumour microenvironment:

Patient A: AXL +ve staining on lung tumour cells

- AXL mediated EMT in tumour cells
- AXL+ve Mesenchymal tumour cells are drug resistant & immune evasive

Patient B: AXL +ve staining on lung macrophages

- AXL is required to stabilize M2 macrophages
- M2 macrophages are immune suppressive
- Bemcentinib inhibits AXL and macrophages switch to M1
- M1 macrophages are immune promoting

AXL inhibitors – emerging competitive landscape



Bemcentinib clinical development in COVID19

ACCORD-2 trial

To evaluate the efficacy and safety in hospitalized COVID19 patients

First compound selected by UK Govt. COVID19 Therapeutic Task Force

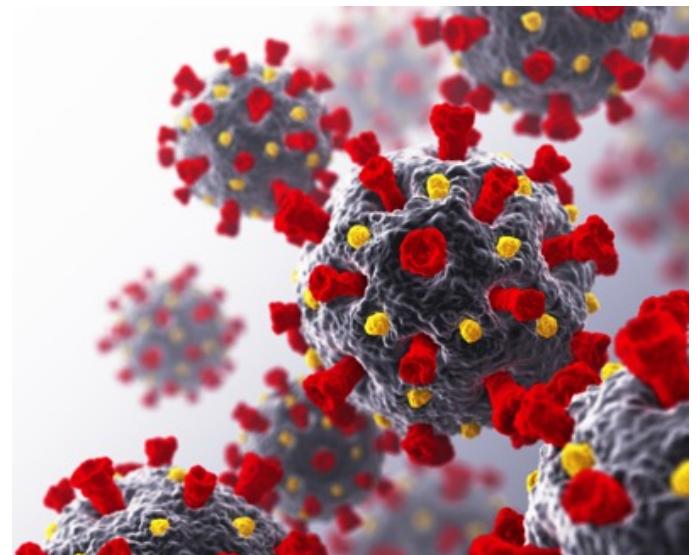
Trial funded by UK Govt.

A multicentre, randomised Phase II (120 patients) seamless Phase III transition option



BerGenBio's bemcentinib selected to be fast-tracked as a potential treatment for COVID-19

- Preclinical data suggest that bemcentinib is potentially useful for the treatment of early SARS-CoV-2 infection, as it selectively inhibits AXL kinase activity
- Bemcentinib selected as the first candidate to be fast-tracked in a new UK national multi-centre randomised Phase II clinical trial initiative to investigate potential treatments for hospitalised COVID-19 patients
- ACCORD (ACcelerating COVID-19 Research & Development platform) study is funded by the UK Department of Health and Social Care and UK Research and Innovation
- Study is a collaboration between the UK Government Scientific Office, the NIHR's Biomedical Research centres and clinical research company IQVIA
- Professor Tom Wilkinson is the academic lead of ACCORD-2, based at the National Institute for Health Research (NIHR) Southampton Biomedical Research Centre
- The study will test 120 patients across 6 UK NHS hospital trusts, with the first patients due to be treated imminently



Protocol title: A Multicentre, Seamless, Phase 2 Adaptive Randomisation Study to Assess the Efficacy and Safety of Multiple Candidate Agents for the Treatment of COVID-19 in Hospitalised Patients

Rationale:

There are currently no approved therapeutic agents available to treat coronaviruses such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of COVID-19 disease, and there is an urgent public health need for rapid development of such interventions. This adaptive platform study is designed to rapidly assess multiple candidate agents as treatments for COVID-19. Candidate drugs that are initially assessed as being efficacious will be moved from an evaluation (pilot) stage to a confirmatory stage, with candidate agents being added to and removed from the study on an ongoing basis, depending on the results of their evaluation. Patients to be included in the study will be hospitalised and may require either supplemental oxygen, noninvasive ventilation or high flow oxygen devices, or invasive mechanical ventilation or extracorporeal membrane oxygenation (ECMO).

Objectives:

Stage 1: To evaluate the efficacy of candidate agents as add-on therapies to standard of care (SoC) in patients hospitalised with COVID-19 in a screening stage.

Stage 2: To confirm the efficacy of identified efficacious candidate agents in patients hospitalised with COVID-19 in an expansion stage.

Endpoints:

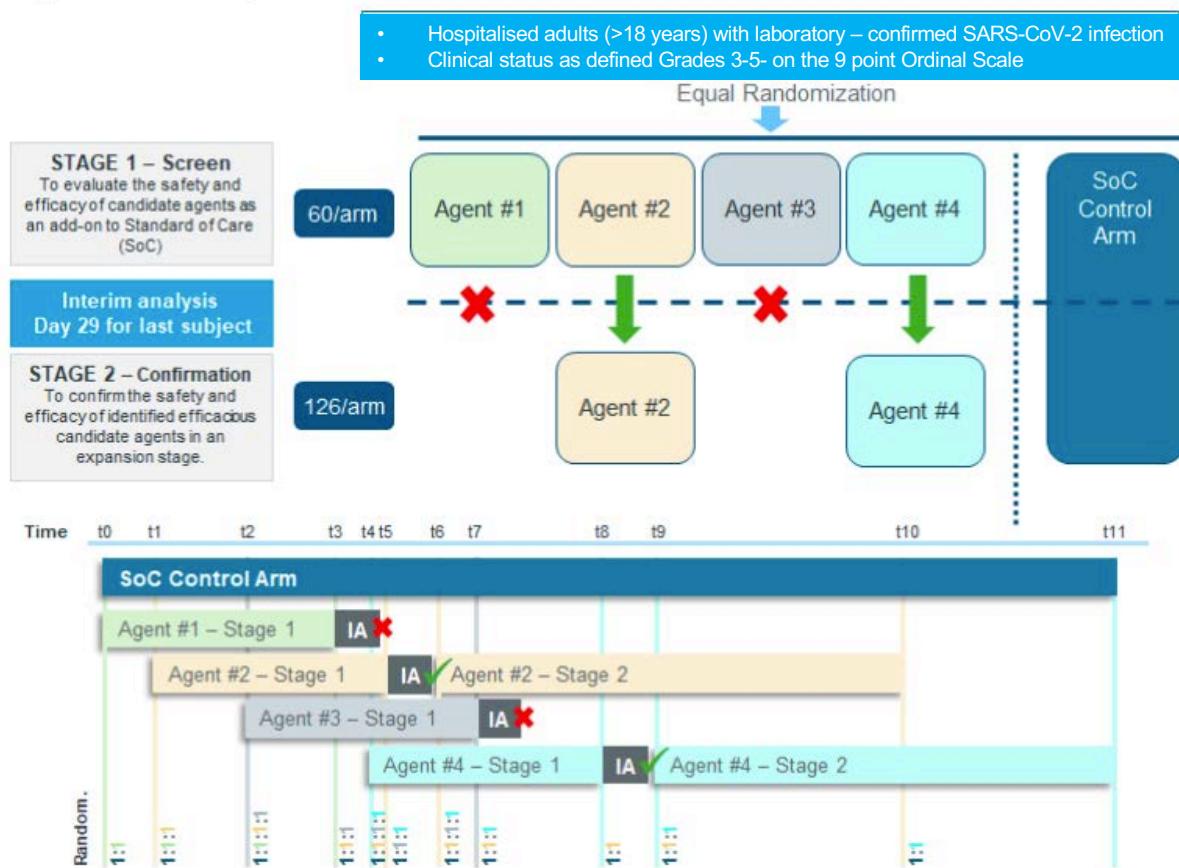
- Time to clinical improvement of at least 2 points (from randomisation) of patients stage 3, 4 or 5 on a 9-point category ordinal scale, or live discharge from the hospital, whichever comes first (this will also define the “responder” for the response rate analyses).

9-Point Category Ordinal Scale:

0. Uninfected, no clinical or virological evidence of infection
1. Ambulatory, no limitation of activities
2. Ambulatory, limitation of activities
3. Hospitalised – mild disease, no oxygen therapy
4. Hospitalised – mild disease, oxygen by mask or nasal prongs
5. Hospitalised – severe disease, noninvasive ventilation or high flow oxygen
6. Hospitalised – severe disease, intubation and mechanical ventilation
7. Hospitalised – severe disease, ventilation and additional organ support – pressors, renal replacement therapy (RRT), extracorporeal membrane oxygenation (ECMO)
8. Death

ACCORD Study overview

Figure 1 Study Schema



IA=interim analysis; SARS-CoV-2=severe acute respiratory syndrome coronavirus 2; SoC=standard of care.

Note: This figure shows a hypothetical situation, where in Stage 1 of the study there are 4 candidate agents being compared with the SoC, of which 2 candidate agents progress to Stage 2.

Study dimensions:

- 6 NHS sites across UK
- Randomized Phase II
- 120 patients (60 receive bemcentinib, 60 in SoC control group)
- IQVIA are the CRO
- Standard bemcentinib dosing
- 15 day dosing schedule
- Independent Data monitoring Committee
- Seamless transition to stage 2 (phase III)

Ref. BGBC003 / NCT02488408

Bemcentinib clinical development in Acute Myeloid Leukemia (AML) and Myelodysplastic syndromes (MDS)

Objective: to evaluate the safety and efficacy of bemcentinib in AML and MDS

Bemcentinib monotherapy in patients relapsed AML or MDS

Bembentinib in combination with low-dose cytarabine (LDAC) in 1L newly diagnosed or relapsed patients with AML

Bembentinib in combination with LDAC in 2L relapsed patients with AML



Acute Myeloid Leukaemia (AML)

Most common type of acute leukaemia in adults¹

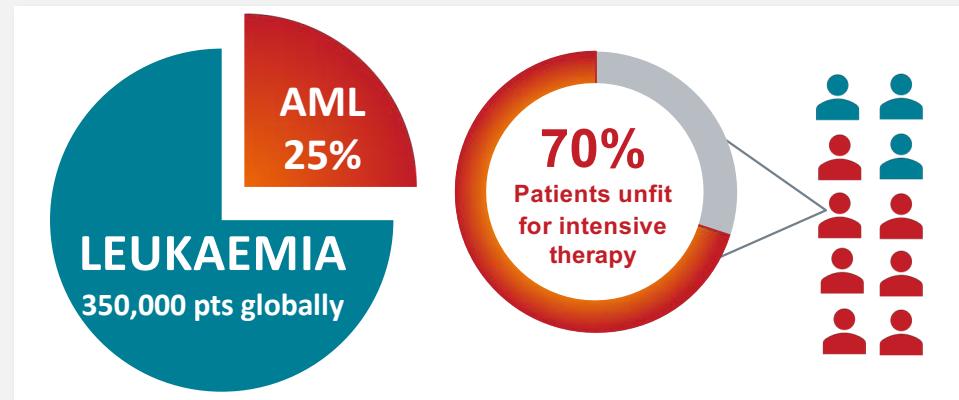
AML is a rare aggressive cancer of the blood and bone marrow characterised by difficult to treat malignancies

~ 21,000 new cases diagnosed and >11,000 deaths in the US in 2018²

AML makes up 32% of all adult leukaemia cases

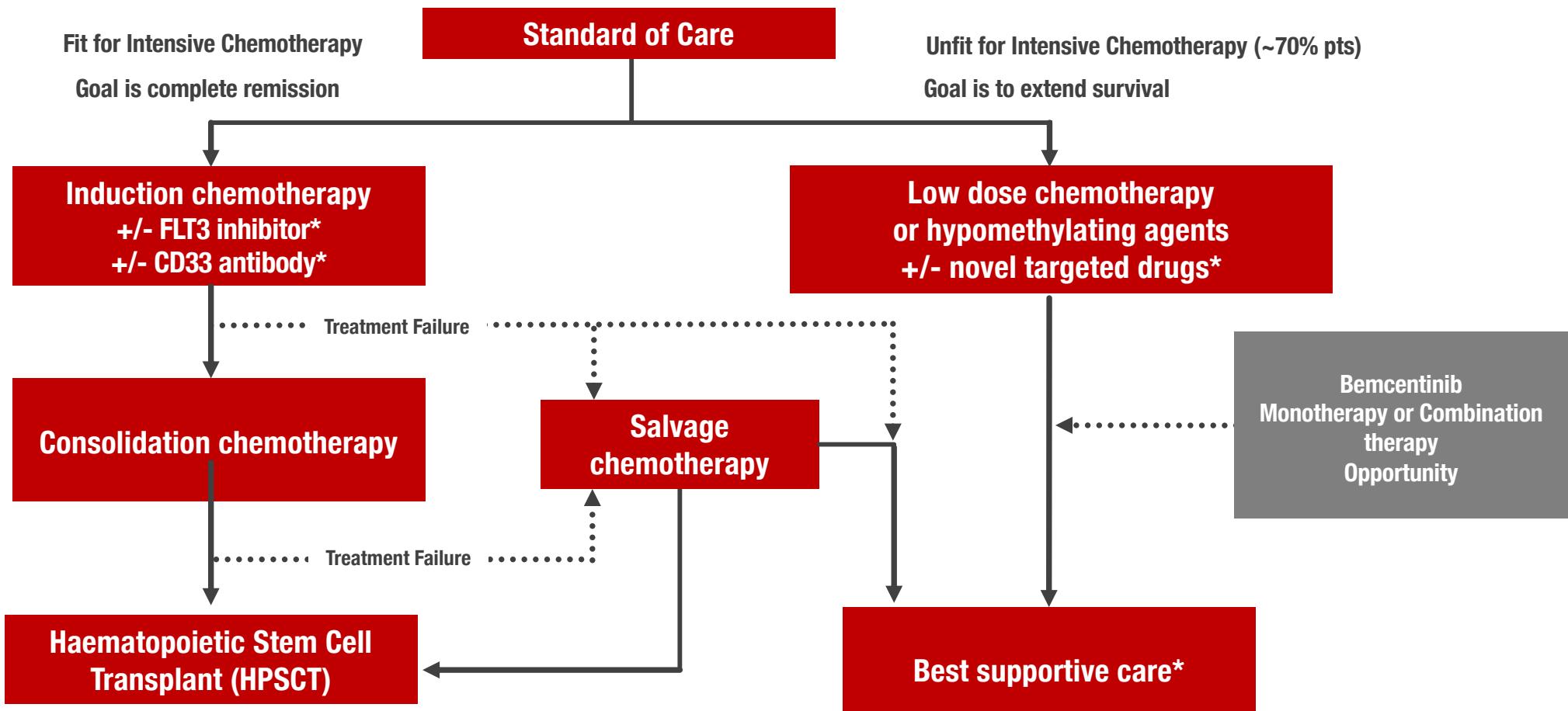
Occurs in a predominantly elderly, frail patient population; 68% of patients diagnosed with AML were aged >60 years⁶

5 year survival rates of 3-8% in patients over 60 years old⁷



(1) Cancer.gov; (2) SEER; (3) https://www.who.int/selection_medicines/committees/expert/20/applications/AML_APL.pdf?ua=1ble
(4) <https://www.cancer.net/cancer-types/leukemia-acute-myeloid-aml/statistics> (5) <https://www.businesswire.com/news/home/20190319005442/en/> (6) <http://asheducationbook.hematologylibrary.org/content/2010/1/62.long>, (7) <https://www.ncbi.nlm.nih.gov/books/NBK65996/>

Acute Myeloid Leukaemia: Standard of Care & Bemcentinib Positioning



Current Approach to AML in Elderly Patients Unfit for Intensive Chemotherapy

Newly Diagnosed AML: Choice of Low Intensity Induction Therapy:

- Hypomethylating agent (HMA) +/- venetoclax (approved in US only)
- LDAC alone or in combination with venetoclax or glasdegib (approved in US only)
- Future direction: AML with mutation of FLT3, IDH1/2

Opportunity for Bemcentinib + LDAC

1st Relapse

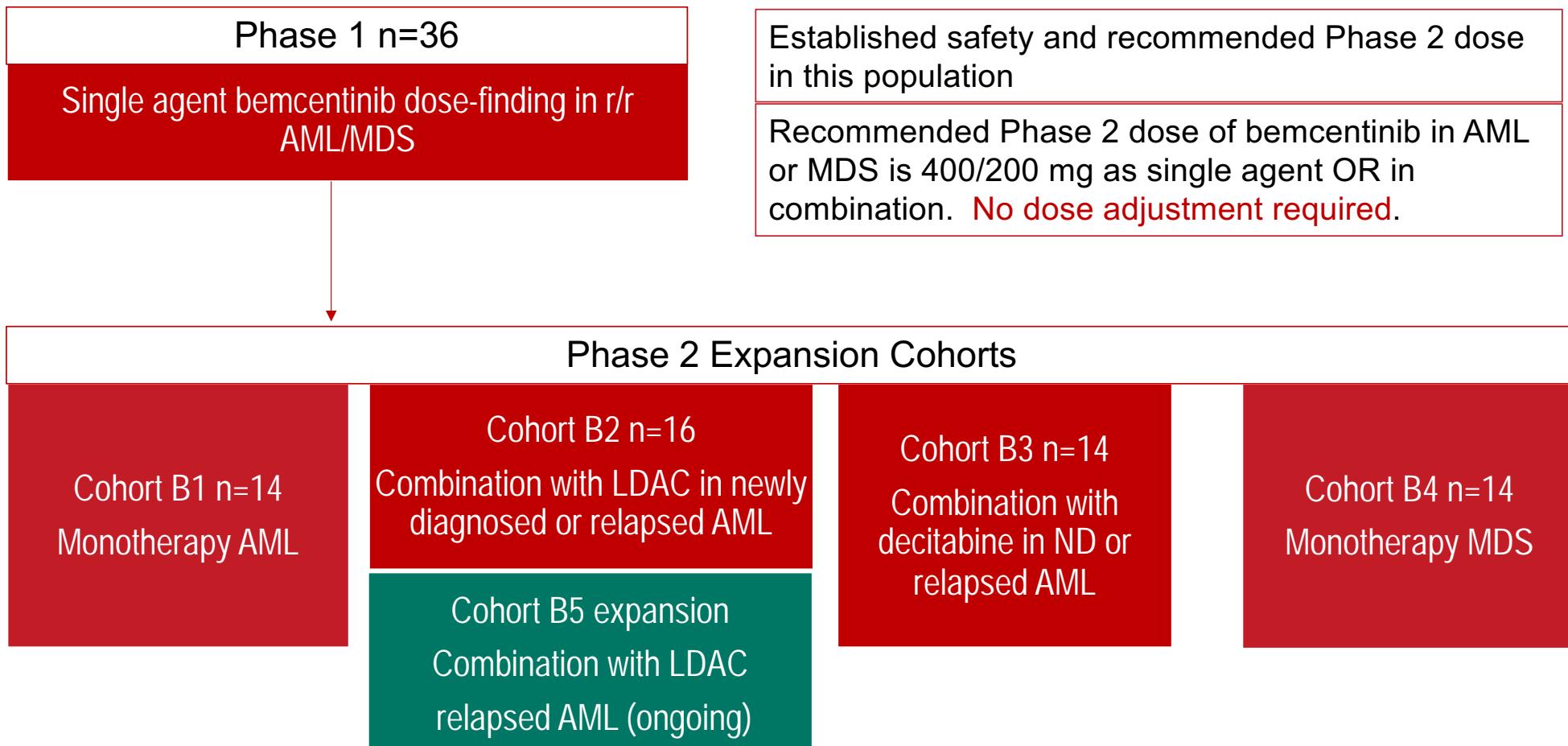
- Clinical trial
- No approved therapy, but options may include HMA, LDAC or single agent venetoclax dependent on funding
- Best supportive care (BSC) or palliative care

Opportunity for Single Agent Bemcentinib

2nd Relapse

- Clinical trial
- BSC or palliative care

Bemcentinib clinical development in Acute Myeloid Leukemia, (BGBC003)



Results Bemcentinib monotherapy in relapsed/refractory $\geq 2L$ r/r AML.

	Overall (n=27)		sAXL low (n=14)		sAXL high (n=11)	
	n	%	n	%	n	%
CR/CRI/CRp	6	22%	6	43%	0	0%
SD	8	30%	3	21%	5	45%
PD*	13	48%	5	36%	6	55%
ORR	6	22%	6	43%	0	0%

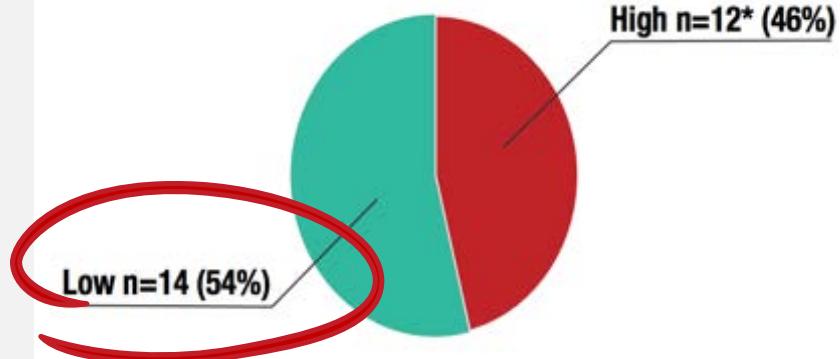
* 2 evaluable patients were not evaluable for sAXL status

* Monotherapy responses. One additional response was reported in combination with decitabine for a total of 7 responses in phase I/II.

* 1 CR, 4 CRI, 1 CRp

* PD includes patients who progressed or came off study before having completed 3 cycles of treatment.

Biomarker: Soluble AXL (sAXL) at screen:
Inversely correlated with AXL receptor activity



$\geq 2L$ Relapse patients >75yrs
No approved SoC
Bemcentinib Monotherapy

AXL +ve* patients

14/27

54%

Stable Disease

3/14

21%

CR/Cri/CRp

6/14

43%

mDOR **3.1mo. (5.5* mo.)**

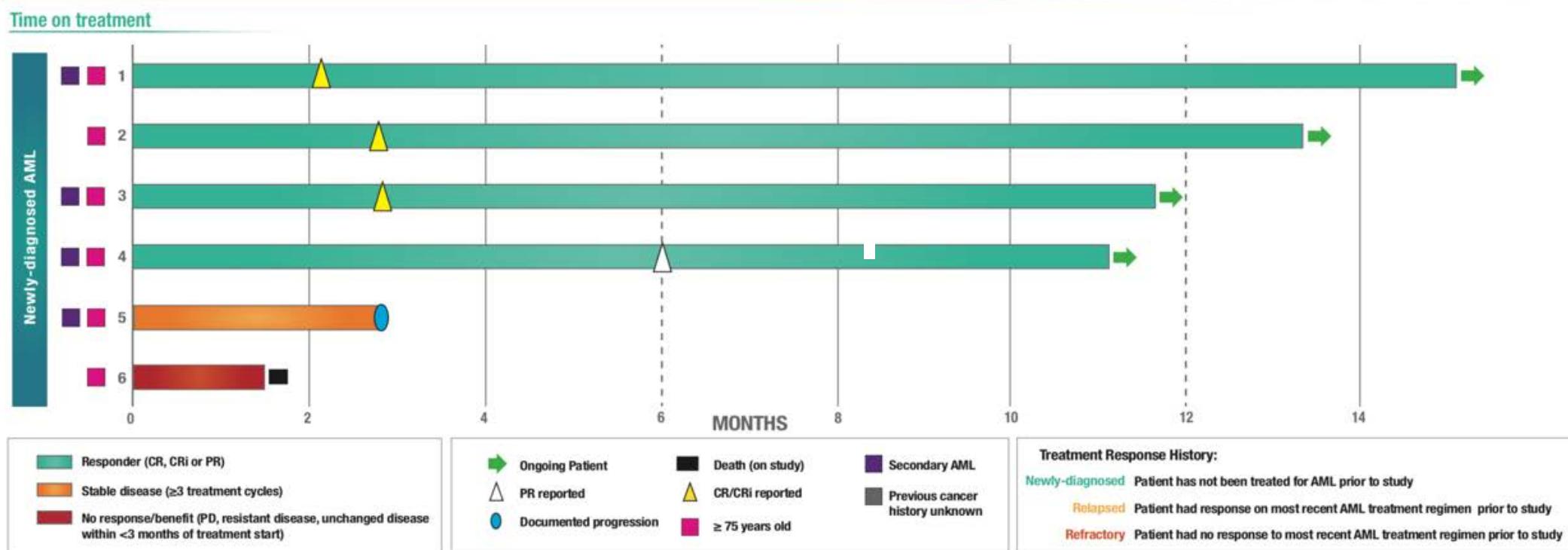
Safety profile was well tolerated

* including 2 patients with low dose decitabine, one remains in CR after 20 months

Bemcentinib + LDAC combination is active and effective in 1L newly diagnoses unfit/elderly AML patients

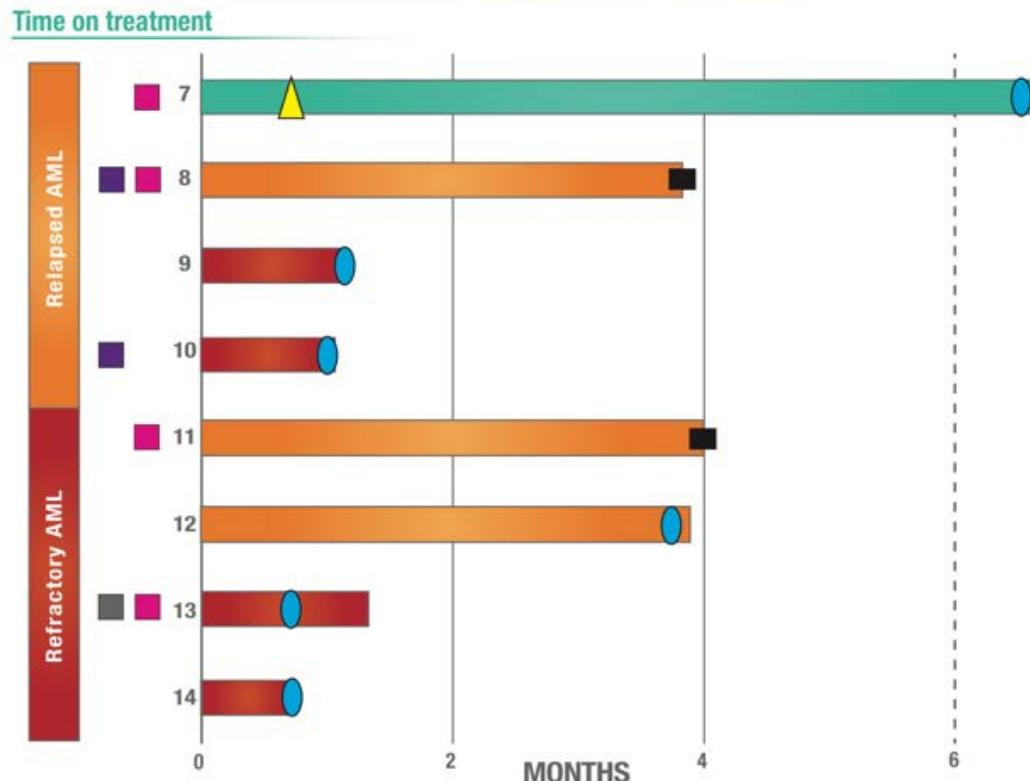
- 4/6 patients with ORR
- mDoR immature >12months and all 4 responding patients ongoing
- Responding patients have poor risk factors

Clinical Activity in Newly-Diagnosed Patients

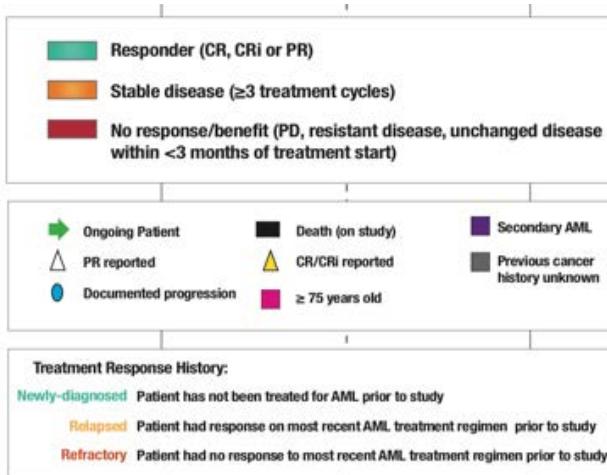


Bemcentinib + LDAC in r/r AML patients

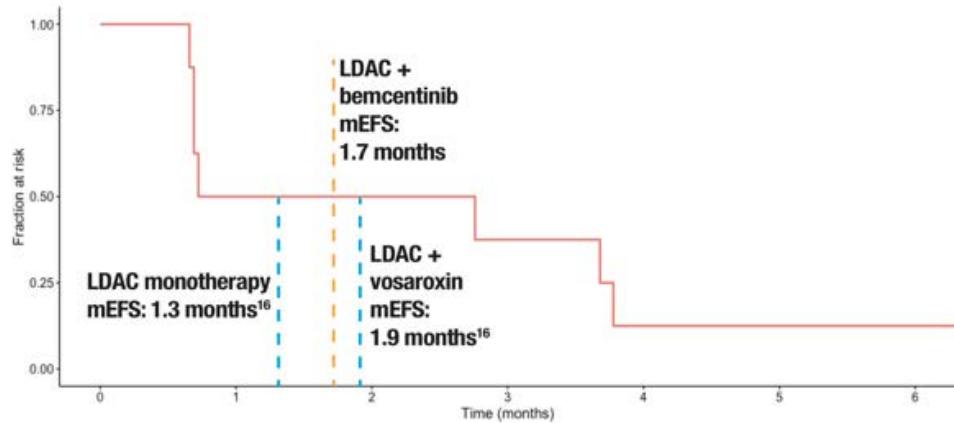
Clinical Activity in Relapsed/Refractory Patients



2L r/r AML LDAC combo expansion cohort 28pts ongoing



Event-free Survival (Relapsed/Refractory Patients)



Registration strategies for bemcentinib in AML under consideration

Bemcentinib has FAST TRACK DESIGNATION by FDA in AML.

3 possible registration paths are apparent, in slightly different patient populations

Scientific advice will be sort early 2020, route to registration to be discussed

1. 2L Bemcentinib + LDAC combination

- relapse patients >60 years, patients having failed HMA or HMA+Venetoclax
- rPh II / III, to receive bem+LDAC or LDAC alone
- End points: ORR and DoR
- Anticipated sample size 200 with 6 month f/u

2. ≥2L bemcentinib mono therapy

- Heavily pre-treated, ≥2L relapse patients >75yrs, with low sAXL
- sAXL assay is a CLSI validate Clinical Trial Assay method performed at a CLIA lab.
- Possible single arm or comparator being best supportive care (BSC) or palliative care
- End points: ORR and DoR
- Anticipated sample size 100 with 6 month f/u

3. 1L Bemcentinib + LDAC combination

- 1L patients >60 yrs, unsuitable for HMA+Venetoclax
- rPh II / III
- End points: ORR and DoR/OS
- Anticipated sample size 200 with 12 month f/u

Ref. BGBC008 / NCT03184571

Bemcentinib clinical development in Non Small Cell Lung Cancer (NSCLC)

Objective: to improve the effectiveness of immune check point inhibitor (CPI) (pembrolizumab/Keytruda) refractory NSCLC patients, with a well tolerated, effective, and convenient drug

Chemotherapy refractory patients

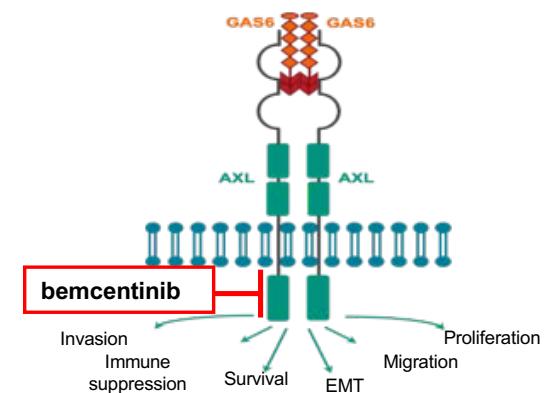
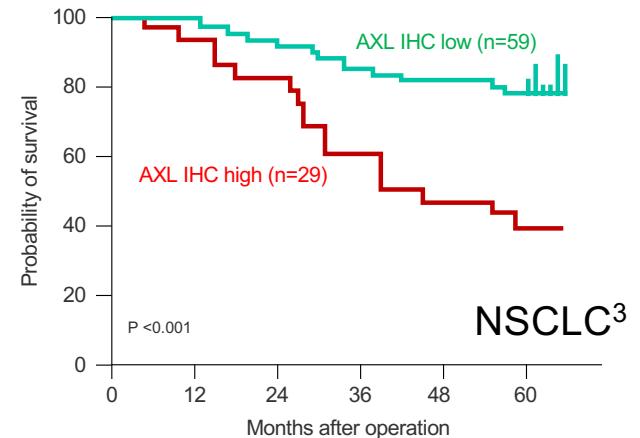
CPI +/- chemotherapy refractory patients

CPI+Chemotherapy refractory patients



Rationale for AXL inhibitor bemcentinib as an immuno-oncology agent in combination with check point inhibitor (CPI)

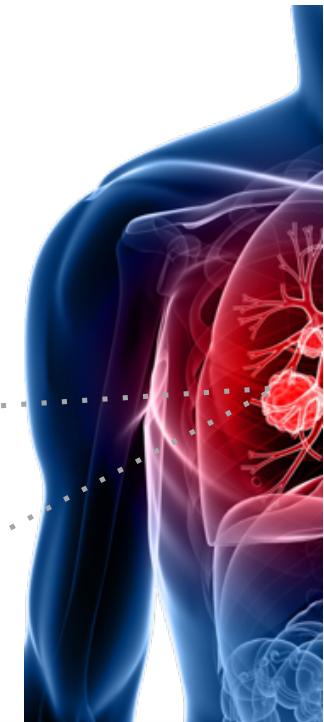
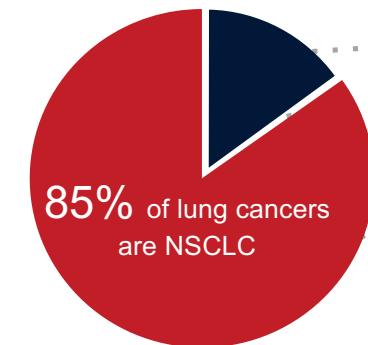
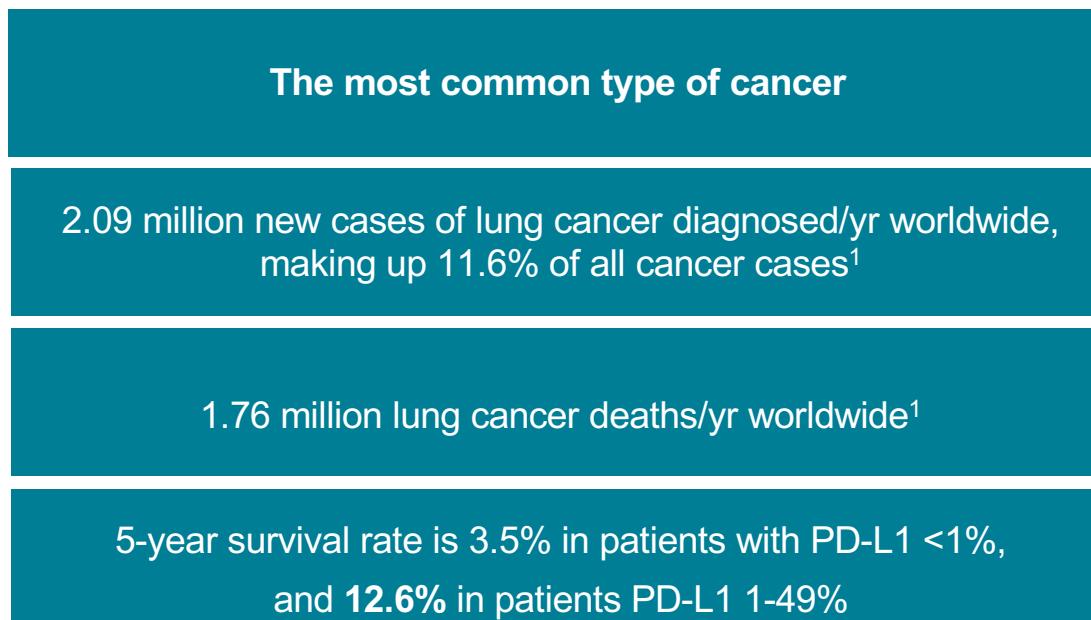
- AXL drives tumor EMT and resistance to cytotoxic lymphocyte-mediated cell killing¹
- AXL receptor tyrosine kinase is a negative prognostic factor for many cancers including NSCLC²
- AXL expression is associated with anti-PD-1 therapy failure in melanoma patients³
- AXL is expressed by suppressive tumor-associated M2 macrophages and dendritic cells⁴
- Bemcentinib is a first-in-class highly selective, potent, and orally bioavailable, small molecule AXL kinase inhibitor
- Bemcentinib reverses EMT, repolarizes TAMs and potentiates efficacy of immunotherapy in murine cancer models⁴



31 ¹Terry, 2019; ²Hugo, 2016; ³Ishikawa, 2012, Davidsen, 2017; ⁴Ludwig, 2018, Davidsen, submitted

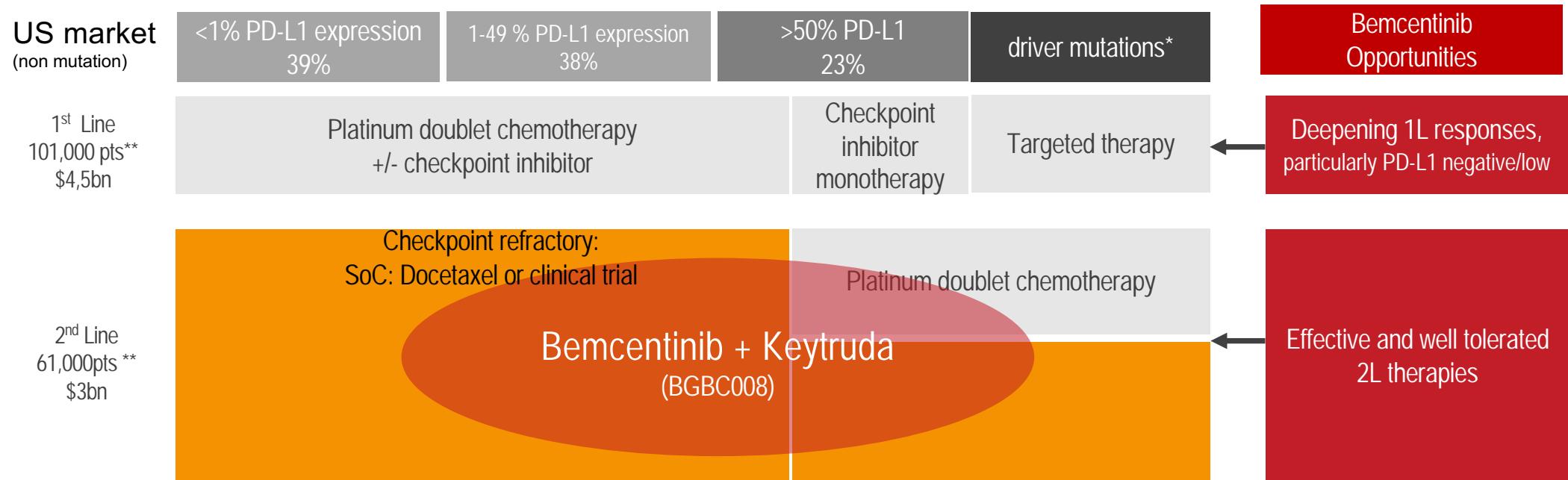
NSCLC causes more cancer related deaths than breast, colon, pancreas and prostate combined

The largest cancer killer, most patients depend on drug therapy



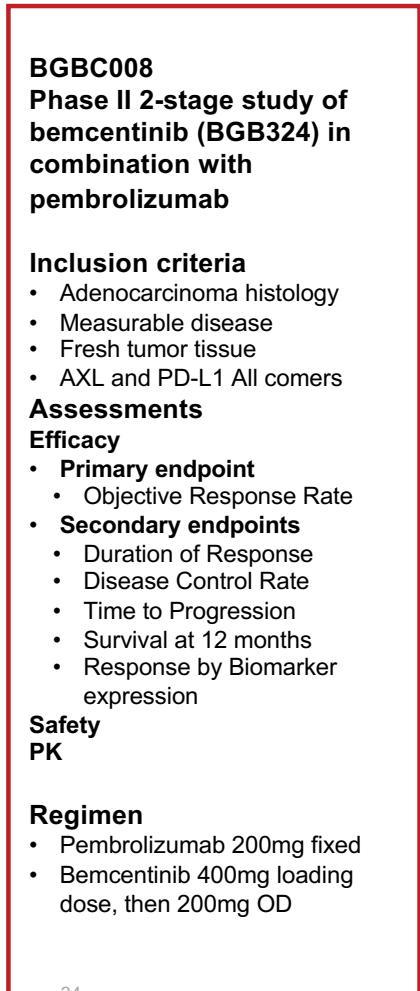
Non-Small Cell Lung Cancer (NSCLC)

Rapidly evolving SoC creates opportunities for novel effective, chemo free well tolerated regimens



Bemcentinib + KEYTRUDA in refractory/relapsed NSCLC

Phase II Study Design



Cohort A

- Previously treated with a platinum containing chemotherapy
- 2nd line advanced adeno NSCLC

Cohort B

- Previously treated with a checkpoint inhibitor (PD-L1 or PD-1 inhibitor)
- No more than 2 previous lines of treatment
- Must have had disease control for ≥12 weeks followed by progression
- 2nd or 3rd line advanced adeno NSCLC

Cohort C

- Previously treated 1st line with a checkpoint inhibitor- containing regimen in combination with a platinum-containing chemotherapy
- Disease control on 1st line therapy for ≥12 weeks followed by progression
- 2nd line advanced adeno NSCLC

COMPLETED: INFORMS 1L OPPORTUNITY

Interim Analysis



Stage 1

N=24 patients
(each patient has the potential for at least 24 weeks follow-up)

Stop at this stage for:
Futility (H0:15% if ≤3 responses)
Or unfavorable risk/benefit

Final Analysis



Stage 2

N=50 patients total
(each patient has the potential for at least 24 weeks follow-up)

Interim Analysis



Stage 1

N=13 patients/cohort
(each patient has the potential for at least 24 weeks follow-up)

Stop at this stage for:
Futility (H0:15% if 0 responses)
Or unfavorable risk/benefit

Final Analysis



Stage 2

N=29 patients/cohort
(each patient has the potential for at least 24 weeks follow-up)

Interim Analysis



Stage 1

N=13 patients/cohort
(each patient has the potential for at least 24 weeks follow-up)

Stop at this stage for:
Futility (H0:15% if 0 responses)
Or unfavorable risk/benefit

Final Analysis



Stage 2

N=29 patients/cohort
(each patient has the potential for at least 24 weeks follow-up)

ONGOING WILL INFORM 2L PIVOTAL STUDY

Cohort A Patient Disposition and Demographics*

Patient disposition	N
Screened	74
Enrolled	50
Evaluable	44
Ongoing	9

Patient demographics		N (%)
Age	Median	65
	Range	39-82
ECOG at screen	0	22 (44%)
	1	28 (56%)
Sex	Female	20 (40%)
Smoking Status	Smoker	10 (20%)
	Ex-smoker	29 (58%)
	Never smoked	10 (20%)
	Unknown	1 (2%)

Disease mutations	N (=50)
None	36 (72)
KRAS	7 (14)
TP53	2 (4)
EGFR	3 (6)
Other	4 (8)

Safety Summary

The safety profile of combination treatment is consistent with that of each individual drug

Treatment related adverse events were generally mild and reversible

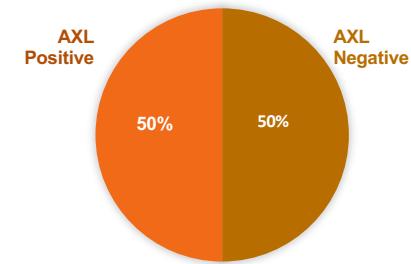
Treatment related adverse events were considered to be less severe and better tolerated than for other TKIs or CPI combinations used in NSCLC

Most frequent TRAEs ($\geq 10\%$ dosed pts)

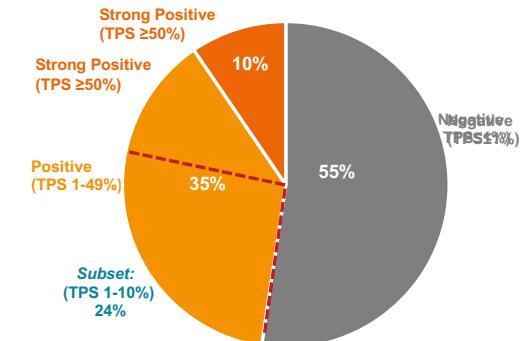
Event Terms	All Grades		Grade ≥ 3	
	n	%	n	%
Transaminase increased*	19	38 %	7	14%
Asthenia / Fatigue	15	30 %	4	8%
Diarrhoea	12	24 %	0	0%
Nausea	7	14 %	0	0%
Anaemia	6	12 %	1	2%
Blood creatinine increased	6	12 %	0	0%
Decreased appetite	6	12 %	0	0%
Pruritus	5	10 %	0	0%

Biomarker

cAXL status	n = 30
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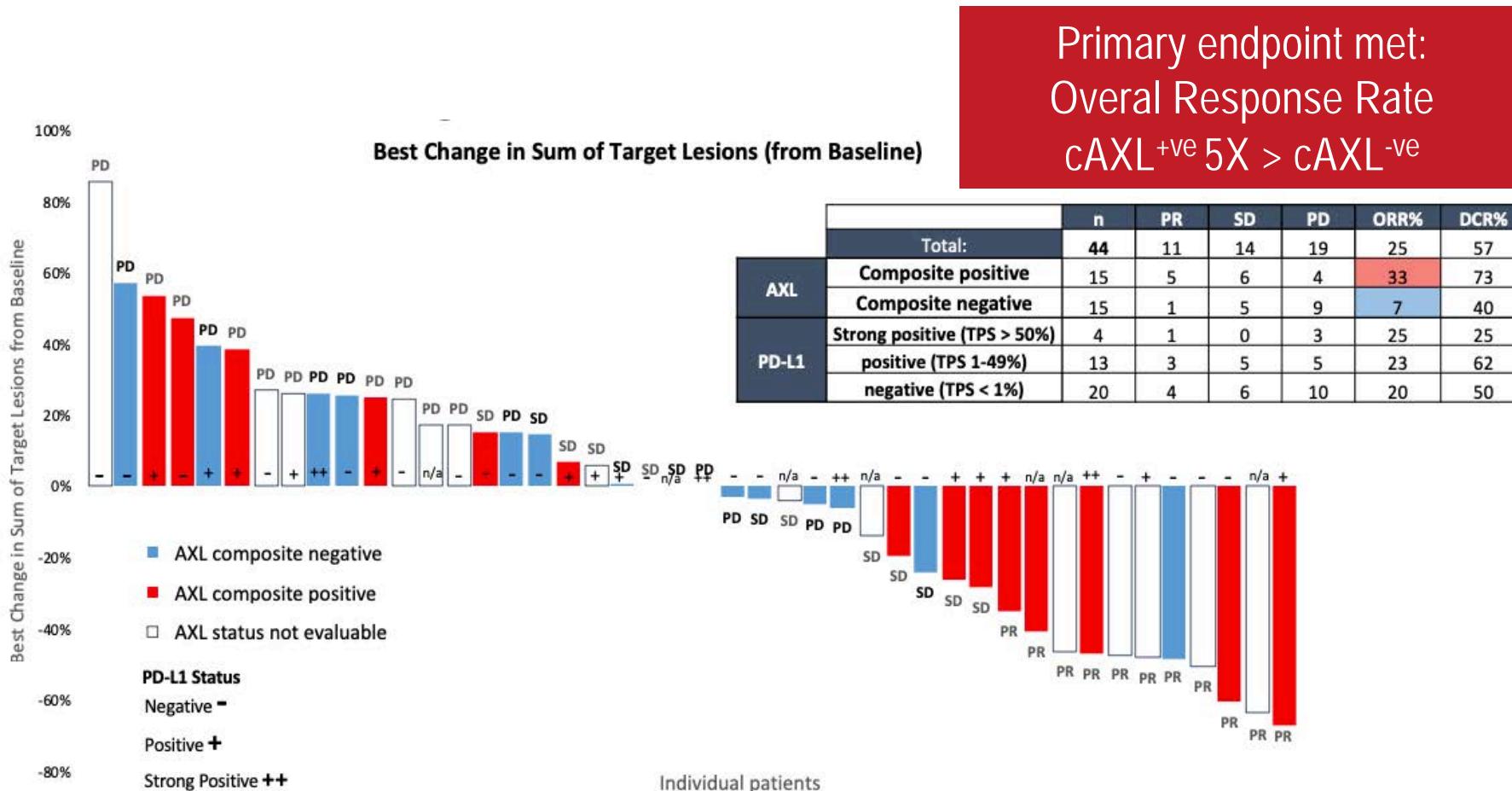
PD-L1 status	n = 37
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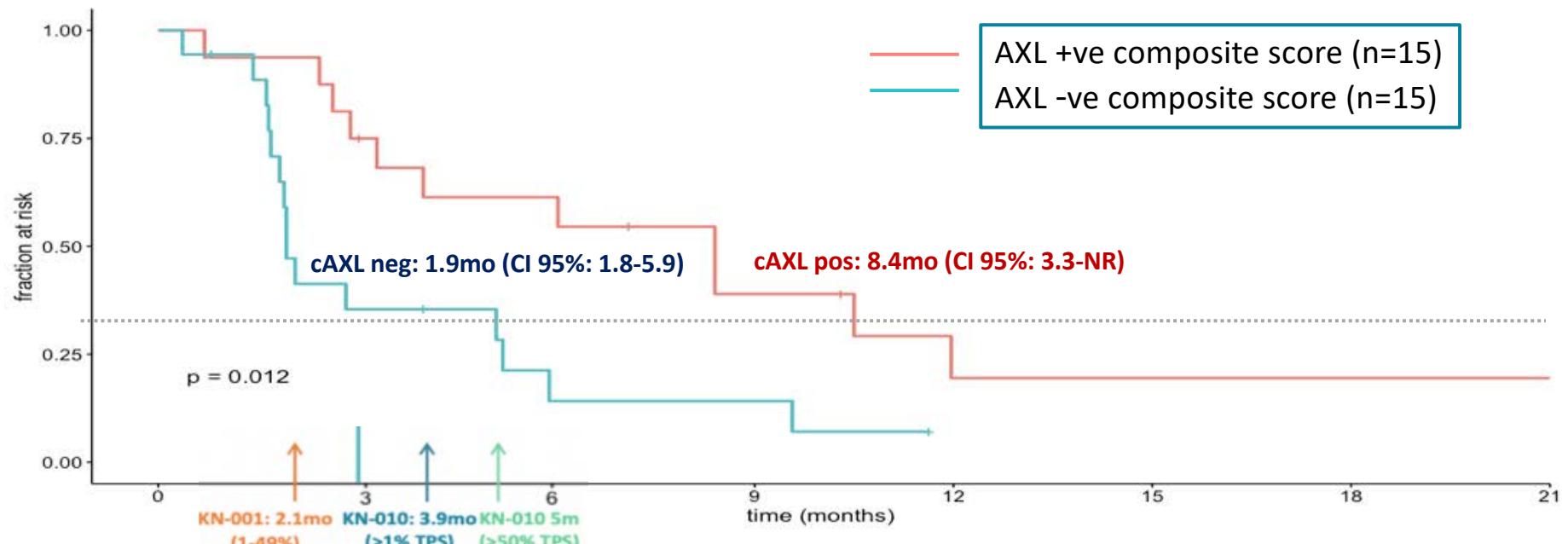
*Data cutoff (30 Sep 2019)

Cohort A: Anti-tumor activity of bemcentinib in combination with pembrolizumab

Change in tumour size from baseline by RECIST 1.1



Cohort A: >4 X improvement in mPFS* in composite AXL positive patients

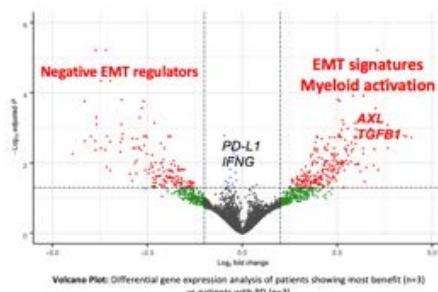


- ✓ 4-fold improvement in cAXL +ve vs. cAXL -ve patients.
- ✓ 4-fold improvement in what might be expected in the same patient population with Keytruda monotherapy

BerGenBio's proprietary novel gene signature predicts patients that benefit from bemcentinib - pembrolizumab combination therapy

SITC 2019: BerGenBio & Merck independently published related gene signatures that predict response or resistance to pembrolizumab

Novel gene signature predicts patients that benefit from bemcentinib-pembrolizumab combination therapy

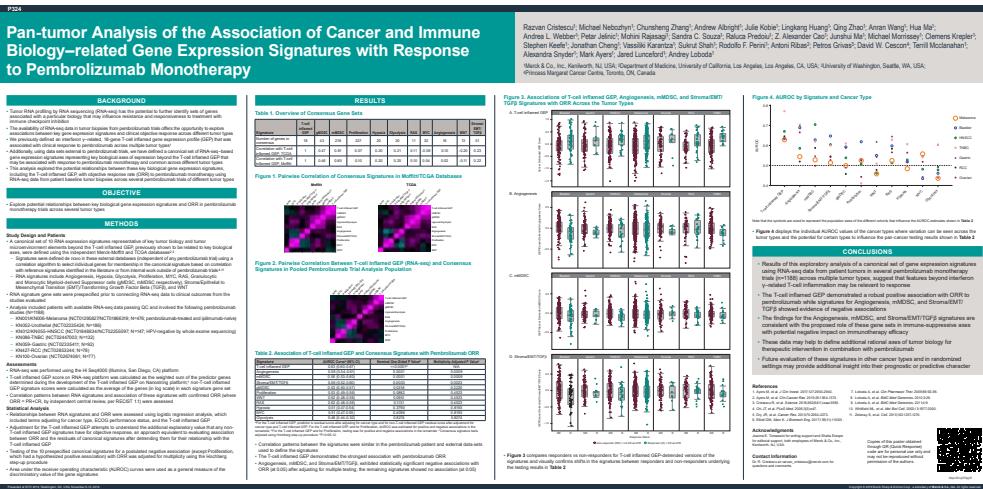


- Responding patient gene expression matches signatures that predict poor outcome, lack of response to pembrolizumab, and are enriched for EMT and myeloid activation
- PD-L1 and IFNy expression do not predict response
- AXL expression in tumor and immune cells (composite score) is associated with response to combination treatment

34th Annual Meeting & Pre-Conference Programs



#SITC2019



Merck reported a gene signature from patients that did not respond to Keytruda monotherapy in many cancers, this was similar to the BerGenBio gene signature EXCEPT these patients did respond to Keytruda + bemcentinib

Cohort B: Bemcentinib + KEYTRUDA in CPI refractory patients

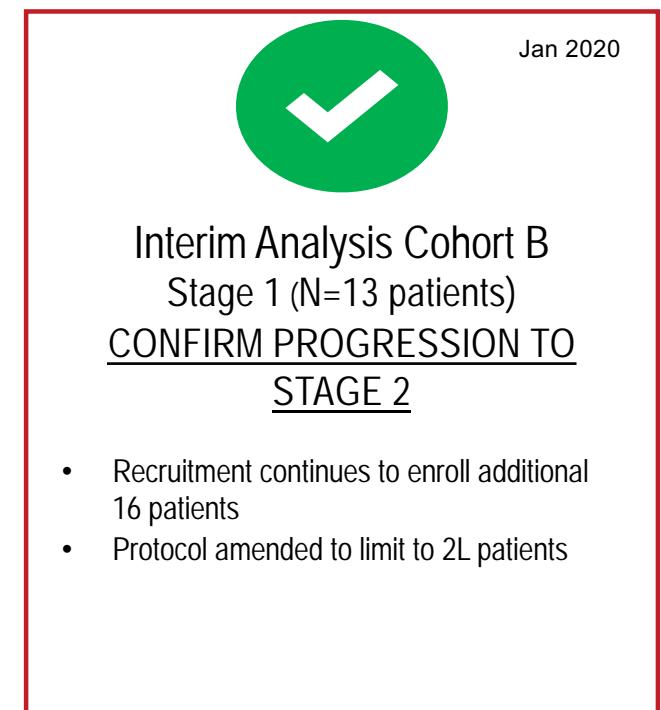
CHECK POINT INHIBITOR REFRACTORY PATIENTS: precise and specific definition

Patients must have reported an initial clinical benefit (CR, PR or SD) for at least 12 weeks and subsequently progressed on treatment with an anti-PD1/L1 monoclonal antibody (mAb) administered either as monotherapy, or in combination with other checkpoint inhibitors or other therapies. PD-1 treatment progression is defined by meeting all of the following criteria:

- a) Has received at least 2 doses of an approved anti-PD-1/L1 mAb.
- b) Has demonstrated disease progression after PD-1/L1 as defined by RECIST v1.1. The initial evidence of disease progression (PD) is to be confirmed by a second assessment no less than four weeks from the date of the first documented PD, in the absence of rapid clinical progression.
- c) Progressive disease has been documented within 12 weeks from the last dose of anti-PD-1/L1 mAb. Seymour et al; iRECIST: Guidelines for response criteria for use in trials testing immunotherapeutics. Lancet Oncol 18: e143-52

This determination is made by the investigator. Once PD is confirmed, the initial date of PD documentation will be considered the date of disease progression.

- a) Other therapies not to be administered between last dose of anti PD-1/L1 mAb and commence of clinical trial agent

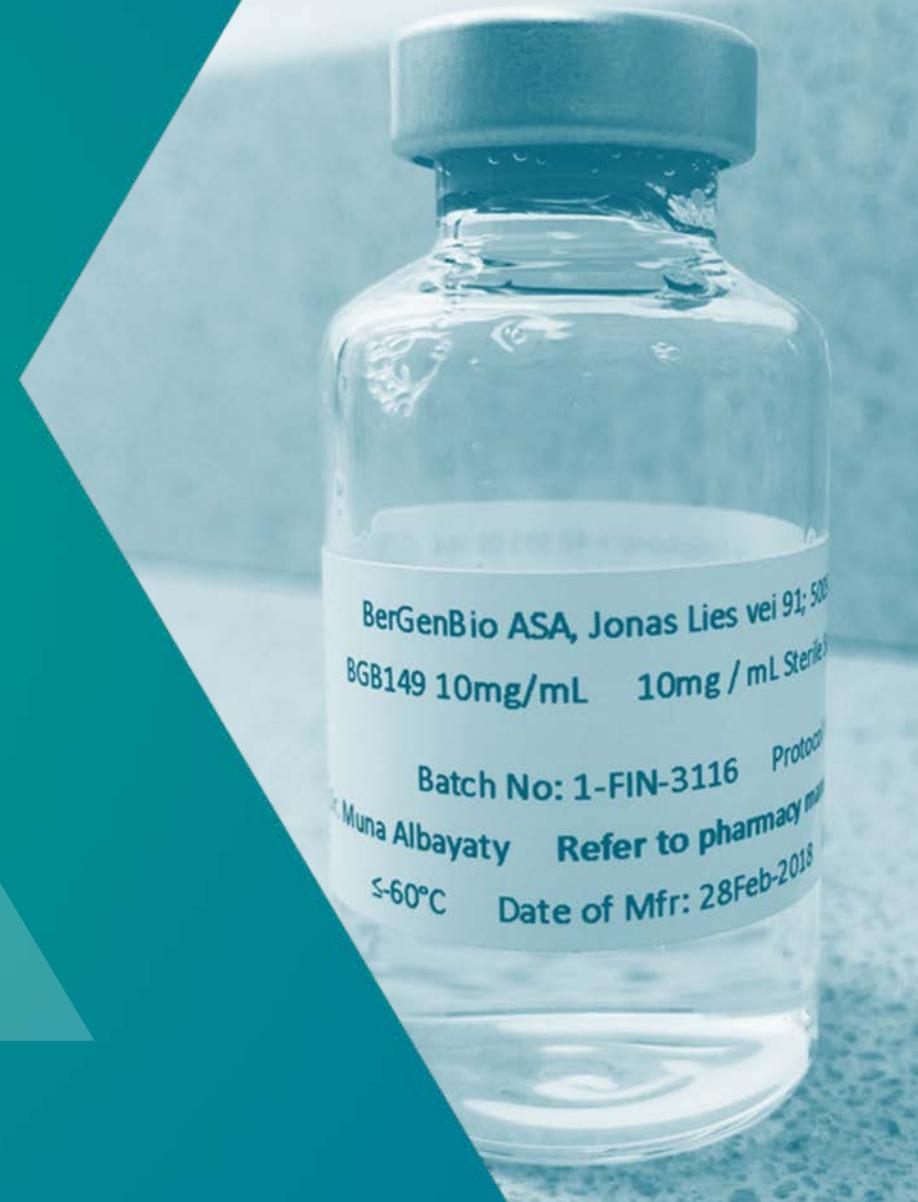


Development strategy for Bemcentinib in NSCLC (ad. & Sc.)

Clinical Position	Patient Population	Concept	Development Plan – target conditional approval / BT
2L IO(+chemo) refractory	Stage III/IV Ad. PD-L1 all comers cAXL +ve.	Randomised Phase IIb / III Bemcentinib + CPI vs. docetaxol 1 ^o endpoints: Interim mPFS, (for C/A A) 6 & 12mn OS, OS (for full approval) 2 ^o endpoints: ORR, DoR, Safety, tolerability.	<ol style="list-style-type: none"> 1. Pending BGBC008 cohort B + C 2. SA advice from FDA & EMA 3. cAXL assay validation in BGBC008 B&C
1L		TBA	



BGB149 anti-AXL monoclonal antibody



BGB149: Anti-AXL monoclonal antibody

Phase I clinical trial ongoing



Functional blocking fully-humanised IgG1 monoclonal antibody

Binds human AXL, blocks AXL signalling

High affinity (KD: 500pM), Anti-tumour efficacy demonstrated *in vivo*

Robust manufacturing process established, 18 months stability

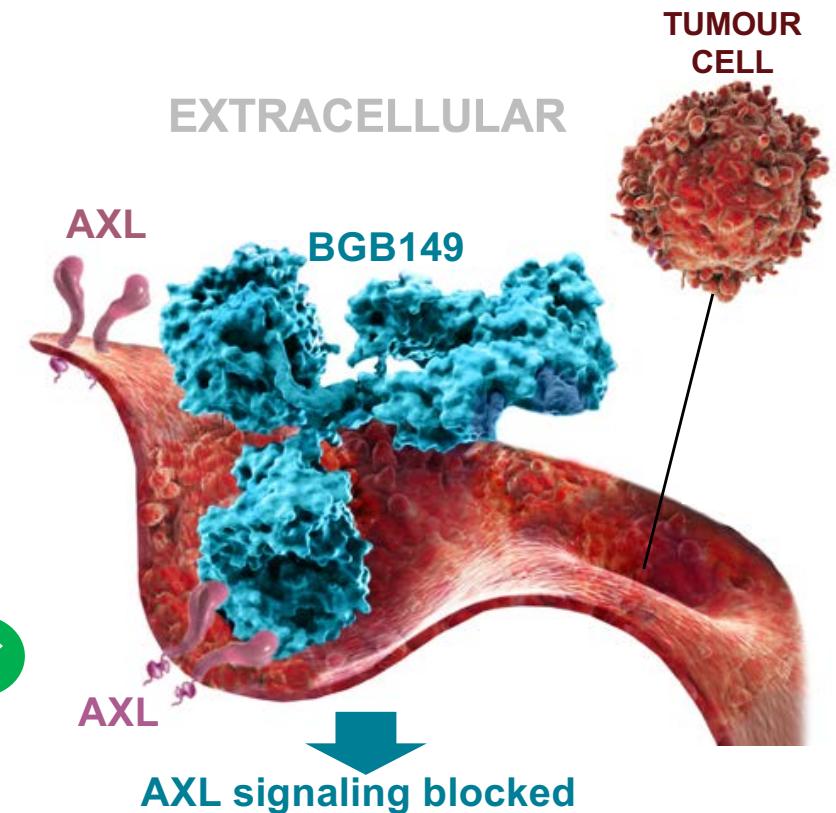
Phase Ia healthy volunteer SAD study complete

Safety – no dose limiting toxicity seen up to 3mg/kg dose

Pharmacokinetics - exposure predictable with dose proportional Cmax increase

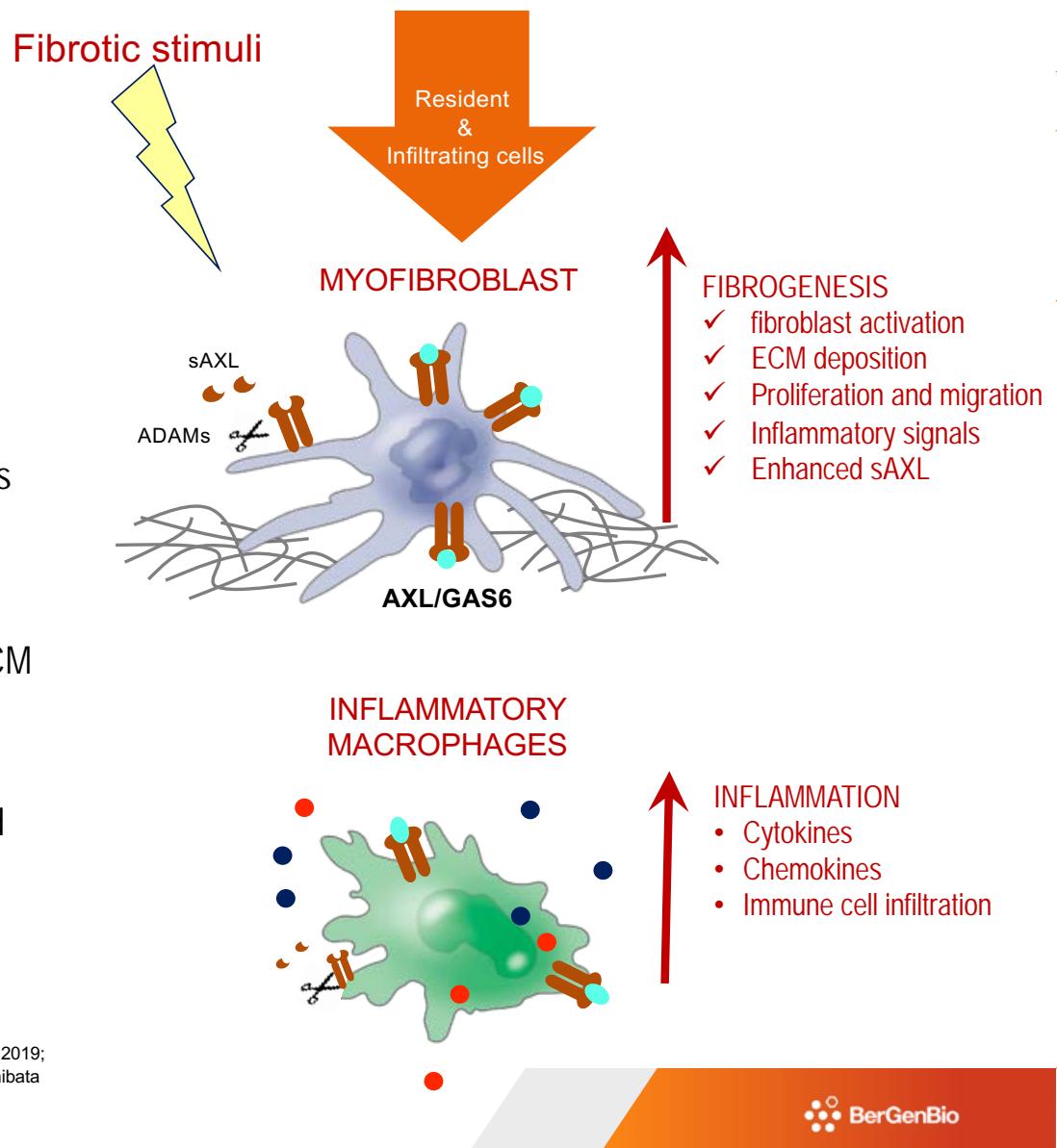
Confirmatory evidence of *in vivo* target engagement with sAXL -- stabilisation in circulation

Phase I safety trial ongoing



The role of AXL in fibrosis

- AXL Regulates and modulates key fibrogenic pathways
 - TGFb signaling^{1,2}
 - Mechanosensing Hippo pathway³
 - Peroxisome proliferator-activated receptor⁴
- Axl regulates cellular plasticity implicated in fibrotic pathologies e.g. EMT, EndMT, Macrophage polarity
- AXL is a negative regulator of epithelial cell barrier integrity⁵
- Axl is required for hepatic stellate cell (HSC) activation and ECM deposition⁶
- Pharmacological modulation of Axl inhibits pre-clinical development of Liver (CCl4₆/HighFatDiet₇), Renal (UUO₈) and Pulmonary (Asthma⁹, Bleo¹⁰, IPF¹⁰) fibrosis

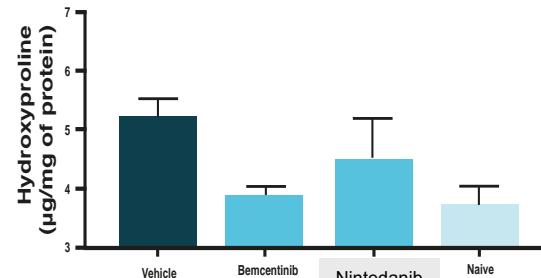


1 Gilbane ART 2015; 2 Reichl Hep. 2015; 3 Gibault ChemMed 2017; 4 Zhu AJTR 2016; Fujino Lab invest 2017, J Exp Med 2019; 6 Barcena J. Hep 2015; 7 Tutzus A. Cell Mol Gastroenterol 2019 Hepatol. 2019; 8 Landolt L. Physiol Reports 2019; 9 Shibata J Immunology 2014; 10 BerGenBio ASA, unpublished; 11 Espindola MS. Am J Respir Crit Care Med 2018

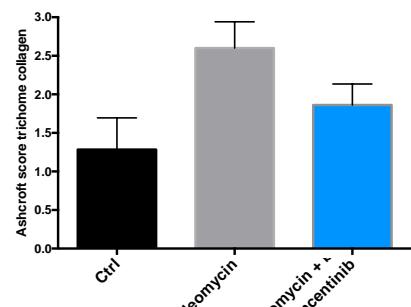
AXL inhibition prevents fibrosis in a panel of pre-clincial models

Lung

Bemcentinib reduces fibrosis in a human xenograft model of IPF ¹

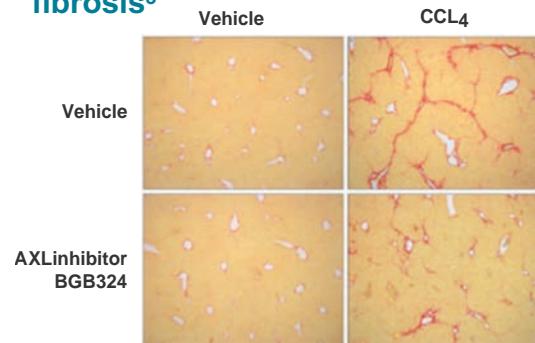


Bemcentinib reduces bleomycin induced fibrosis²

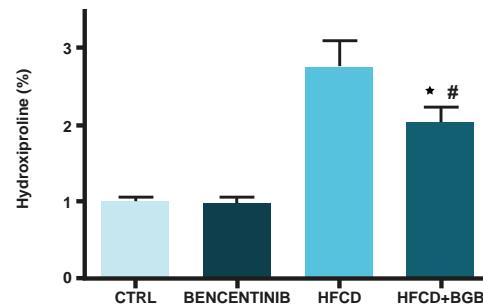


Liver

Bemcentinib reduces fibrosis in the CCL₄-induced model of liver fibrosis³

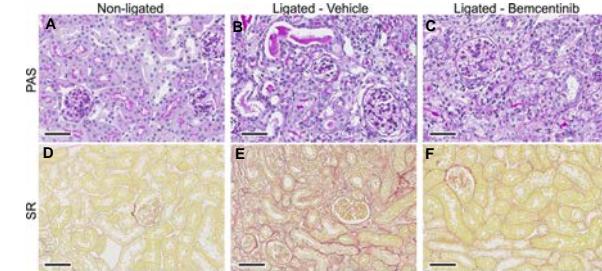


Bemcentinib reduces fibrosis in a diet induced model of NASH⁴

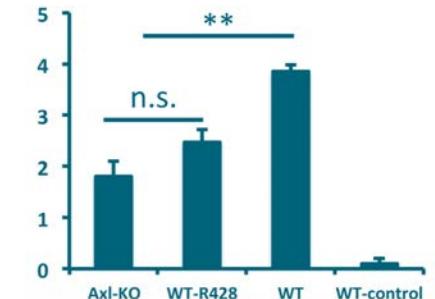


Kidney

Bemcentinib reduces kidney fibrosis following Unilateral Ureteral Obstruction (UUO)⁵

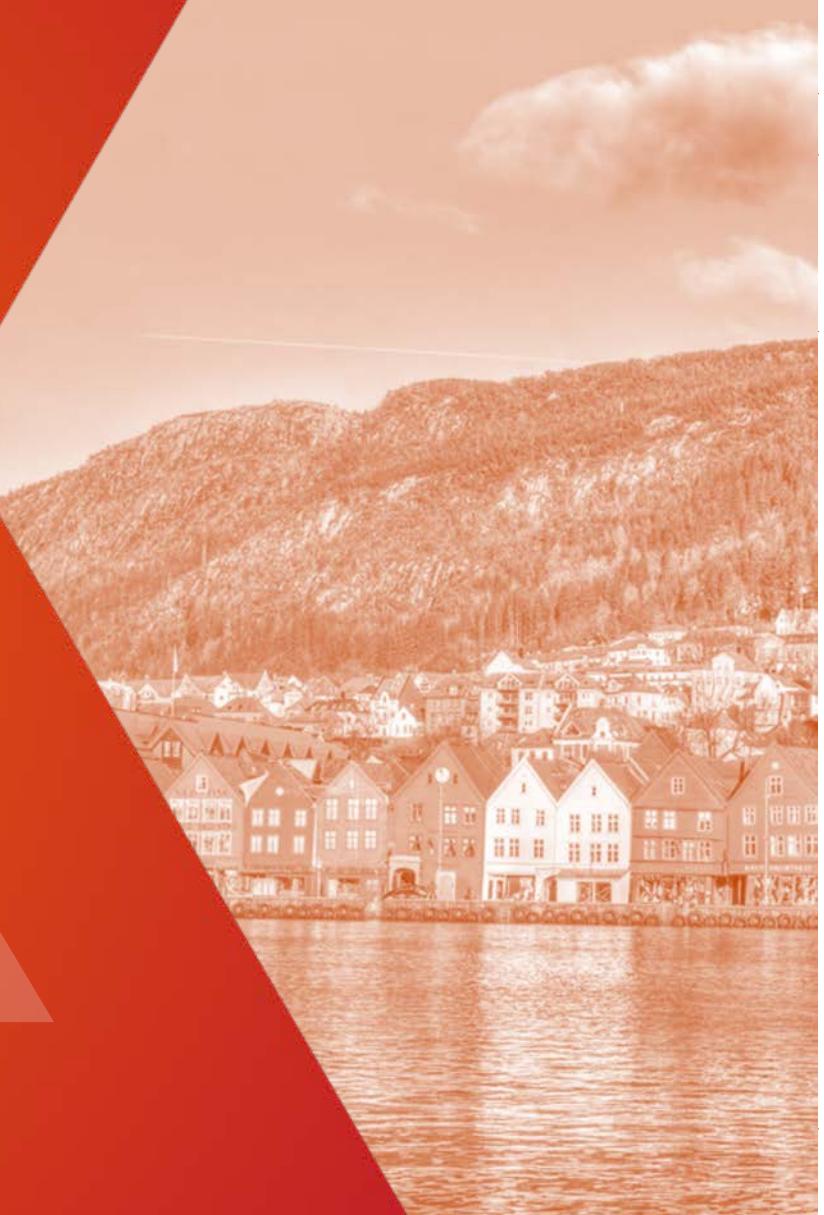


Bemcentinib ameliorates anti-GBM induced lupus like nephritis and improved kidney function⁶



¹ Espindola et al., 2018; ² BerGenBio ASA; ³ Barcena et al., 2015; ⁴ Tutsaus et al., unpublished; ⁵ Landolt et al., 2019 ⁶ Zhen et al., 2018

Corporate



BerGenBio pipeline – near term news flow

Candidate	Targeted Indication	Discovery	Preclinical	Phase I	Phase II	Next expected news
Bemcentinib	>2L AML	► Ph II safety and POC efficacy demonstrated in 39 patient trial				
Bemcentinib (combination with LDAC)	2L AML	► Ph Ib Safety demonstrated, efficacy POC expansion study- 28 pts.				ASH 2020 Update clinical & translational data
 Bemcentinib (combination with Keytruda)	2L NSCLC (chemo refractory)	► Ph II POC efficacy demonstrated in 50 patient trial, end points met				SITC 2020 Updated mOS
	2L NSCLC (CPI refractory)	► Ph II POC study ongoing 29 pts – stage 1 met end point				SITC 2020 Stage 1 interim clinical and translational data
	2L NSCLC (CPI+chemo refractory)	► Ph II POC study ongoing 29 pts				SITC 2020 Stage 1 interim clinical and translational data / WCLCL 2021
 Bemcentinib	COVID19	► Ph II Efficacy & Safety study ongoing 120 pts				Q2/3 2020 Top line clinical data
Tilvestamab (BGB149)	TBA	► Ph I Healthy volunteer study ongoing				Q4 2020 Top line clinical data
 BGB601	Various solid tumors	► Ph I safety study Terminated (change in clinical plan and drug supply)				Update by collaborators

Select Company Financials

Oslo Børs

BGBIO

Cash (YE'19 + Q1'20 - PIPE)

\$45m

Shares Outstanding

73,3m

Board of Directors



Sveinung Hole, Chairman of the board

- Non-Executive director of BerGenBio since 2010, chairman from 2019.
- Master of International Management.
- Representative of lead shareholder.



Prof. Stener Kvinnslund, MD, PhD Non-Executive Director

- Non-Executive director of BerGenBio since 2015
- More than 30 years of experience in oncology, Chair Oslo University Hospital, CEO of the Bergen Hospital Trust, Head of the Department of Oncology and Professor of Medicine (Oncology) at the University of Bergen and Director Clinical R&D, Oncology for Pharmacia & Upjohn in Milan.



Dr. Debra Barker MD, Non-Executive Director

- Non-Executive director of BerGenBio since 2019.
- Diploma in Pharmaceutical Medicine and MSc in immunology.
- Executive experience with Novartis, Roche, Smithkline Beecham and Knoll and served until recently as the Chief Medical and Development Officer at Polyphor Ltd.



Grunde Eriksen, Non-Executive Director

- Non-Executive director of BerGenBio since 2019.
- Experienced capital markets advisor and investor.
- 18 years international experience in corporate finance and equity sales with SEB & Arctic Securities



Dr. Pamela Trail, Non-Executive Director

- Non executive director of BerGenBio since 2019.
- PhD from the University of Connecticut.
- Strategic oncology leadership roles at Regeneron, MedImmune, Bayer Healthcare and BMS and served as CSO at Seattle Genetics

Analyst coverage



H.C. Wainwright & Co

Joseph Pantginis

Telephone: +1 646 975 6968

E-mail: jpantginis@hcwresearch.com



Jones Trading

Soumit Roy

Telephone: +1 646 454 2714

E-mail: sroy@jonestrading.com



Arctic Securities

Pål Falck

Telephone: +47 229 37 229

E-mail: pal.falck@arctic.com

Sponsored research:



Trinity Delta

Mick Cooper, PhD

Telephone: +44 20 3637 5042

mcooper@trinitydelta.org

Link to reports from Trinity Delta:

<https://www.bergenbio.com/investors/analyst-coverage/>

Background published data on AXL role in viral infection



AXL mediates viral entry through “apoptotic mimicry” and suppresses the anti-viral type I interferon (IFN) response

AXL promotes the infection of a wide range of enveloped viruses including pox-, retro-, flavi-, arena-, filo-, and alpha-viruses (Shimojima 2006, Brindley 2008, Meertens 2012, Dowall 2016, Meertens 2017).

Viral particle binding via GAS6-AXL potently activates signal transduction through its tyrosine kinase domain to suppress type I interferon (IFN) signaling and facilitate viral replication (Bhattacharyya 2013, Meertens 2017).

AXL increases viral infection through two mechanisms:

- 1) enhanced viral entry through “apoptotic mimicry”; and
- 2) suppression of anti-viral type I interferon (IFN) responses

AXL mediates viral entry through “apoptotic mimicry” and suppresses the anti-viral type I interferon (IFN) response

AXL signaling suppresses viral-induced IFN responses via SOCS1/3, leading to increased viral replication in infected cells and decreased anti-viral defenses of neighboring cells (Huang 2015, Chen 2018, Strange 2019).

Therapeutic AXL receptor inhibition ameliorated pulmonary pathology resulting from primary viral infection in experimental models, indicating an important role for AXL within the lung (Shibata 2014).

During primary respiratory syncytial virus (RSV) infection, AXL inhibition increased the number of IFNg-producing T cells and NK cells, suppressed RSV replication and whole lung levels of IL-4 and IL-13.

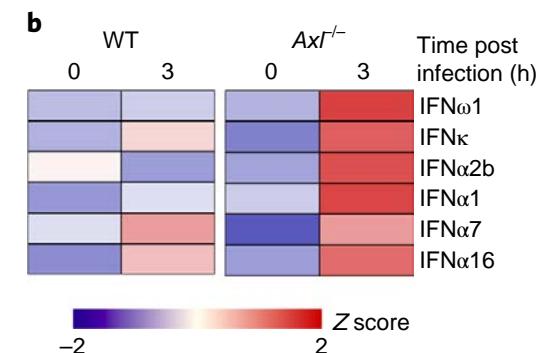
The lethal effect of intrapulmonary H1N1 infection inflammation was reduced by AXL inhibition. AXL inhibition in infected mice increased the number of IFN- β -producing macrophages and dendritic cells and suppressed neutrophil infiltration.

Axl-null mice are resistant to ZIKA pathogenesis likely due to a combination of reduced virus entry and enhanced IFN responses (Hastings 2019), **indicating a potential role for AXL inhibitors as therapeutics during viral infection.**

AXL is a unique type I interferon (IFN) response checkpoint

- IFNR signaling induces *AXL* expression^{4,5}
- AXL is a critical negative feedback regulatory mechanism for TLR-induced type I interferon (IFN) responses in myeloid (dendritic cells, macrophage), NK and tumor cells¹⁻⁴.
- AXL is an IFN checkpoint: AXL signaling blocks IFNR signaling via SOCS1/3 and TBK1^{5,6}.
- **AXL on dendritic cells is targeted by viruses (e.g. Zika) to abrogate IFN responses and inhibit anti-viral immunity⁷.**

AXL inhibition enhances type I interferon gene response to viral infection



1. Rothlin *et al* *Cell.* (2007) 131:1124–36
2. Lee *et al.*, *Front Immunol.* (2019) 10:1261
3. Cañadas *et al.*, *Nat Med.* 2018 Aug;24(8):1143-1150
4. Davidsen *et al*, submitted; Bougnaud, *et al*, unpublished.
5. Sharif *et al.*, *J Exp Med.* (2006) 203(8):1891-901.
6. Cruz *et al* *JCI Insight.* 2019 Apr 2
7. Chen *Nat Microbiol.* 2018 Mar;3(3):302-309

Bemcentinib showed effect against lethal EBOV infection in animal models conducted by PHE



Article

Antiviral Screening of Multiple Compounds against Ebola Virus

Stuart D. Dowall ^{1,6,*}, Kevin Bewley ¹, Robert J. Watson ¹, Seshadri S. Vasan ^{1,2}, Chandradhish Ghosh ³, Mohini M. Konai ³, Gro Gausdal ⁴, James B. Lorens ⁴, Jason Long ⁵, Wendy Barclay ⁵, Isabel Garcia-Dorival ⁶, Julian Hiscox ^{6,7}, Andrew Bosworth ^{1,7}, Irene Taylor ¹, Linda Easterbrook ¹, James Pitman ¹, Sian Summers ¹, Jenny Chan-Pensley ¹, Simon Funnell ¹, Julia Vipond ¹, Sue Charlton ¹, Jayanta Haldar ³, Roger Hewson ^{1,7} and Miles W. Carroll ^{1,7}

¹ Public Health England, Porton Down, Salisbury, Wiltshire SP4 0JG, UK; kevin.bewley@phe.gov.uk (K.B.); robert.watson@phe.gov.uk (R.J.W.); seshadri.vasan@phe.gov.uk (S.S.V.); andrew.bosworth@phe.gov.uk (A.B.); irene.taylor@phe.gov.uk (I.T.); linda.easterbrook@phe.gov.uk (L.E.); james.pitman@phe.gov.uk (J.P.); sian.summers@phe.gov.uk (S.S.); jenny.chan-pensley@phe.gov.uk (J.C.-P.); simon.funnell@phe.gov.uk (S.F.); julia.vipond@phe.gov.uk (J.V.); sue.charlton@phe.gov.uk (S.C.); roger.hewson@phe.gov.uk (R.H.); miles.carroll@phe.gov.uk (M.W.C.)

Abstract: In light of the recent outbreak of Ebola virus (EBOV) disease in West Africa, there have been renewed efforts to search for effective antiviral countermeasures. A range of compounds currently available with broad antimicrobial activity have been tested for activity against EBOV. Using live EBOV, eighteen candidate compounds were screened for antiviral activity *in vitro*. The compounds were selected on a rational basis because their mechanisms of action suggested that they had the potential to disrupt EBOV entry, replication or exit from cells or because they had displayed some antiviral activity against EBOV in previous tests. Nine compounds caused no reduction in viral replication despite cells remaining healthy, so they were excluded from further analysis (zidovudine; didanosine; stavudine; abacavir sulphate; entecavir; JB1a; Aimspro; celgosivir; and castanospermine). A second screen of the remaining compounds and the feasibility of appropriateness for *in vivo* testing removed six further compounds (ouabain; omeprazole; esomeprazole; Gleevec; D-LANA-14; and Tasigna). The three most promising compounds (17-DMAG; BGB324; and NCK-8) were further screened for *in vivo* activity in the guinea pig model of EBOV disease. Two of the compounds, BGB324 and NCK-8, showed some effect against lethal infection *in vivo* at the concentrations tested, which warrants further investigation. Further, these data add to the body of knowledge on the antiviral activities of multiple compounds against EBOV and indicate that the scientific community should invest more effort into the development of novel and specific antiviral compounds to treat Ebola virus disease.

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Non-Oncology

Viruses

Best SM. Viruses Play Dead to TAM Interferon Responses. *Cell Host Microbe* 2013 14:117

-Thoughtful editorial on the role of AXL in viral infection accompanying *Bhattacharyya 2013*

Bhattacharyya S et al. Enveloped viruses disable innate immune responses in dendritic cells by direct activation of TAM receptors. *Cell Host Microbe* 2013 14:136

- Demonstration that GAS6-AXL complexes tether enveloped viruses to cells, activating AXL and dampening type I interferon responses.

Chen J et al. AXL promotes Zika virus infection in astrocytes by antagonizing type I interferon signalling. *Nat Microbiol* 2018 3:302

- Key article showing that Zika virus targets AXL on dendritic cells to block type I interferon responses including several type I interferon genes and IFN-stimulating genes.

Dowall SD et al. Antiviral Screening of Multiple Compounds against Ebola Virus. *Viruses* 2016, 8:27

- Report from Public Health England on the efficacy of bemcentinib inhibition of Ebola virus infection in vitro and in vivo.

Hastings et al. Loss of the TAM Receptor Axl Ameliorates Severe Zika Virus Pathogenesis and Reduces Apoptosis in Microglia *iScience* 2019 13:339

- Report showing that Axl knockout mice are resistant to ZIKV pathogenesis.

Huang MT et al. Feedback regulation of IFN- $\alpha\beta$ signaling by Axl receptor tyrosine kinase modulates HBV immunity. *Eur. J. Immunol.* 2015. 45:1696

- AXL silencing decreased HBV clearance of adult mice whereas enhanced HBV clearance. IFN- β signaling induced AXL regulatory pathway and facilitated Treg-cell differentiation.

Hunt CL et al. The Tyro3 Receptor Kinase Axl Enhances Macropinocytosis of Zaire Ebolavirus. *J Virology*, 2011, Jan:334

- Demonstration that AXL mediates Ebola virus infection via micropinocytosis

Meertens L et al. The TIM and TAM Families of Phosphatidylserine Receptors Mediate Dengue Virus Entry. *Cell Host & Microbe* 2012, 12:544

- Report detailing the role of GAS6-AXL in Dengue viruses (DVs) infection.

Meertens L et al. Axl mediates ZIKA virus entry in human glial cells and modulates innate immune responses. *Cell Rep* 2017 18:324

Demonstration that bemcentinib blocks ZIKA virus infection of glial cells but blocking AXL-mediated viral entry and dampened innate immunity.

Moller-Tank, S, Maury W. Phosphatidylserine receptors: Enhancers of enveloped virus entry and infection *Virology* 2014 :468-70:565

Review of receptors driving apoptotic mimicry.

Shibata T et al. Axl Receptor Blockade Ameliorates Pulmonary Pathology Resulting from Primary Viral Infection and Viral Exacerbation of Asthma. *J Immunology*, 2014, 192: 3569.

- Therapeutic AXL receptor inhibition ameliorated pulmonary pathology resulting from primary viral infection in experimental models, indicating an important role for AXL within the lung.

Shimojima M et al. Tyro3 family-mediated cell entry of Ebola and Marburg viruses. *J Virol.* 2006 80:10109

- First demonstration of AXL in Ebola cell entry.

Strange DP et al. Axl promotes Zika virus entry and modulates the antiviral state of human Sertoli cells. *mBio* 2019 10:e01372.

- Demonstration that bemcentinib blocks Zika virus infection in multicellular organoids by attenuating both viral entry and type I interferon antagonism.

Published papers in 2019 registered on Pubmed for AXL and Fibrosis: 8

Tutusaus et al., (2019) Axl targeting abrogates experimental non-alcoholic steatohepatitis (NASH) progression, Cellular and Molecular Gastroenterology and Hepatology, In Press

- Bemcentinib reduces inflammation and fibrosis in a diet induced model of Non Alcoholic Steato Hepatitis (NASH)
- Patients with advanced fibrosis and cirrhosis have elevated sAXL in circulation and AXL expression in liver biopsies.

Landolt et al., (2019) AXL targeting reduces fibrosis development in experimental unilateral ureteral obstruction. Physiol Rep

- Unilateral ureteric obstruction by ligation in mice, induced tubulointerstitial fibrosis with enhanced expression of AXL on cells of the interstitium, tubules and glomeruli
- Bemcentinib reduced development of fibrosis and inflammation in obstructed kidneys

Reviews

- Bellan M, et al. (2019) Gas6/TAM System: A Key Modulator of the Interplay between Inflammation and Fibrosis. *Int J Mol Sci*
- Smirne C, et al. (2019) Gas6/TAM Signaling Components as Novel Biomarkers of Liver Fibrosis. *Dis Markers*.

COPD

Fujino et al., (2019) Sensing of apoptotic cells through Axl causes lung basal cell proliferation in inflammatory diseases. J Exp Med.

- Continued AXL signaling results in basal cell hyperplasia and a dysfunctional epithelial barrier in trachea with pathology typical of chronic inflammatory pulmonary diseases.
- Genetic depletion of AXL allows resolution of inflammation with differentiation to ciliated epithelium

Published papers in 2019 registered on Pubmed for AXL and Cancer: 122

Pearson et al., (2019) AXL Inhibition Extinguishes Primitive JAK2 Mutated Myeloproliferative Neoplasm Progenitor Cells.' HemaSphere 3.

- Inhibition of AXL with Bemcentinib preferentially kills early hemopoietic stem cells from patients with JAK2 mutated driven MPN

Terry et al., (2019 Cancer Immunology Research) AXL Targeting Overcomes Human Lung Cancer Cell Resistance to NK- and CTL-Mediated Cytotoxicity, Cancer Immunology Research.

- AXL drives tumor EMT and resistance to cytotoxic lymphocyte-mediated cell killing
- Bemcentinib sensitizes NSCLC tumor cells to lymphocyte mediated cell killing

Cruz et al., (2019) Axl-mediated activation of TBK1 drives epithelial plasticity in pancreatic cancer. JCI Insight

- AXL drives an epithelial plasticity program enhancing invasive and metastatic capacity via TBK1 in KRAS-mutant PDA

Quinn et al., (Mol Cancer Ther.2019) Therapeutic Inhibition of the Receptor Tyrosine Kinase AXL Improves Sensitivity to Platinum and Taxane in Ovarian Cancer. Mol Cancer Ther.

- AXL contributes to platinum and taxane resistance in ovarian cancer, and inhibition of AXL improves chemoresponse and accumulation of chemotherapy drugs

Tanaka et al., (2019) Axl signaling is an important mediator of tumor angiogenesis, Oncotarget.

- Bemcentinib decreases the secretion of pro-angiogenic factors and impairs functional properties of endothelial cells *in vitro* and *in vivo*

Tsukita et al., (2019) Axl kinase drives immune checkpoint and chemokine signalling pathways in lung adenocarcinomas. Mol Cancer.

- AXL positively correlates expressions of PD-L1 and CXCR6
- Bemcentinib decreased mRNA expressions of PD-L1 and CXCR6 in EGFR mutation-positive cell lines.

Reviews

- Yan S, et al., AXL Receptor Tyrosine Kinase as a Therapeutic Target in Hematological Malignancies: Focus on Multiple Myeloma. Cancers (Basel). 2019
- Zhu C et al., AXL receptor tyrosine kinase as a promising anti-cancer approach: functions, molecular mechanisms and clinical applications. Mol Cancer. 2019
- Arner EN et al., Behind the Wheel of Epithelial Plasticity in KRAS-Driven Cancers. Front Oncol.
- Myers KV et al., Targeting Tyro3, Axl and MerTK (TAM receptors): implications for macrophages in the tumor microenvironment. Mol Cancer.
- Niu ZS et al., Role of the receptor tyrosine kinase Axl in hepatocellular carcinoma and its clinical relevance. Future Oncol

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Bemcentinib:

Ludwig, K.F.,et al.,(2017) Small molecule Axl inhibition targets tumor immune suppression and enhances chemotherapy in pancreatic cancer,' *Epub ahead of print.*

- Axl associated with poor outcomes in pancreatic cancer uniquely links drug resistance and immune evasion.
- Bemcentinib blocks aggressive traits of pancreatic cancer & enhances activity of gemcitabine.
- Bemcentinib drives tumour cell differentiation and provokes an immune stimulatory microenvironment. Treatment reduces expression of Arginase-1 a key player in immune-suppression.

Guo et al (2017) Axl inhibition induces the antitumor immune response which can be further potentiated by PD-1 blockade in the mouse cancer models, *Oncotarget*

- Axl inhibition via bemcentinib reprograms immunological microenvironment Increased proliferation and activation of CD4 and CD8
- Bemcentinib and PD-1 blockade act synergistically

Mode of Action & Biomarkers

Haaland, G.S.,et al.,(2017) 'Association of warfarin use with Lower overall cancer incidence among patients older than 50 years,' *JAMA Intern Med.*, Nov 6.

- Warfarin inhibits Axl signalling and Axl-mediated biological response at doses lower than those which mediate anti-coagulation effects.
- Retrospective analysis of a large population cohort demonstrates that patients on low dose Warfarin had a significantly lower incidence of cancer.

Aguilera, T.A.&Giaccia, A.J. (2017) 'Molecular Pathways: Oncologic Pathways and Their Role in T-cell Exclusion and Immune Evasion-A New Role for the AXL Receptor Tyrosine Kinase,' *Clin.Cancer Res.*,June 15th.

- Immune checkpoint inhibitors are most effective against T-cell inflamed tumours. Non-T-cell or T-cell excluded tumours remain a significant barrier to treatment.
- Axl identified as a key mediator of immune evasion and experimental evidence demonstrates Axl targeting leads to greater anti-tumour immune response post radiotherapy.

Miller, M.A.,et al.,(2017) 'Molecular Pathways: Receptor Ectodomain Shedding in Treatment, Resistance, and Monitoring of Cancer,' *Clin. Cancer Res.*,Feb 1.

- Proteases known as sheddases cleave the extracellular domain of several receptor tyrosine kinases such as Axl generating soluble Axl (sAxl).
- Plasma levels of sAxl are predictive of patient response to standard of care BRAF&MEK inhibitor therapy and could be used for patient stratification strategies.

Antony et al (2017) The GAS6-AXL signaling network is a mesenchymal (Mes) molecular subtype-specific therapeutic target for ovarian cancer. *Science Signalling*

- Axl particularly abundant in ovarian cancer subtype designated as mesenchymal (Mes)
- Axl co-clustered cMET, EGFR, and HER2, producing sustained extracellular signal-regulated kinase (ERK) activation in Mes cells
- Bemcentinib reduced tumor growth in chick chorioallantoic membrane model.

Kanzaki, R.,et al.,(2017) 'Gas6 derived from cancer-associated fibroblasts promotes migration of Axl-expressing lung cancer cells during chemotherapy,' *Nature Scientific Reports*,Sept 6th.

- Tumor stroma microenvironment (TME) is comprised of cancer-associated fibroblasts (CAF) which influence cancer cells such as non-small cell lung cancer (NSCLC).
- In a murine model, NSCLC treated with cisplatin induced an up-regulation of Gas6.
- NSCLC line H1299 migrated in response to Gas6.
- The CAF cell line LCAH expresses GAS6 and can promote H1299 cell migration.
- Conclusion- CAF derived GAS6 promotes migration of Axl-expressing lung cancers.

Reviews

Levin et al (2016) Axl Receptor Axis: A New Therapeutic Target in Lung Cancer. *J Thoracic Oncol*

Chouaib et al (2014) Tumor Plasticity Interferes with Anti-Tumor Immunity. *Critical RevImmunology*

Gay et al (2017) Giving AXL the axe: targeting AXL in human malignancy. *BJC*

Brown et al (2016) Gene of the month: Axl. *BMJ*

Halmos et al (2016) New twists in the AXL(e) of tumor progression. *Science Signalling*

References

Resistance

Zucca, L.E., et al., (2017) 'Expression of tyrosine kinase receptor AXL is associated with worse outcome of metastatic renal cell carcinomas treated with sunitinib,' *Urol Oncol*, Oct 3.

- Renal cell carcinoma (RCC) represents 2-3% of all cancers in the Western world.
- First line therapy is sunitinib (PDGF/VEGF TK inhibitor).
- 47% of RCC patients treated with sunitinib were +ve for Axl.
- Axl expression in sunitinib treated patients correlated with worse clinical outcome (13 months Vs 43 months survival).

Husain, H., et al., (2017) 'Strategies to Overcome Bypass Mechanisms Mediating Clinical Resistance to EGFR Tyrosine Kinase Inhibition in Lung Cancer,' *Mol. Cancer Ther.*, Feb 2017.

- Patient treated with EGFR based therapies develop resistance via multiple mechanisms.
- Resistant metastatic lung cancers exhibit increased AXL, EMT and PDL1 expression.

Elkabets et al (2015) AXL Mediates Resistance to PI3Ka Inhibition by Activating the EGFR/PKC/mTOR Axis in Head and Neck and Esophageal Squamous Cell Carcinomas. *Cancer Cell*

- Axl mediates persistent mTOR activation and upregulated in resistant tumors
- Combined treatment with PI3Ka and either EGFR, AXL, or PKC inhibitors reverts this resistance

Mak et al (2015) A patient-derived, pan-cancer EMT signature identifies global molecular alterations and immune target enrichment following epithelial to mesenchymal transition. *Clin Cancer Res*

- EMT signature was developed based on 11 tumor types
- Axl frequently overexpressed in EMT tumors along with PD-L1, PD1, CTLA4, OX40L, and PDL2
- highlights the possibility of utilizing EMT status--independent of cancer type--as an additional selection tool to select patients who may benefit from immune checkpoint blockade

Zhang et al (2012) Activation of the AXL kinase causes resistance to EGFR targeted therapy in lung cancer. *Nature Genetics*

Mueller et al (2014) Low MITF/AXL ratio predicts early resistance to multiple targeted drugs in melanoma

- high Axl in melanoma cells correlates with drug resistance
- BRAF and ERK inhibitors are more effective when using Axl inhibition

References

Non-Oncology

Pulmonary fibrosis

Fujino N. et al., (2017) Phenotypic screening identifies Axl kinase as a negative regulator of an alveolar epithelial cell phenotype. *Lab Invest.* 2017 Sep;97(9):1047-1062.

- Axl was activated in hyperplasia of epithelial cells in idiopathic pulmonary fibrosis patients where the epithelial barrier integrity was lost
- In vitro, Axl inhibition or downregulation by small interfering RNA led to increase in epithelial surfactant protein expression and promotion of an epithelial cell phenotype.

Espindola, M. S. et al., (2018) Targeting of TAM Receptors Ameliorates Fibrotic Mechanisms in Idiopathic Pulmonary Fibrosis. *Am J Respir Crit Care Med* 197, 1443–1456.

- IPF patients with high expression of Axl are rapid (declining lung function) progressors.
- Bemcentinib inhibited the fibrogenic phenotype of IPF patient derived fibroblasts.
- GAS6 knockout animals were protected from Bleomycin induced lung fibrosis (Gold standard model of pulmonary fibrosis).
- Bemcentinib inhibited the development of fibrosis in the IPF SCID mouse model (Human IPF fibroblasts induce pulmonary fibrosis in the SCID mouse).

Chronic Obstructive Pulmonary Disease

Fujino, N. et al., (2019) Sensing of apoptotic cells through Axl causes lung basal cell proliferation in inflammatory diseases. *J Exp Med* 216, 2184–2201.

- Basal epithelial cells in the trachea, express AXL and are activated by Gas6 ligand interaction with apoptotic cells in airway inflammation.
- AXL signaling is critical for expansion of the pool of basal cells, but needs to be silenced to allow differentiation of basal epithelium ciliated cell regeneration.
- Continued AXL signaling results in basal cell hyperplasia and a dysfunctional epithelial barrier with abnormal differentiation to squamous (not ciliated) epithelium and continued cell turnover, typical of the pathology of chronic inflammatory pulmonary diseases.
- Genetic depletion of AXL allows resolution of inflammation with differentiation to ciliated epithelium

Liver Fibrosis

Stauffer K., et al., (2017) 'The non-invasive serum biomarker soluble Axl accurately detects advanced liver fibrosis and cirrhosis,' *Cell Death Dis.* Oct 26.

- sAxl confirmed to be accurate biomarker of liver fibrosis and cirrhosis.
- sAxl/albumin demonstrated to be further enhancing as a cheap and accurate biomarker.

Barcena et al (2015) Gas6/Axl pathway is activated in chronic liver disease and its targeting reduces fibrosis via hepatic stellate cell inactivation. *J Hepatology*, Sep;63(3):670-8

- Axl levels paralleled HSC activation
- Axl knock out mice displayed decreased HSC activation in vitro and liver fibrogenesis after chronic damage by CCl4 administration
- Bemcentinib reduced collagen deposition and CCl4-induced liver fibrosis in mice

Tutusaus et al., (2019) Axl targeting abrogates experimental non-alcoholic steatohepatitis (NASH) progression, *Cellular and Molecular Gastroenterology and Hepatology*, In Press

- Bemcentinib reduces inflammation and fibrosis in a diet induced model of Non Alcoholic Steato Hepatitis (NASH)
- Patients with advanced fibrosis and cirrhosis have elevated sAXL in circulation and AXL expression in liver biopsies.

Kidney fibrosis

Landolt, L. et al., (2019) AXL targeting reduces fibrosis development in experimental unilateral ureteral obstruction. *Physiol Rep* May;7(10):e14091

- Progressive chronic kidney disease is typified by kidney fibrosis, typified by activated myofibroblast accumulation and deposition of extracellular matrix.
- Unilateral ureteric obstruction by ligation, in mice, induced tubulointerstitial fibrosis with enhanced detection of AXL on cells of interstitium, tubules and glomeruli
- Bemcentinib reduced development of fibrosis and inflammation in obstructed kidneys compared to treatment with an ACE-inhibitor

Polycythaemia Vera, Myelofibrosis (MyeloProliferative Neoplasms - MPN)

Pearson, S. et al., (2019) 'AXL Inhibition Extinguishes Primitive JAK2 Mutated Myeloproliferative Neoplasm Progenitor Cells.' *HemaSphere* 3.

- AXL is upregulated and activated in JAK2 associated MPNs
- Inhibition of AXL with Bemcentinib preferentially kills early hemopoietic stem cells from patients and, as such represents a promising therapeutic approach for JAK2 driven MPN

Reviews

Bellan M. et al. (2019) Gas6/TAM System: A Key Modulator of the Interplay between Inflammation and Fibrosis. *Int J Mol Sci.* Oct 12;20(20)

Smirne C. et al. (2019) Gas6/TAM Signaling Components as Novel Biomarkers of Liver Fibrosis. *Dis Markers.* Sep 8;2019:2304931.