



PREDICT-Meso Investigator Meeting Introduction and Overview of Progress

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Glasgow
 Pleural
 Disease
 Unit



Today's Programme

ltem No.	Time	Item	Work package	Speaker					
1.	1-1.25	Introduction and an overview of PREDICT-Meso Progress and Activities	All	Prof Kevin Blyth					
2.	1.25-1.50	Meso-ORIGINS feasibility study results, final design and main study update	WP1	Dr Katie Ferguson					
3.	1.50-2.15	Making the most of mesothelioma histopathology	Wp1/2	Prof John Le Quesne					
4.	2.15-2.40	Integrated Analysis of Mouse and Man for Early Detection	Aligned to Wp3/4	Prof Daniel Murphy					
5.	2.40-3.10	Break							
6.	3.10-3.35	Insights from serum proteomics in the DIAPHRAGM dataset	Aligned to Wp2	Prof Crispin Miller/Dr Holly Hall					
7.	3.35-4.00	Mesothelioma organoid development: working towards macrophage-containing TME	WP3	Dr Marco Bianchi					
8.	4.00-4.25	Dysregulated mRNA Translation as therapeutic target in Mesothelioma	WP4	Prof Anne Willis/Prof Marion MacFarlane					
9.	4.25-4.50	Fully Automated Volumetric Tumour Segmentation using Deep Learning AI	WP5	Prof Kevin Blyth					

Plan



- Brief Background and Updated Timelines
- Overview of Progress by Work Package
- Website
- Additional Funding

Aim and Key Questions



Aim

To build a large cohort of **Benign-MPM tissue pairs**, plus the technologies and infrastructure needed to

- Design effective MPM therapies
- Deliver future human trials

Key Questions

- How does asbestos-driven chronic inflammation evolve into MPM? What are the key molecular events and vulnerabilities?
- Can individuals destined to develop MPM be identified at a pre-malignant stage?
- Can suitable treatment response tools be validated?





		2020				2021				2022			2023			2024			2025				
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	Meso-ORIGINS Recruitment						_		· II.	Prospe	ctive: n=50	10; 25 s	ites; Matche	tissue	63 MPM,	,1/21	10 MPN	N; Multiomic	risk-pro	filing			
-	Mesobank Conort Creation					Retrospectiv			ive: Ba	sanked FF matched to local FFPE; 82 MPM Cohort complete by M30													
≶	Predictive Marker Conort Recruitment					Prospective:				=50; Patients receiving experimental Rx; Barcelona/Madrid; FF & Serum; Discovery Set Cedres, Bar													
							Multiomic Database (Miller, Glasgow)																
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	Parlei DNA Seq. Genomic Drivers of MPM			st		Glasgow			Initially using 82 IVIPINI samples from Mesobank; plus 63 Matched BAPE/MPM as these evolve; Total 145														
2	RNA Seq: Transcriptomic Drivers of MPM	and Re				Cedres, Bar Esteller, Bar			WPW evolution vs MPM non-evolution FF samples as Discovery Set														
ž	Methylation: Epigenetic Drivers of MPM									Samples matched to Panel DNA Seq: high-throughput Infinium MethylationEPIC Bead Chip (Illumina)													
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\$	WP Report, including Validated Target-Drugs						Glasgow & Wiki			10AICOIDE	sy onne, can	inninge	0	Barroty		vo va	inducioni	or positive u	ug seree				
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	5.1 Integrated Bioinformatic Analysis												Mu	tiomic s	ignature:	develo	ops MP	M vs does no	t Ar	nalvsis i	in Gla	sgow	
	5.2 CT Image Anonymisation, Transfer to NCIMI									<u>п</u> ц	sing NCIMI	infrastr	ucture 100) CT sca	ns pre- &	post-	chemot	therapy			0.0.		1
9	5.2 External Validation of AI RECIST											ALI	RECIST algorit	hm valio	dated. on	timise	d by NC	CIMI					
5	5.2 Prospective Serum Mesothelin Sampling							via	ASSESS	Meso: 15	0 of total 7	00 recr	uited @ MO	Cohort	complete	by M	48 by u	upscaling site	from 6	-16			
	5.2 Mesothelin ELISA analysis							10			Samples	nosted	immediately	to Brist	ol Analys	ed in	hatches	s by Fujirebio	(funding	in plac	ce)		
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WP1: Network & Cohorts

Turin

Glasgow



Network Coordination

Cambridge

• Cohort Building

Glasgow

- Data Integration & Sharing
- Education & PhD Training
- Governance
- PPI & Engagement





WP1 Progress



- Appointment of PREDICT-Meso Project Manager: Alex MacPherson
- Funding & Collaboration Agreement \rightarrow Funds Released to UK sites
- Network Governance: PMG, Steering Group, Tissue & Data Access Board, Membership access and terms
- PREDICT-Meso Research Tissue Bank (RTB): REC Approval March 2021
- Completion of multi-centre Meso-ORIGINS Feasibility Study: Update later...
- Meso-ORIGINS Protocol and documentation complete, REC Approval Nov '21
- CTU Database design ongoing, ~12 recruitment sites in setup
- <u>www.predict-meso.com</u> coming soon **Second Predict_Meso** live

Meso-ORIGINS: <u>Meso</u>thelioma <u>O</u>bservational study of <u>RI</u>sk prediction and <u>G</u>eneration of benign-meso tissue pairs, <u>I</u>ncluding a <u>N</u>ested MRI <u>S</u>ub-study

Arm A

- 500 patients with asbestos exposure and an initial benign pleural biopsy
- Recruited post-biopsy.
- FFPE biopsy retrieval and 2-year surveillance
- Repeat biopsies if Mesothelioma evolution suspected
- Invitation to repeat biopsy in 145 patients with benign follow-up
- Risk profiling at baseline: serum proteomics, breath metabolomics, perfusion MRI

Arm B

- Initial sample of 39 patients with suspected Mesothelioma
- Recruited prior to Thoracoscopy
- Multi-region pleural biopsies for heterogeneity analyses



Northumbria

GRI, Glasgow

Paislev

PREDICT-Meso

Spatial Heterogeneity





Kiyotani et al, Oncoimmunology 2017

Zhang et al, Nature Comms 2021

WP2: Targets & Vulnerabilities





- Molecular Processes
- Key Vulnerabilities
- Heterogeneity
- Vertical Integration
- Validation of models

Changes:

- 1. Panel DNA Seq \rightarrow WES
- 2. FFPE only: Restructure Transcriptome Analysis



PREDICT-Meso

WP2 Progress

- DNA Panel Seq not available (CCG Max): Narrower Panel v WES/WGS?
 - WES likely to be best approach \rightarrow Pilot and Tender Process ongoing
 - 5 Benign-Meso Pairs from Glasgow being retrieved (Craig Dick)
- FF preferred over FFPE for Transcriptomics
- However, FF re-biopsy at Thoracoscopy feasible in ~50% in Meso-ORIGINS Feasibility Study: Mix of FFPE/FF v all FFPE?
 - FFPE samples throughout in Meso-ORIGINS (Prospective)
 - FF Discovery RNA Seq not feasible; restructure samples sent to VHIO



WP2 Progress

- Central Pathology Review and DNA/RNA extraction pipeline:
 - Targeting of Epithelial v Stromal Compartments?



WP3 and WP4: Pre-clinical models and Drugs







WP3 and 4 Progress

3.1 *In vitro* model generation and validation

- Cell lines from pleural fluid. Collection protocol (McFarlane, Murphy, Coffelt + Kanellakis)
 > Unprocessed samples from sites close to Cambridge/Glasgow
- Organotypic models with retained macrophages. Update later from Marco Bianchi
- 3.2 In vivo GDMM Expansion and Validation
- Maintained and expanded. Update later from Daniel Murphy
- 3.3 High throughput drug screening
- Planned activities on schedule
- 4 Target-Drug Validation
- BoxA (HMGB1, + anti-tumour immunity) → GDMM soon (Mezzapelle *et al*, EMBO Mol Med 2021)
- Update later from Anne Willis re mTORC1/2 inhibition (Grosso et al, Nat Comms 2021)

Translation of Human MRI endpoints to Mouse Models

Human Meso at Local Anaesthetic Thoracoscopy: T1N0M0 Epithelioid. Both images are from left pleural space after drainage of associated large pleural effusion. Arrows highlight multiple areas of tumour. Ao: Aorta, LLL: Left lower lobe, LHD: left hemidiaphragm



Thoracic MR images of human Mesothelioma: 3T Siemens Magnetom scanner, Glasgow Imaging Centre of Excellence. Left panel: T1-weighted, coronal, contrast-enhanced (IV Gadovist) showing nodular left pleural tumour (arrows), ipsilateral effusion and compressed lung. Right panel: T2-weighted axial showing ipsilateral effusion in white (see red *).





Wildtype Mouse:

Normal post-mortem appearances



Pleural Space



July '21: Pilot work in wildtype mice





Thoracic MR images of wild type mouse: 7-T Bruker Biospec scanner, Glasgow Experimental MRI Centre. Left panel: T1-weighted, axial showing cardiac structures (* on left ventricle) but no pleural effusion nor mass. Right Panel: T2-weighted, contrast enhanced (IV Magnevist) following intra-pleural injection of 250 µl saline to induce a small right pleural effusion (arrow)

Meso GDMM: Extensive post-mortem tumour (arrows) after pleural effusion drained



Pleural Space



GDMM imaging planned, 7T v 1T, effusion +/- more complex eg volumetry, perfusion

WP5: Risk and Response







Blyth Irion Glasgow Manches

Irion Van Meerbeeck Manchester Antwerp

Gleeson Bibby Oxford Bristol

- Additional longitudinal human cohorts
- RISK of Benign Meso Evolution
 - Serum Proteomics
 - Exhaled Breath Metabolomics
 - Perfusion MRI
- RESPONSE: AI volumetric imaging and circulating markers
- Critical for future trials





WP5.1 Progress

Risk Profiling (@ Benign Inflammation in Meso-ORIGINS)

- Perfusion MRI Manual complete. Training, Software and Remote Access → Matheus Zanon and Stephan Altmayer
- Breath Metabolomic training videos complete. Kevin Lamote
- Serum Proteomics:
 - DIAPHRAGM study, Tsim *et al*, JTO 2021
 - Meso v Asb Exp Controls:
 - Se 75% Sp 82%, AUC 0.855
 - Further work ongoing

Site Feasibility and Recruitment

Check for up

Serum Proteomics and Plasma Fibulin-3 in

Rehan Naseer, MbChB,⁴ John Edwards, PhD,⁴ Cyrus Daneshvar, MD,⁴ Reketh Panchal, Mres.⁴ Mohammed Munawar, MD,⁴ Bachel Ostroff, Pf

Differentiation of Mesothelioma From Asbestos-Exposed Controls and Patients With Other Pleural Diseases

> insley, MSc,⁶ Stephen Clark,⁶ Matthew Evison, MbChB,⁴ Jayne Holme, MD, eron, PhD,⁶ Davand Sharma, MbChB,⁴ Angela Wright, MbChB,⁶ MV, PhD⁷ Dunlats Grieve, MD⁷ Jalia Ioneccu, MD⁷ David P Reven, MbChB







WP5.2 Progress

Response Biomarkers

- Circulating Markers in ASSESS-meso
 - Prospective, multi-centre, longitudinal observational cohort study
 - Longitudinal banking of pleural fluid and blood (plus data and imaging)
 - 15 of 20 planned sites now open: Serum mesothelin analyses planned
 - Infrastructure and banked samples leveraged in:
 - IAMMED-Meso CRUK Programme: Details later...
 - ctDNA Meso Biomarker: Collins Lab, UBC
- Automated Volumetric Segmentation using Deep Learning AI
 - Prototype complete and *manuscript under review*. Details later...





People and Partners 🗸 Research 🗸 Updates and Events Patients and Families Research and Tissue Bank

PRE-MALIGNANT DRIVERS COMBINED WITH TARGET-DRUG VALIDATION IN MESOTHELIOMA

PREDICT-MESO IS AN INTERNATIONAL NETWORK OF RESEARCHERS FROM ACROSS THE UK AND EUROPE INTERESTED IN THE STUDY OF MESOTHELIOMA, AN INCURABLE CANCER MOST Mesothelioma is preceded by decades of pleural inflammation providing a window of opportunity for precision prediction and early treatment that the Network wishes to explore. Together the teams hope to better understand how mesothelioma develops from its early stages and translate this into more effective diagnosis and treatment for patients.

Additional Funding



Summary



- Despite challenges there has been considerable progress
- Timetable has effectively been shifted back by 1 year; *on-schedule*
- Moving into tissue collection phase, feeding downstream pre-clinical pipelines
- Final design decisions re tissue pipeline and molecular analysis
- COVID pressures will make recruitment to Meso-ORIGINS challenging
- Increased visibility soon via <u>www.predict-meso.com</u>
- Tissue and data sharing, new collaborations and projects, additional funding
- Project Manager: alexandrea.macpherson@glasgow.ac.uk

Acknowledgements

Glasgow Pleural Disease Unit Selina Tsim Laura McNaughton Carolyn MacRae

Research Fellows

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Laura Alexander Caroline Kelly Ann Peek Jim Paul Rob Jones Steven Clark

CRUK Beatson Institute Glasgow, U of Glasgow

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Glasgow Biorepository

Clare Orange Craig Dick William Sloan

Glasgow CRF Nurses

Patricia Clark Diane Murray **Glasgow Research imaging** John Foster Rosie Woodward Tracey Hopkins

Molecular Pathology Nicola Williams Alan Winter

Patients and Families Study participants Julie & Wilma Roberts Angela Elliot

Meso-ORIGINS Feasibility Sites

Nick Maskell, Hugh Welch (Bristol) Naj Rahman, Rachel Mercer (Oxford) Matt Evison, Rachael Kelly, Jenny King (Manchester)

Leicester Dean Fennel



MRC Toxicology Unit Marion MacFarlane Anne Willis

MesobanK/Papworth Robert Rintoul Sallyanne Meakins

UCL Sam Janes Ioannis Psallidas

Manchester Klaus Irion Juliette Novasio

ASSESS-Meso Anna Bibby Jenny Symonds

Italy

Marco Bianchi Isabella Righi Mario Papotti

Spain

Manel Esteller Susanna Cedres Enriqueta Filip

Belgium Jan Van Meerbeeck Kevin Lamote

Brazil Bruno Hochhegger

NCIMI Fergus Gleeson Claire Bloomfield

The June Hancock

Mesothelioma

Research









đ











Partners





Questions or Comments



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Identified at outpatient clinic, MDT meetings or during inpatient reviews, or via Arm A

INCLUSION CRITERIA

- History of asbestos exposure or imaging compatible with this (e.g., pleural plaques)
- Any form of pleural biopsy within last 1 year showing evidence of associated pleural inflammation (e.g., benign fibrinous pleurisy, non-specific pleuritis, atypical mesothelial proliferation)

VISIT A1 (Day 1) CONSENT, REGISTRATION, BASELINE DATA & SAMPLES

 Informed written consent to at least banking of any previous and future pleural tissue samples

Study introduced, provision of PIS and written consent. Patient registered with CTU. Baseline

data recorded, bloods, exhaled breath +/- pleural fluid collected. Arrange retrieval of pleural

es) • Any cytologically or histologically

confirmed pleural malignancy*

EXCLUSION CRITERIA

- Any pleural infection including TB
- Granulomatous pleural inflammation
- Any specific pleuritis
- diagnosed (e.g. RA)
- O Previous Pleurodesis
 *Clinical suspicion of MPM

after initial negative (benign)

biopsy is NOT an exclusion

biopsy from local pathology and transport to research tissue bank. At participating sites, MRI sub-study introduced, PIS provided, written consent, CTU registration. MRI safety questionnaire completed, and MRI appointment scheduled NB: Patients declining F/U visits can consent to retrieval and banking of previous and subsequent biopsy & fluid samples.





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ZONE	APPEARANCE	RESEARCH E	(3) CLINICAL			
		Ideally 4-6 fi	BIOPSIES			
1		🗖 No	🛛 Yes	Pot(s) #	🗆 Yes	
2		🗆 No	🛛 Yes	Pot(s) #	🛛 Yes	
3		🗆 No	🗆 Yes	Pot(s) #	□ Yes	
4		🗆 No	🛛 Yes	Pot(s) #	🛛 Yes	
5		🗆 No	🛛 Yes	Pot(s) #	🗆 Yes	
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10		🗆 No	🛛 Yes	Pot(s) #	🗆 Yes	
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