

A laboratory setting featuring a robotic arm positioned over two racks of small vials. The vials are arranged in a grid pattern on the racks. The scene is illuminated with a blue light, creating a high-tech, scientific atmosphere. The robotic arm is a dark, metallic structure with a long, thin arm extending towards the vials.

# MEDIVIR

Improving life for cancer patients  
through transformative drugs

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April 2018

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# Medivir in Brief

# Improving life for cancer patients through transformative drugs

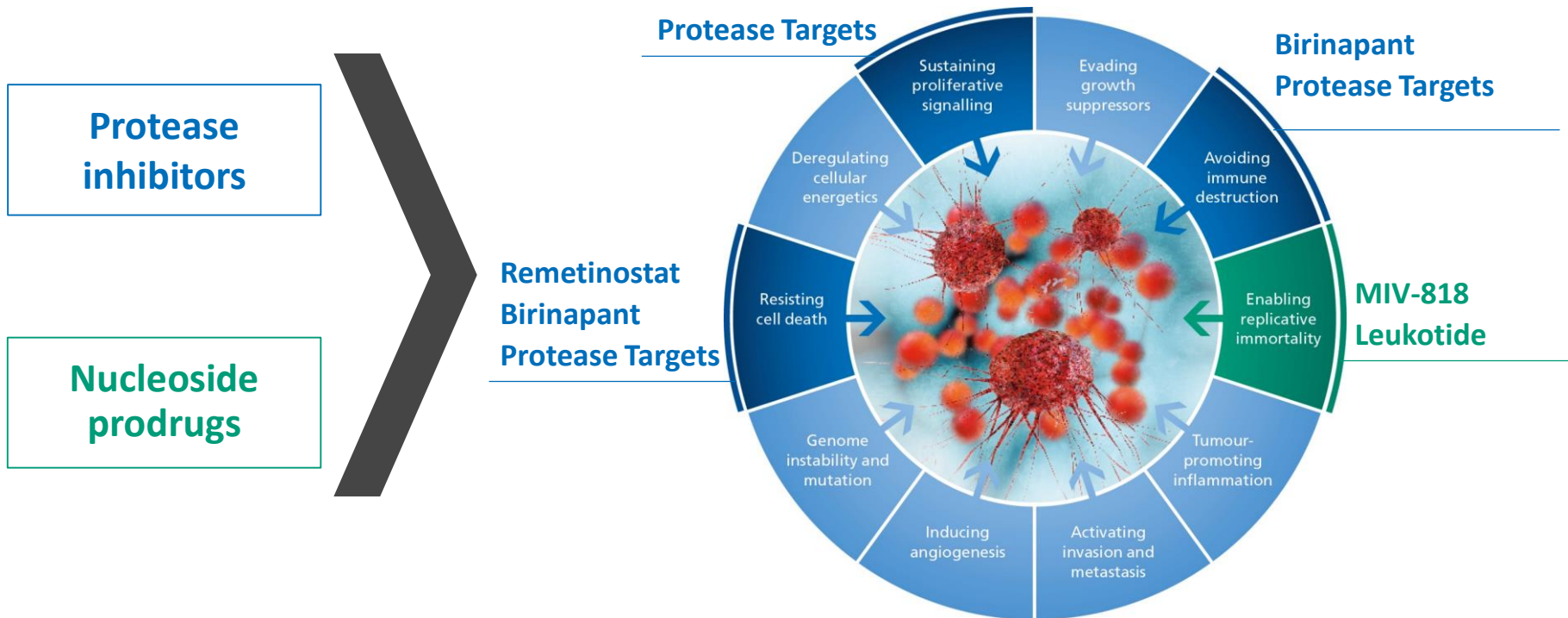
- Using **world-class scientific expertise** to bring new therapies to cancer patients
- **Clinical pipeline** composed of projects with **multi-billion dollar sales** potential as well as **orphan cancer drug candidates**
- Strong commercial focus – delivered more than **20 global partnerships** and **2 products from idea to market**

## Basic facts

- Headquarters in Huddinge, Sweden
- 77 employees, 43 with PhDs
- Listed on the Nasdaq Stockholm, ticker: MVIR
- Current market capitalization: SEK 967m (~USD 125m)<sup>1</sup>
- Website: [www.medivir.com](http://www.medivir.com)



# Leveraging scientific expertise to build pipeline in oncology



Adapted from: The Hallmarks of Cancer: The Next Generation.  
Hanahan and Weinberg, Cell (2011), 144, 646-674

# Oncology drug development in areas of high unmet need

Strong and balanced development pipeline based around areas of scientific expertise and focused on cancer

	Project, Mechanism	Disease area	Clinical phase				Market	Next step
			Preclinical	Phase I	Phase II	Phase III		
Cancer	<b>Remetinostat</b> Topical HDAC inhibitor	<b>Early-stage cutaneous T-cell lymphoma</b>	[Blue bar spanning Preclinical, Phase I, and Phase II]				~\$1b US only	P3 start 2018
	<b>Birinapant</b> SMAC mimetic	<b>Solid tumors</b> (combo with Keytruda®)	[Blue bar spanning Preclinical and Phase I]				Blockbuster	P2 start 2H2018
	<b>MIV-818</b> , Nucleotide DNA polymerase inhibitor	<b>Hepatocellular carcinoma</b>	[Green bar in Preclinical]				Orphan US/EU Significant Asia	P1 start 2H2018
	<b>MIV-711</b> Cathepsin K inhibitor	<b>Osteoarthritis</b>	[Blue bar spanning Preclinical, Phase I, and Phase II]				Blockbuster	Partner

■ Protease related  
■ Nucleot(s)ide related

# Collaborations enhance the value of programs

## Academic



## Industrial

### Product/Project

Zoviduo®/Xerclear  
(labial herpes)  
*acyclovir + hydrocortisone*

MIV-802 (HCV)  
*Nucleotide NS5B  
polymerase inhibitor*

### Platform Link

Nucleoside  
analogue

Nucleotide

### Partners



### Status

Marketed

Phase I ready

### Medivir Interests

- Royalties from sales
- Approval milestones for additional OTC switches
- Development milestones
- Royalties from sales

# Competences from discovery through regulatory approvals

## Management team with extensive experience and proven track record of successful development



**RICHARD BETHELL**, Chief Scientific Officer

- 28 years drug discovery and development in oncology and infectious disease
- VP, Biology/DMPK (Boehringer Ingelheim (Canada))
- VP, Therapeutic Research (Shire)
- Pfizer and GlaxoSmithKline R&D
- Doctor of Philosophy (D. Phil.) in chemistry from Oxford University



**JOHN ÖHD**, Chief Medical Officer

- Senior director of Experimental Medicine, Shire
- Early development group director, cognitive and neurodegenerative disorders at AstraZeneca
- Cancer research at Lund University and at Karolinska Institute
- Clinical training at Karolinska University Hospital
- MD, Linköping University, PhD in Experimental Pathology, Lund University



**ÅSA HOLMGREN**, EVP Strategic Regulatory Affairs

- Head of Regulatory Affairs at Orexo AB
- Various large pharmaceutical companies, including 12 years as Senior Global Regulatory Affairs Director at AstraZeneca, and at AstraZeneca in Canada and Japan
- M. Sc. in Pharmacy, trained Uppsala University



**CHRISTINE LIND**, President and CEO

- EVP, Business Development at Medivir
- VP, Business Development, LifeCell Corporation
- Biotech and pharma strategic advisory and capital raising at Merrill Lynch & Co. and GKM & Co.
- B. Sc. Finance and Info Systems, NYU and MBA, Columbia Business School



**ERIK BJÖRK**, Chief Financial Officer

- CFO for AstraZeneca Sweden Operations
- 11 years with Procter & Gamble, in global finance leadership positions in Switzerland, UK and Sweden
- MSc in Finance and LLM from Lund University



**CHRISTINA HERDER**, EVP Strategic Business Development

- CEO of Modus Therapeutics
- Director, Corporate Development at Sobi
- Project & Portfolio Management at Biovitrum
- Current member of the boards of PCI Biotech and Idogen
- Ph. D. in physical chemistry from Royal Institute of Technology and MBA from Stockholm University



**DANIEL ERIKSSON**, Chief Information Officer

- Various IT roles relating to security, decision support, innovation, and digitalization
- Most recently, Technical Director for G4S Risk Management
- PhD Coventry University and BSc in Systems Science, Linköping University

**Cancer biology, chemistry, intellectual property, DMPK, CMC, toxicology, clinical development, regulatory strategy, business development**

77 employees, 43 with PhDs,  
18 nationalities, balanced gender split



# MIV-711 for Osteoarthritis

# No existing disease-modifying drug for osteoarthritis

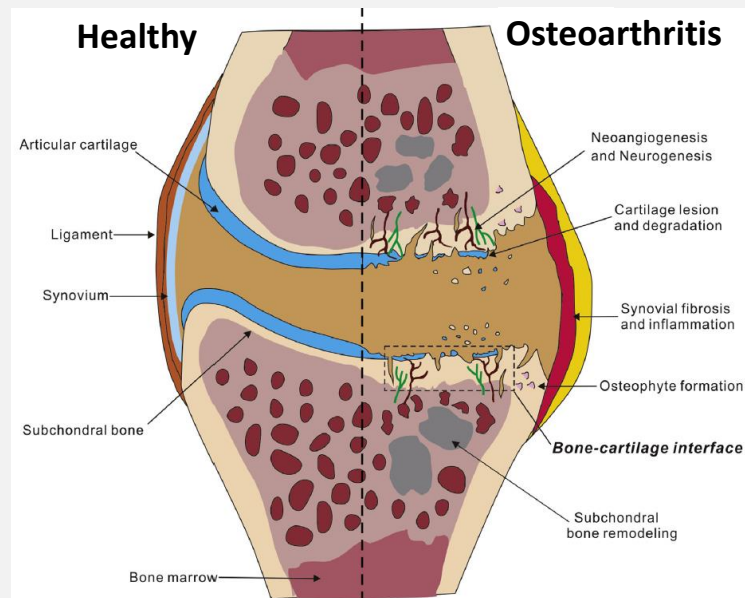
## Blockbuster revenue opportunity for a disease-modifying osteoarthritis drug

- Affects >30m adults in the US, and ~240m worldwide
- Prevalence increasing due to aging population and obesity epidemic
- Current treatments are insufficient focusing only on symptom relief



## Disease involves both bone and cartilage

- Cathepsin K protease involved in the breakdown of collagen in both bone and cartilage



Yuan *et al.* Osteoarthritis and Cartilage (2014), 22, 1077

# Phase IIa data show unprecedented OA disease modification after 6 months

## Potential disease-modifying convenient osteoarthritis drug

- Only cathepsin K-inhibitor in development for osteoarthritis
- Once daily oral administration

## Strong patent position

- Expected patent life to ~2034, including extensions

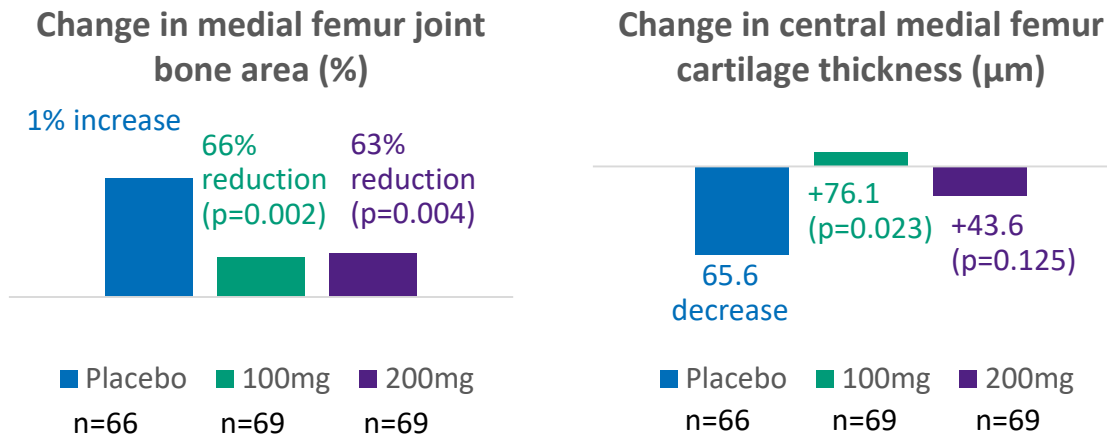
## US FDA Fast Track designation

- Granted by FDA October 2017

“The finding that MIV-711 slows the degenerative changes on both bone and cartilage in knees affected by OA is an enormously exciting finding”

Professor Philip Conaghan, Professor of Musculoskeletal Medicine at the University of Leeds, UK, and lead investigator on the MIV-711-201 study

## Benefit on both bone and cartilage in Phase IIa study



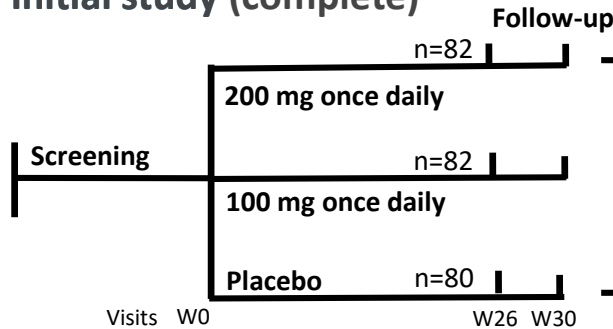
- MIV-711 consistent tendency to improve outcomes across all pain and other patient reported symptoms vs. placebo
- Acceptable safety and tolerability profile

<http://acrabstracts.org/> Abstract 14L

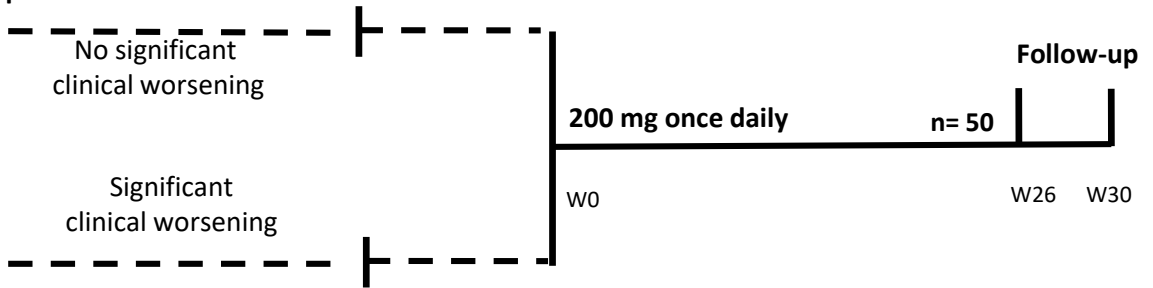
# MIV-711: Ongoing development and future plans

- Partnering discussions ongoing
- Additional 12 and 6 month efficacy data from extension study expected 1H'18

## Initial study (complete)



## Extension study (ongoing)



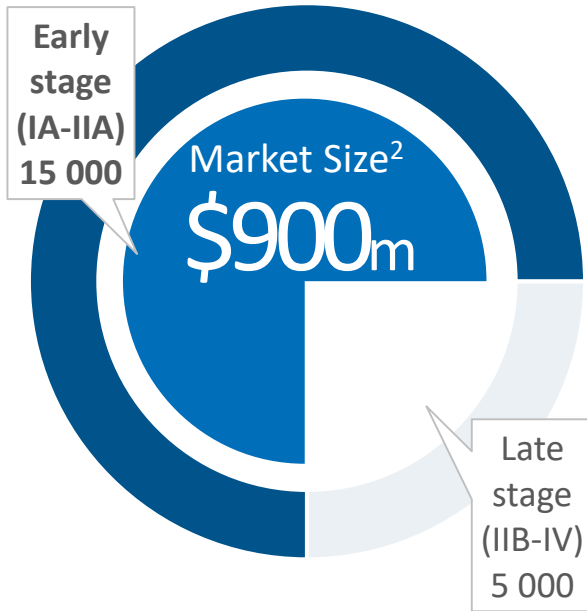
- Principal objective: effect of MIV-711 on joint structure
- Primary endpoint: change in patient-reported pain
- Secondary endpoints including joint structure outcomes measured by MRI
- Topline data reported September 2017

- Primary objective: safety and tolerability
- Secondary endpoints including joint structure outcomes and effect on symptoms

# Remetinostat for early-stage CTCL

# CTCL: orphan blood cancer with significant market opportunity

## US CTCL patients<sup>1</sup>: orphan disease



### Early Stage CTCL: Disease background

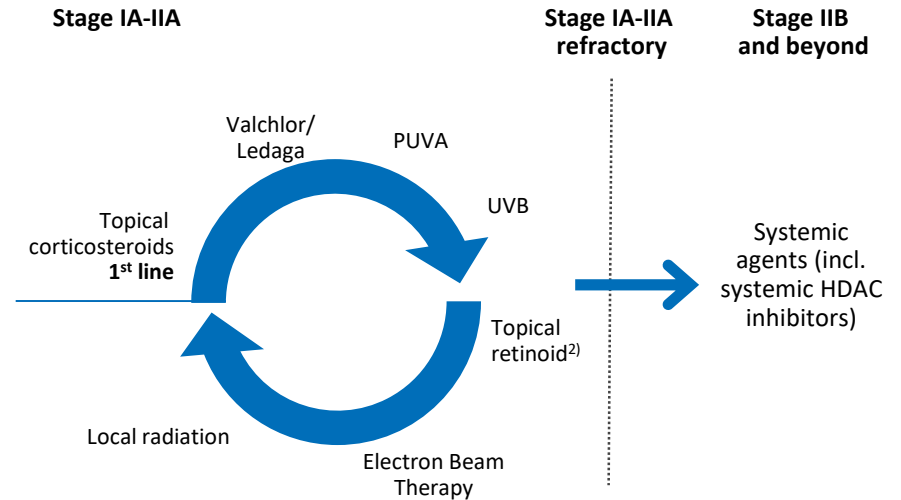
- Confined to the skin
- High 5-year survival rates (~85%)
- Patients remain at this stage for extended periods and require long-term treatment
- Significant quality of life issues, especially pruritus (itch)

**Key unmet need:**  
balance of efficacy and long-term tolerability

# Patients & physicians need new treatments for early-stage CTCL

- Currently approved early-stage CTCL drugs lack sustained efficacy and/or tolerability and are highly irritating
- Valchlor/Ledaga is a topical alkylating agent (the active agent in mustard gas)
- No single treatment for long-term use
- At this early stage, physicians avoid using systemic drugs, including other HDAC inhibitors, due to the side effect profile

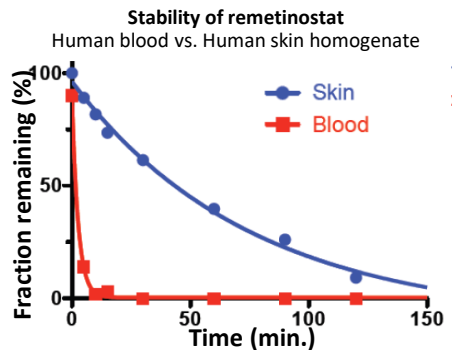
## Currently approved therapies by disease stage



# Remetinostat potential to meet patients' key unmet need

## Designed to act only where needed

- HDAC inhibitors<sup>1</sup> approved in late-stage CTCL patients but not in early-stage patients due to systemic toxicities
- Reteminostat's unique design and topical application provides activity in skin, but rapid degradation in blood



- Expected patent life to ~2034 (including extensions)
- US orphan drug designation

“As a topical, skin-specific HDAC inhibitor, reteminostat has the potential to be efficacious and have an improved safety profile compared to other available treatments.”

*Youn Kim M.D.*

*Stanford University Medical Center, USA*



## Addresses key unmet need with positive Phase II data

### Effect on lesions & reduction of pruritus (itch)

Dose	1% 1x/day n=20	0.5% 2x/day n=20	1% 2x/day n=20
Lesion responses <sup>1</sup>	20%	25%	<b>40%</b>
Patients with clinically significant pruritus <sup>2</sup>	8/20 (40%)	6/20 (30%)	<b>10/20 (50%)</b>
Pruritus responses	37.5%	50%	<b>80%</b>

### Highly tolerable with no systemic side effects

- Even dose distribution of AEs, mostly grade 1 or 2
- No HDAC inhibitor-associated systemic adverse events
- Median time on treatment: 332 days (1% 2x/day dose)

M Duvic *et al.*, EORTC Cutaneous Lymphoma Task Force Meeting (2017), Abstract O55

## Planned Phase III clinical development for early-stage CTCL

### Design

- One Phase III study expected to be sufficient for NDA
- Past approvals in CTCL were based on pivotal clinical studies involving  $\leq 260$  patients
- Focus on treatment-experienced patients where the medical need is high

### Program Timing

- Phase II final data reported (EORTC CLTF Meeting, 2017)
- Ongoing discussions with the FDA (End of Phase II) to enable Phase III

### Costs

- ~\$50m (SEK 400m) expected clinical costs to NDA submission over a ~3 year period (incl. Phase III study and third party milestones)

**“The introduction of remetinostat to the market as a novel topical agent for the treatment of CTCL is likely to find broad application and lead to novel combinatorial approaches in CTCL.”**

*Pierluigi Porcu, M.D.  
Jefferson University Hospital, USA*



# Birinapant for solid tumors

# Linking targeted therapy with immuno-oncology

## Uniquely potent molecule against a novel target

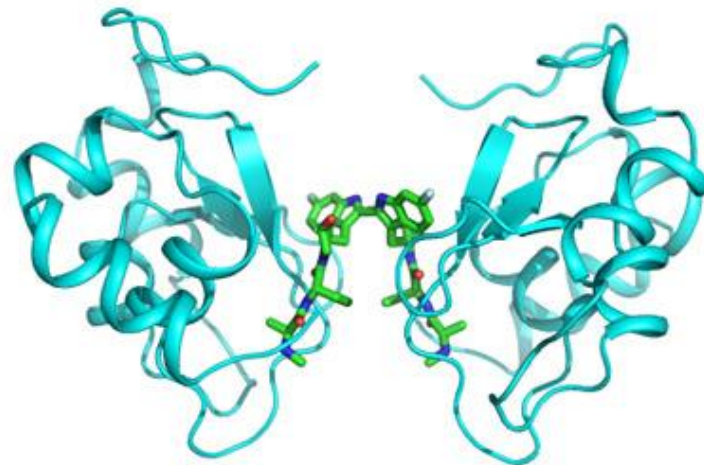
- Only bivalent SMAC (second mitochondrial-derived activator of caspases) mimetic in development
- Targeting of cIAPs results in dual action on T-cells and tumor cells

## Strong rationale for use in combinations

- Synergistic with anti-PD1 and likely other IO pathways
- Efficacy observed in both hematological and solid tumor models
- Phase I/II study in combination with Merck's Keytruda® underway

## Blockbuster potential and strong patent position

- Expected patent life to ~2034, including extensions



# Despite immuno-oncology breakthroughs patients have unmet needs

Multi-billion dollar market,  
and growing for immuno-  
oncology agents

Revenues of  
PD-1 inhibitors <sup>1)</sup>

**\$8bn**

**< 1/2**

of patients derive  
meaningful clinical  
benefit in approved  
indications

**0%**

ORR in other indications  
such as MSS colorectal  
cancer

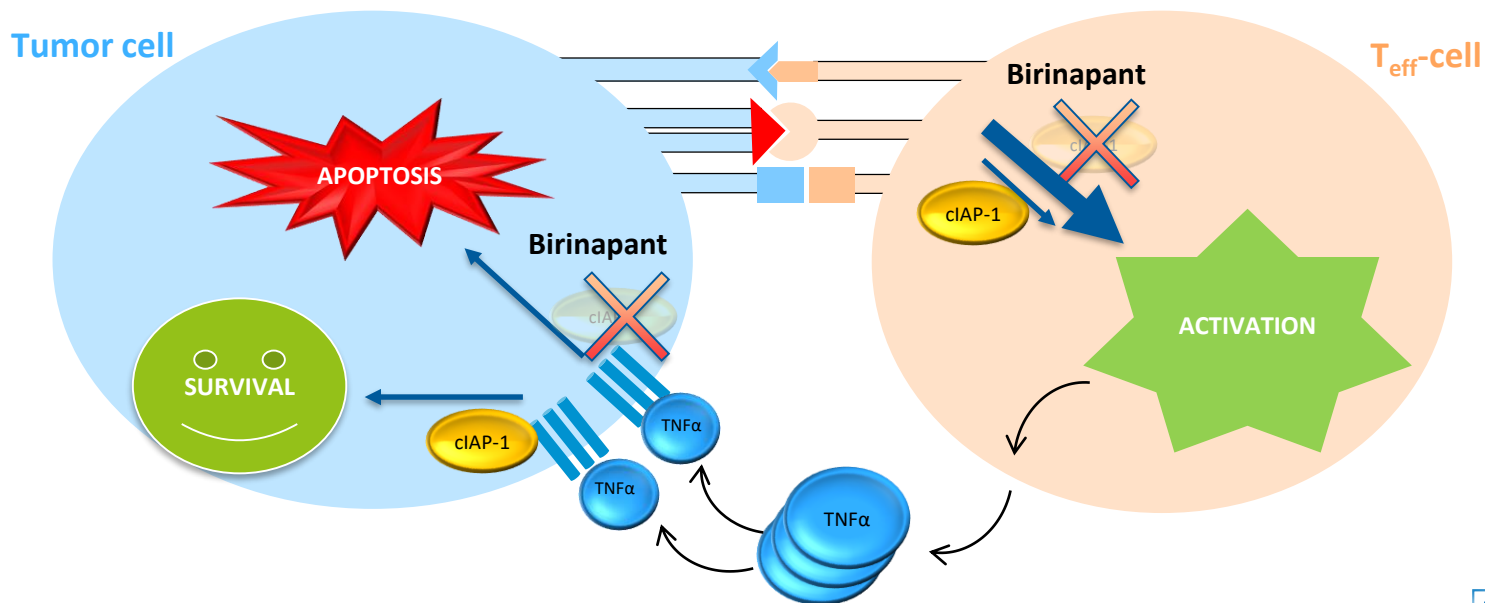
Combination  
regimens to  
enhance benefit  
in underserved  
patients



## Dual action enhances cancer cell death

### Targeting of cIAPs results in dual action on T-cells and tumor cells

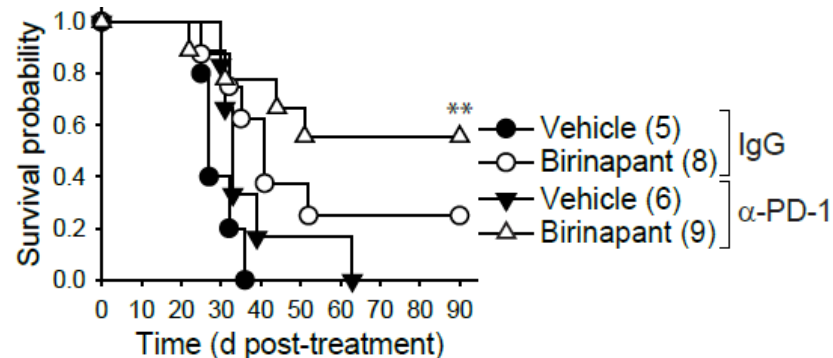
- Enhances pro-apoptotic, and suppresses pro-survival, signaling downstream of TNF- $\alpha$
- Augments human T cell responses to physiologically relevant stimuli<sup>1</sup>



## Potential to enhance patient response with immune-oncology therapies

### Strong rationale for combination with Keytruda®

- Birinapant/anti-PD1 mAb combo showed enhanced activity in preclinical models<sup>1</sup> compared to either agent alone



<sup>1</sup> Solid tumor model: Beug et al., Nature Communications (2017) 8:14278

Multiple myeloma model: Chesi et al., Nature Med. (2016) 22, 1411–1420

Cooperation of IAPs and PD-L1 to protect tumor cells: Kearney et al., Cell Death and Diff. (2017), 24, 1705–1716

# Birinapant/Keytruda® combination: Phase I/II Study underway

## Collaboration with



- Development collaboration for the Phase I/II study in solid tumors
- Keytruda® provided at no cost
- Joint Development Committee to oversee the study, bringing Merck's immuno-oncology expertise
- Medivir retains full global rights to birinapant and data

## Costs

- ~\$20m (SEK 160m) expected costs to completion of planned studies (incl. Phase I/II study over 3 years; no third party milestones)

## Design



**Phase I:** Sequential group dose-escalation to determine the dose-limiting toxicity and recommended Phase II dose, in combination with Keytruda®

**Phase II:** Safety and tolerability of the recommended dose of birinapant, in combination with Keytruda® in 3-4 defined disease cohorts





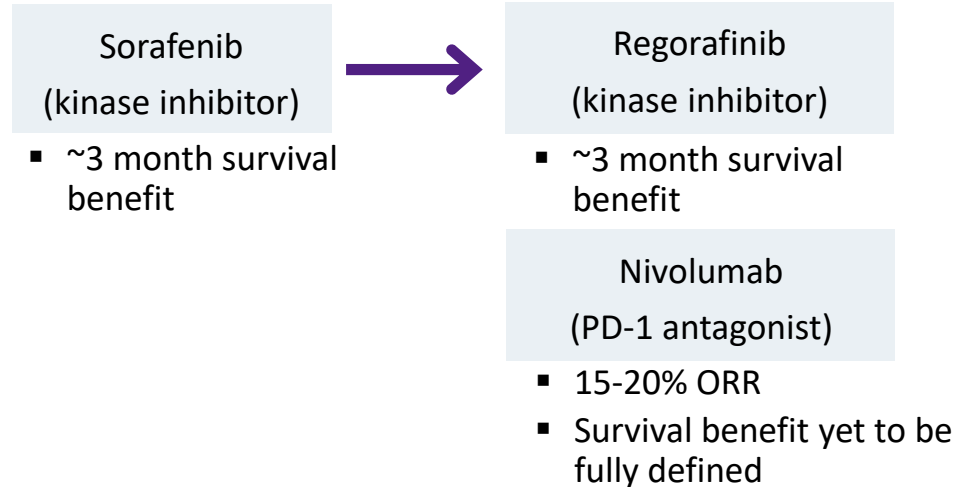
# MIV-818 for liver cancers

# Liver cancer is 2<sup>nd</sup> leading cause of cancer related death worldwide

## Liver cancer<sup>1</sup>

- Orphan disease in Western markets, but much more common in Asia
- One of fastest growing and most deadly cancers in US
- Genetically heterogeneous leading to limited effect of molecularly targeted therapies

## Patients with advanced liver cancer in need of new treatments



1) Howlader et al. (eds). SEER Cancer Statistics Review, 1975-2011, National Cancer Institute. Bethesda, MD, [http://seer.cancer.gov/csr/1975\\_2011/](http://seer.cancer.gov/csr/1975_2011/)

# Potential to improve efficacy and safety for patients with liver cancers

## Improve a nucleoside with Medivir prodrug technology

### Troxacitabine

(nucleoside)

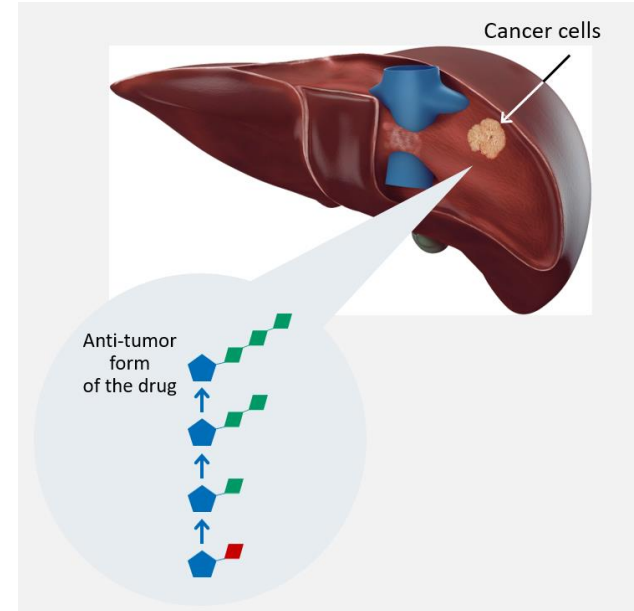
- **Active** in preclinical cancer models and in clinic
- Failed in clinic due to systemic dose-limiting **toxicities**

Medivir  
prodrug  
technology

### MIV-818

(liver-targeted nucleotide prodrug)

- **Enhanced activity** 10x more potent against HCC cell lines than parent troxacitabine
- **Selectivity for cancer** Active on HCC cells while sparing non-cancerous hepatocytes
- **Improved delivery to the liver** >10-fold increased delivery of the active drug to the liver, with a 10-fold reduction in exposure to troxacitabine elsewhere
- **Market exclusivity** with full new chemical entity patent protection



# MIV-818: Ongoing development and future plans

## Significant interest in MIV-818



- GLP safety studies completed in January 2018
- Documentation being prepared for submission to regulatory authorities
- Phase I study planned to start in second half of 2018



# Outlook

# Cash position and shareholder base

## CASH POSITION

Cash and ST investments  
SEK468m (USD 60m)

+

Directed offering: SEK155m  
(USD 20m) gross proceeds

Successful out-licensing:  
additional cash mid-term

Investments in R&D  
Estimated 18+ months  
cash runway

End 2017

## THE SHARE

Market Cap<sup>1)</sup>  
~967m SEK  
(~USD 125m)

International  
Ownership  
~31%

Top 20  
shareholders  
~51%

# Why Medivir?

**For more information:**

- Nasdaq Stockholm, ticker: MVIR
- [www.medivir.com](http://www.medivir.com)

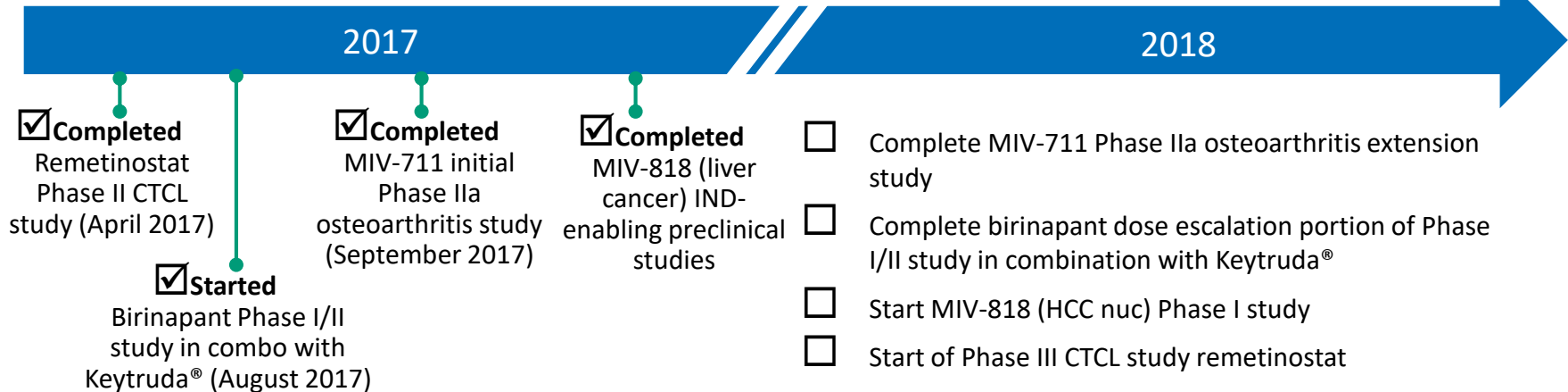
- Track record of delivery

3 new drugs into development in 2 years

2 products from idea to market

>20 global partnerships, multiple repeat partners

- Strong pipeline from discovery through clinical stages with upcoming catalysts



- Near-term opportunity for partnerships



# Additional slides



## Positive Phase II data: Confirmed efficacy on skin lesions and reduced itching

### Study design

- 60 patients with stage IA-IIA MF were randomized into three dose arms and treated for up to 12 months
- Index lesions were identified at baseline and assessed throughout the study
- The primary end-point was the proportion of patients with a complete or partial confirmed response assessed using the Composite Assessment of Index Lesion Severity (CAILS)

### Results

- Dose response: CAILS ORR & pruritus VAS responses
- Patients in the highest dose group had the highest proportion of confirmed responses (40%), including 1 complete response
- A positive effect was also seen on the severity of pruritus, a secondary objective in the trial

Dose	Once Daily		Twice Daily	
	1% (n=20)	0.5% (n=20)	1% (n=20)	1% (n=20)
<b>Lesion Outcomes</b>				
CAILS Confirmed Overall Response Rate (ORR)	4 (20%)	5 (25%)	8 (40%)	
Median Duration of CAILS Confirmed Response <sup>1</sup>	2 months	3 months	7 months	
<b>Pruritus Outcome</b>				
Patients with clinically significant pruritus at baseline (VAS ≥30 mm at baseline)	8/20 (40%)	6/20 (30%)	10/20 (50%)	
Confirmed response in patients with clinically significant pruritus at baseline	3/8 (37.5%)	3/6 (50%)	8/10 (80%)	

## Well tolerated without signs of systemic adverse events

### Results

- Across all the dose groups, remetinostat was well-tolerated without signs of systemic adverse effects, including those associated with systemic HDAC inhibitors
- A balanced safety profile across all three doses
- Minimal systemic exposure, even at the top dose
- Most patients remained on study for the maximum possible duration
  - Median time on treatment: 332 days (1% 2x/day dose)

Treatment-related Adverse Events seen in ≥1 Patients <sup>1</sup>	Once daily		Twice daily	
	1%	0.5%	1%	1%
Any Adverse Event	11	10	11	11
Pruritus	5	3	1	1
Any Other Skin <sup>2</sup>	9	10	11	11
Infections	3	1	0	0
Skin papilloma	0	0	1	1

## Positive trends across all Pain and other Patient Reported Outcomes

**MIV-711 showed consistent tendency to improve patient-reported symptoms, including pain, however did not reach statistical significance**

- A tendency was observed favoring both the 100mg and 200mg groups for patient-reported pain on the NRS scale (the primary endpoint)
- This tendency was observed consistently across other patient-reported symptoms such as:
  - Daily reporting of pain in E-diaries
  - Measures of pain associated with the daily activities
  - Satisfaction with the function of the diseased knee
- The findings on pain and other clinical symptoms from this study will enable the design of future, longer, studies aimed at demonstrating the effects of MIV-711 on both joint structure degeneration and pain and other clinical symptoms



# Drug discovery expertise: Nucleoside Prodrugs & Protease Inhibitors

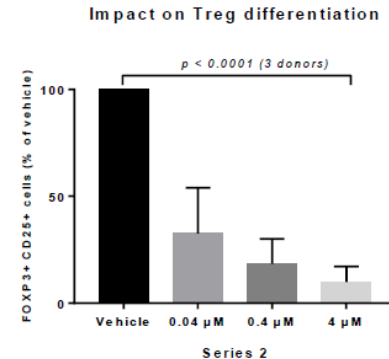
## Leukotide nucleotide prodrug for AML

- Aim to develop better tolerated and more effective agent to improve outcomes for patients with acute myeloid leukemia (AML) and other hematological cancers
- AML is a relatively rare cancer, with around 21,000 cases expected in the US in 2017. The prognosis is poor for many AML patients, especially those who are elderly, because they are often unable to tolerate the intensive treatments currently used to cure the disease.
- Five-year survival of patients in the US diagnosed with AML was 27% in the period 2007–2013

Market exclusivity with full NCE patent protection

## TRIP: T<sub>reg</sub> inhibitor project for immuno-oncology

- A novel biological target enabling selective suppression of T<sub>reg</sub> cells
- IP filed on the target itself and two classes of small molecule inhibitors
- Small molecules with highly potent compounds (K<sub>i</sub> values <15 nM against the molecular target)
- Increase of T<sub>eff</sub>/T<sub>reg</sub> cell ratio demonstrated *in vitro* and *in vivo*



## Coming events and financial reports

Date	Event
26-29 Apr 2018	OARSI World Congress on Osteoarthritis, Liverpool, UK
27 Apr 2018	Interim Report January - March 2018
3 May 2018	Annual General Meeting
1-5 Jun 2018	ASCO Annual Meeting, Chicago, US
5-8 Jun 2018	Jefferies Healthcare Conference, New York, US
19-20 Jun 2018	Citi Healthcare Conference, London, UK
25 Jul 2018	Interim Report January - June 2018