ACEMID

AUSTRALIAN CANCER RESEARCH FOUNDATION

# The Role of Whole Body Imaging & the Opportunity for Screening

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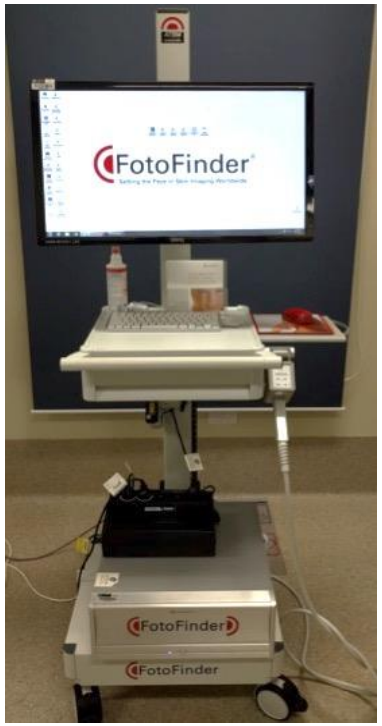
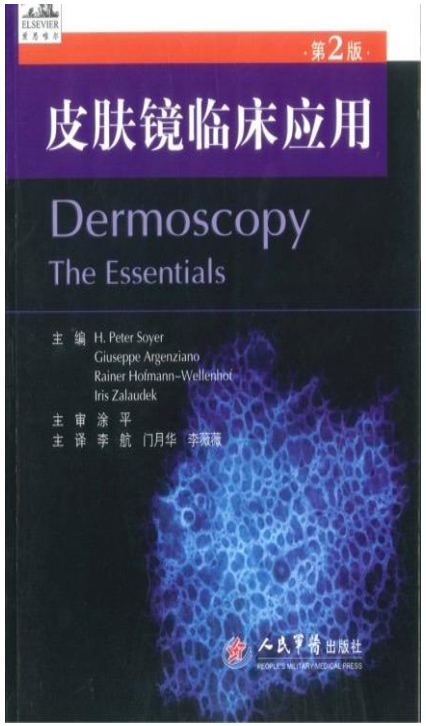
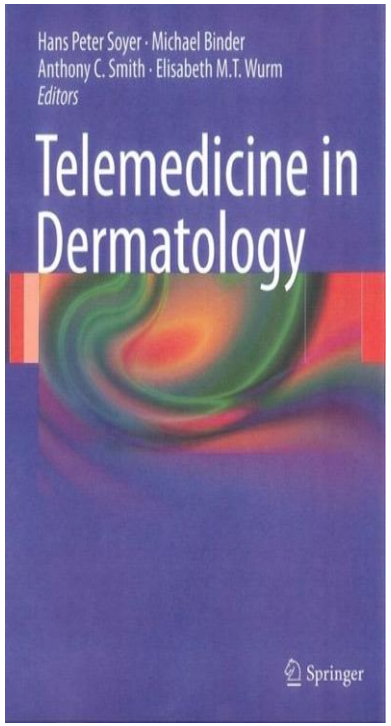
THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

# Conflicts of Interest





e-derm-consult GmbH
MoleMap Australia
iDoc24
MetaOptima Inc
FotoFinder
Canfield Scientific Inc

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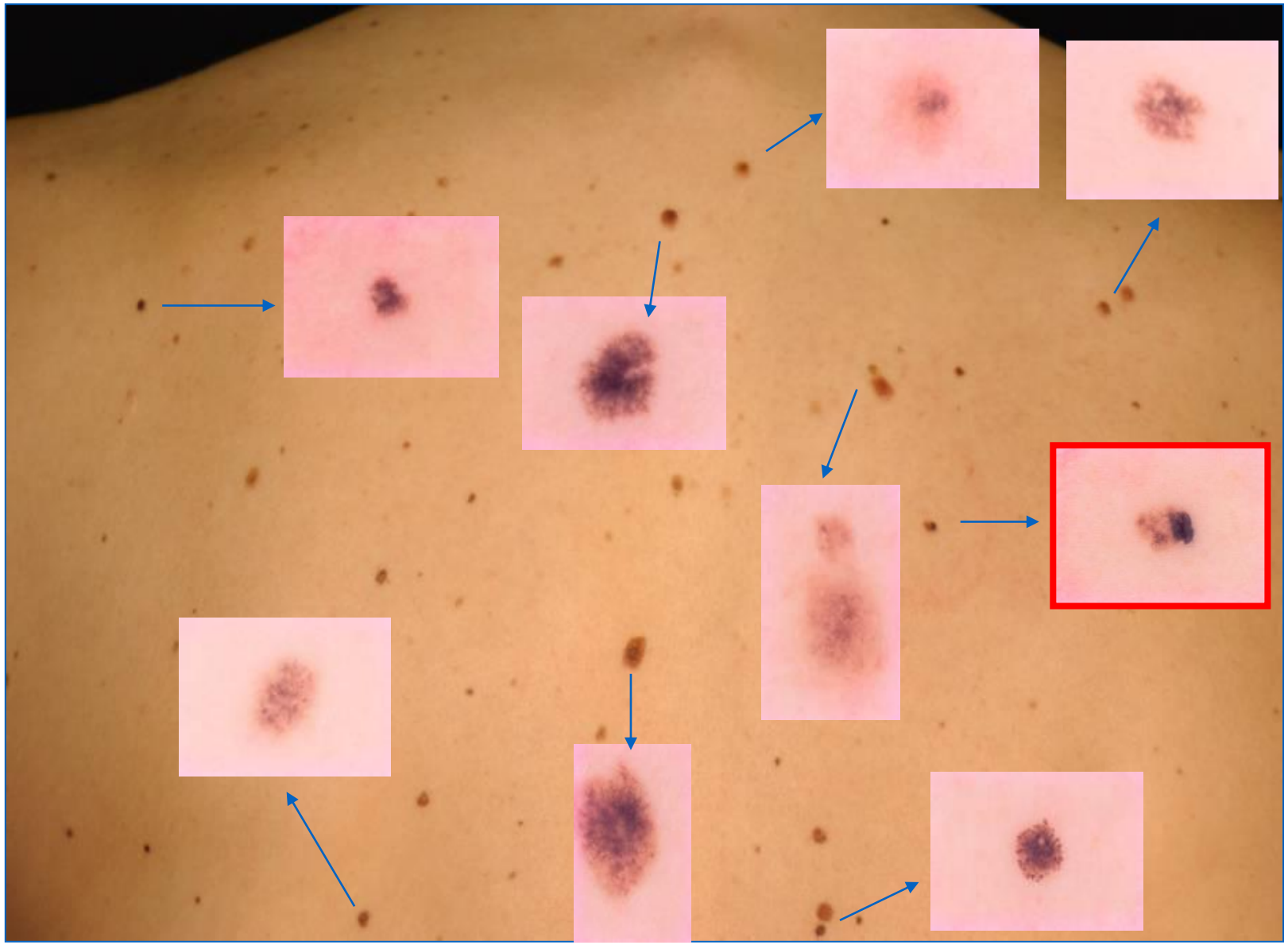
# The Clinical Challenge



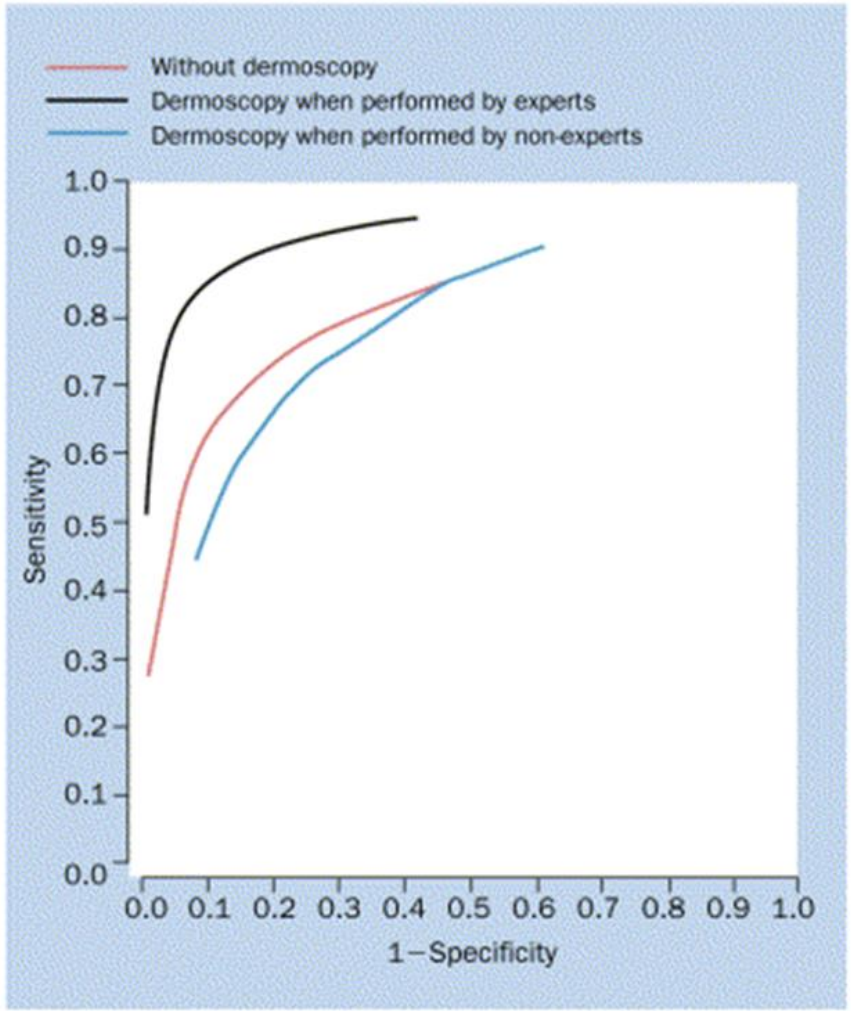
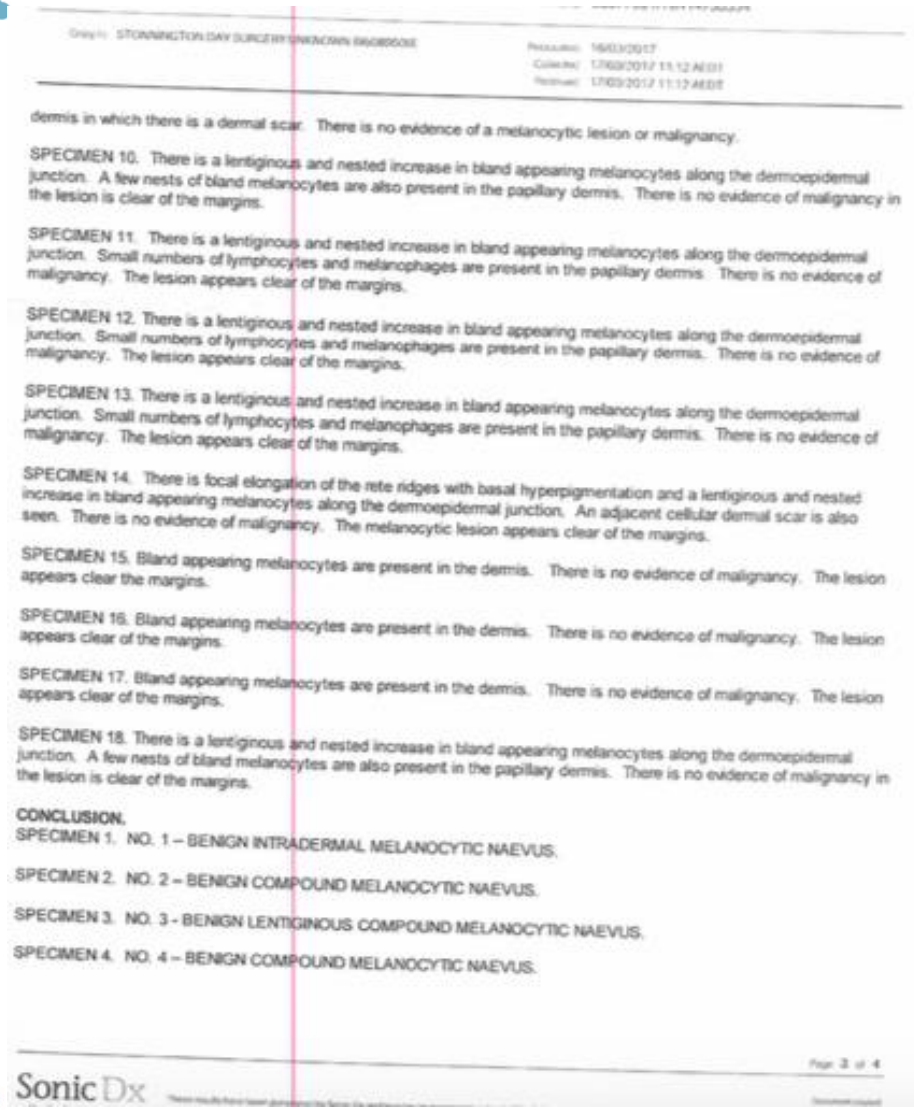



**Figure 2.** SROC curves for the performance of the clinical diagnosis without dermoscopy (red line), dermoscopy by experts (black line), and dermoscopy by non-experts (blue line).

Kittler H et al. Diagnostic accuracy of dermoscopy. Lancet Oncology 2002; 3: 159

# The Clinical Challenge

# Reducing Unnecessary Biopsies



dermis in which there is a dermal scar. There is no evidence of a melanocytic lesion or malignancy.

SPECIMEN 10. There is a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. A few nests of bland melanocytes are also present in the papillary dermis. There is no evidence of malignancy in the lesion is clear of the margins.

SPECIMEN 11. There is a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. Small numbers of lymphocytes and melanophages are present in the papillary dermis. There is no evidence of malignancy. The lesion appears clear of the margins.

SPECIMEN 12. There is a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. Small numbers of lymphocytes and melanophages are present in the papillary dermis. There is no evidence of malignancy. The lesion appears clear of the margins.

SPECIMEN 13. There is a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. Small numbers of lymphocytes and melanophages are present in the papillary dermis. There is no evidence of malignancy. The lesion appears clear of the margins.

SPECIMEN 14. There is focal elongation of the rete ridges with basal hyperpigmentation and a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. An adjacent cellular dermal scar is also seen. There is no evidence of malignancy. The melanocytic lesion appears clear of the margins.

SPECIMEN 15. Bland appearing melanocytes are present in the dermis. There is no evidence of malignancy. The lesion appears clear the margins.

SPECIMEN 16. Bland appearing melanocytes are present in the dermis. There is no evidence of malignancy. The lesion appears clear of the margins.

SPECIMEN 17. Bland appearing melanocytes are present in the dermis. There is no evidence of malignancy. The lesion appears clear of the margins.

SPECIMEN 18. There is a lentiginous and nested increase in bland appearing melanocytes along the dermoepidermal junction. A few nests of bland melanocytes are also present in the papillary dermis. There is no evidence of malignancy in the lesion is clear of the margins.

**CONCLUSION.**

SPECIMEN 1. NO. 1 – BENIGN INTRADERMAL MELANOCYTIC NAEVUS.

SPECIMEN 2. NO. 2 – BENIGN COMPOUND MELANOCYTIC NAEVUS.

SPECIMEN 3. NO. 3 - BENIGN LENTIGINOUS COMPOUND MELANOCYTIC NAEVUS.

SPECIMEN 4. NO. 4 – BENIGN COMPOUND MELANOCYTIC NAEVUS.

SonicDx

Copy to STONNINGTON DAY SURGERY UNKNOWN [950895091]

Requested 16/03/2017
Collected 17/03/2017 11:12 AEDT
Received 17/03/2017 11:12 AEDT

SPECIMEN 5. NO. 5 – BENIGN COMPOUND MELANOCYTIC NAEVUS.

SPECIMEN 6. NO. 6 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS.

SPECIMEN 7. NO. 7 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS.

SPECIMEN 8: NO. 8 – BENIGN COMPOUND MELANOCYTIC NAEVUS.

SPECIMEN 9: NO. 9 – UPPER DERMAL SCAR.

SPECIMEN 10: NO. 10 – BENIGN LENTIGINOUS COMPOUND MELANOCYTIC NAEVUS.

SPECIMEN 11: NO. 11 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS.

SPECIMEN 12: NO. 12 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS.

SPECIMEN 13: NO. 13 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS.

SPECIMEN 14: NO. 14 – BENIGN LENTIGINOUS JUNCTIONAL MELANOCYTIC NAEVUS AND ADJACENT DERMAL SCAR.

SPECIMEN 15: NO. 15 – BENIGN INTRADERMAL MELANOCYTIC NAEVUS.

SPECIMEN 16: NO. 16 – BENIGN INTRADERMAL MELANOCYTIC NAEVUS.

SPECIMEN 17: NO. 17 – BENIGN INTRADERMAL MELANOCYTIC NAEVUS.

SPECIMEN 18: NO. 18 – BENIGN LENTIGINOUS COMPOUND MELANOCYTIC NAEVUS.

# Reducing Unnecessary Biopsies

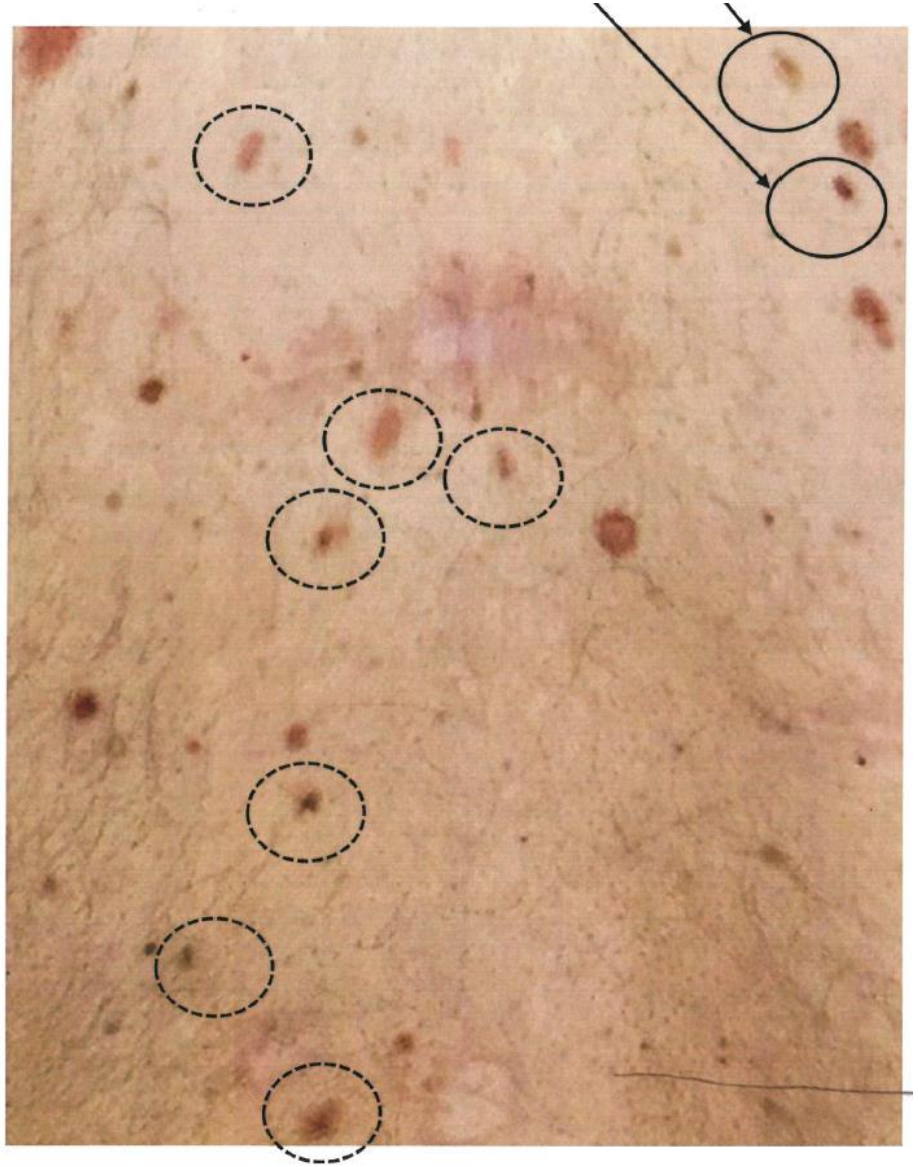
**Participant case study:**
57 year old male with dysplastic naevus syndrome
Previous diagnoses of a Level 2 melanoma in 2015 and a Level 1 melanoma in March 2018
GP recommended excision of circled naevi in Juli 2018, diagnosed as two Level 1 melanomas

June 2018

September 2018 (3 months)

December 2018 (6 months)

# Patient Feedback



# Reducing Unnecessary Biopsies

**Participant case study:**
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June 2018

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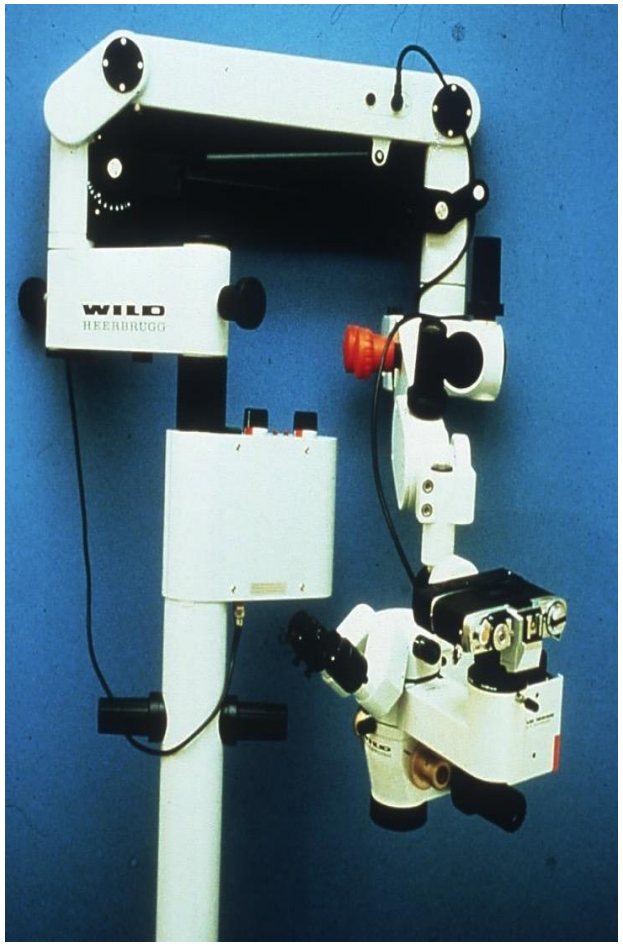
# Imaging Solutions: Dermoscopy




Non-invasive in vivo imaging technique with 10X magnification & illumination

Skin covered with a transparent medium or a polarised filter to minimise skin surface reflectance

Soyer HP et al. Early diagnosis of malignant melanoma by surface microscopy. [Letter to the Editor] Lancet 1987; 2: 803

# Imaging Solutions: Total-Body Photography

August 1988

## Total-Body Photographs of Dysplastic Nevi

William Slue; Alfred W. Kopf, MD; Jason K. Rivers, MD, FRCPC

*Archives of Dermatology* 124.8 (1988): 1239-1243.

First article describing the use of total-body photography to image naevi.

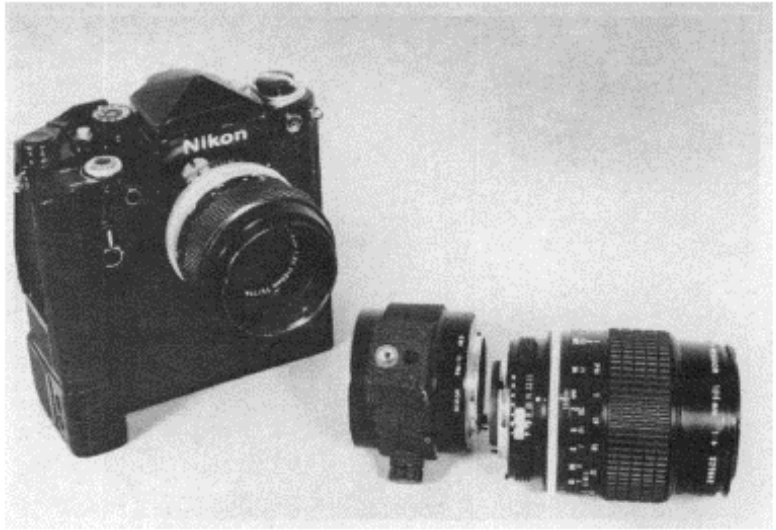



Fig 1.—At left is Nikon camera fitted with motor drive and 55-mm macro lens. This unit is used for 23 of 24 photographs. At right are Micronikkor (Nikon) 105-mm lens and Pn11 extension tube that are used for photographing the 1:1 image.

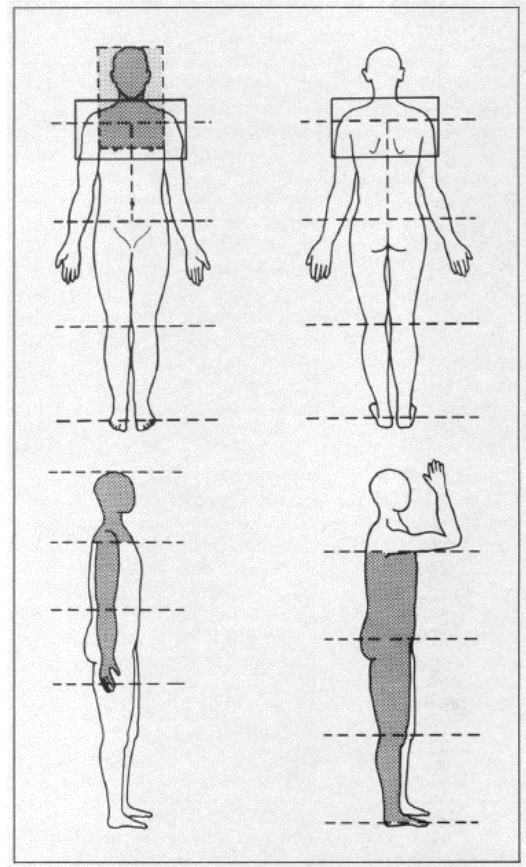


Fig 2.—Illustrations of different views taken for total-body photographs. Sites photographed are bound by dotted lines or solid-line rectangles. Top, On anterior and posterior surfaces of body, all demarcated areas (shaded and unshaded) are photographed. Bottom, On lateral aspects of body, only shaded areas are photographed.

# Imaging Solutions: Total-Body Photography

**1: Images of melanoma**

**(a)** View of posterior thighs of a patient at initial visit (baseline photograph).

**(b)** View of posterior thighs at review visit two years later, showing enlargement and darkening of a pigmented lesion on the right upper medial leg (arrow). Histopathological examination of this lesion showed level II superficial spreading melanoma, measuring 0.49 mm in maximum tumour thickness and arising in a preexisting dysplastic compound naevus.

**(c)** Macroscopic view of the changing lesion.

**(d)** Skin surface microscopy (epiluminescence microscopy) of the lesion.

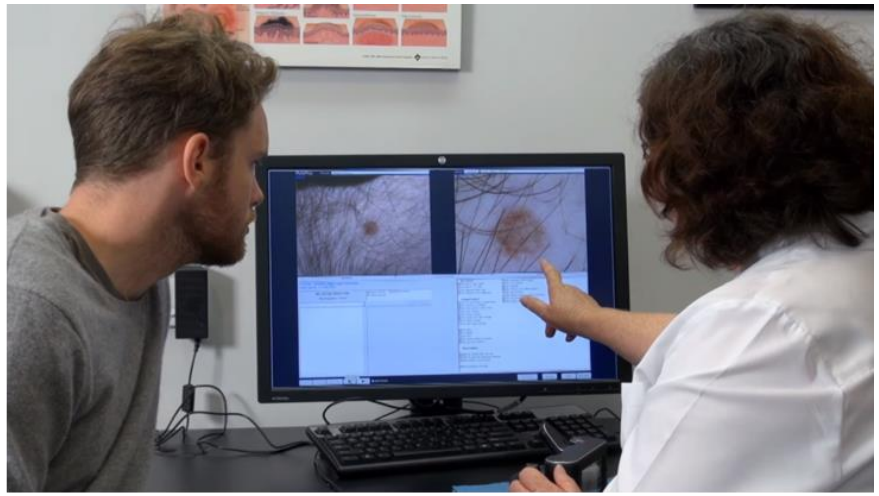
A high incidence of melanoma found in patients with multiple dysplastic naevi by photographic surveillance

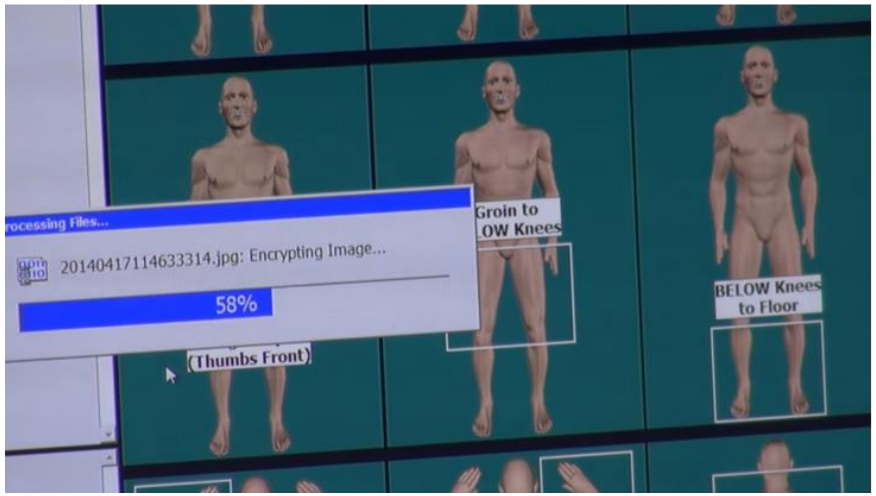
John W Kelly MD BS, FACD, Josephine M Yeatman MB BS, GradDipEpi, Cheryl Regalia, Grahame Mason MB BS, FRCPA, Amanda P Henham BAppSci(Photog), SRN

*Medical Journal of Australia* 167.4 (1997): 191-194.

First article using photographic surveillance to monitor changes in naevi (two year follow-up).
Now adopted into various surveillance services for melanoma worldwide.

# Imaging Solutions: MoleMap

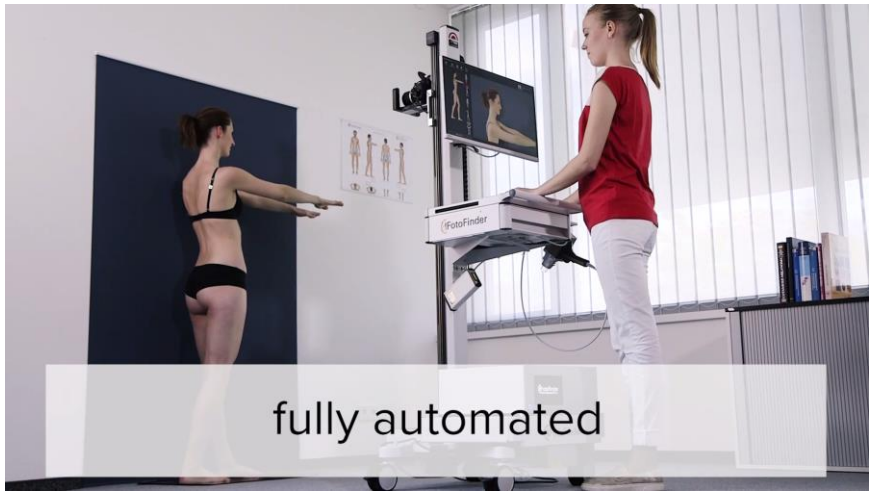





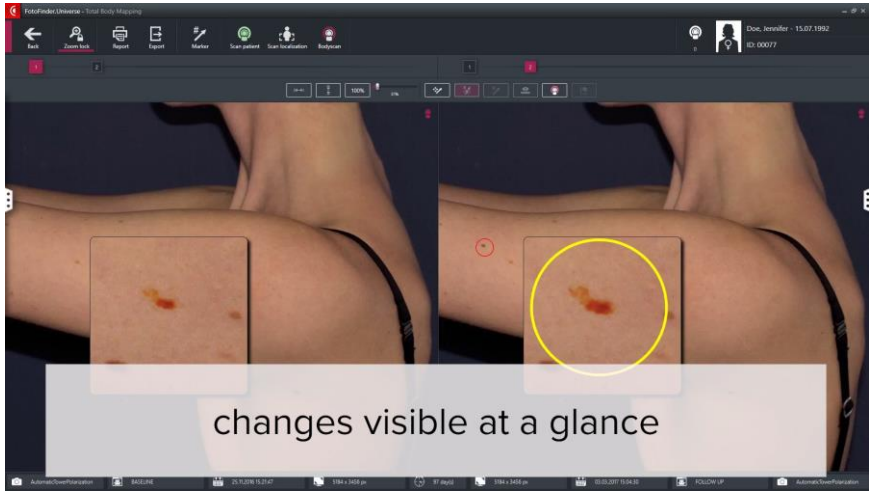

Health service model for melanoma surveillance

- 250,000+ patients (NZ, Australia) have chosen MoleMap
- 5 million+ moles checked
- 30+ clinics around Australia
- Whole-body approach to patient imaging

# Imaging Solutions: Fotofinder



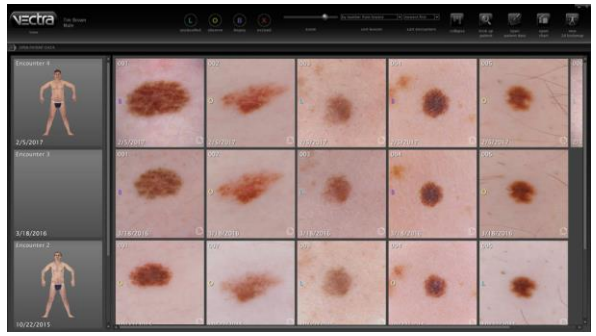



FotoFinder ATBM (Automated Total-Body Mapping)

Offers consistent and automatic whole body documentation including:

- Mole mapping
- Psoriasis + computer-assisted PASI assessment
- Vitiligo
- Inflammatory skin conditions

# Imaging Solutions: Canfield Scientific


Canfield's Vectra WB360 Imaging System

- Captures nearly the entire skin surface in a 3D image
- Macroquality resolution
- Imaging takes a few seconds
- Lesions can be annotated between timepoints with dermoscopy
- Captures details of both pigmented lesions and inflammatory skin conditions (e.g. psoriasis, vitiligo)

# Imaging Solutions: 3D Imaging in Clinics

## Clinical Perspective of 3D Total Body Photography for Early Detection and Screening of Melanoma

*Jenna E. Rayner[1,2], Antonia M. Laino[1,2], Kaitlin L. Nufer[1], Laura Adams[1], Anthony P Raphael[1], Scott W Menzies[3,4] and H. Peter Soyer[1,2]*

Front Med (Lausanne) 2018 May 23;5:152.

First article establishing the use of 3D total body photography to improve early melanoma detection.

# Imaging Solutions: 2D vs 3D Photography

- Time consuming.
- Requires multiple separate images of the patient to be taken in a variety of anatomical positions.
- Manipulation of a 3D surface into a 2D photograph can compromise the accuracy of the image.

- Rapid acquisition.
- Single anatomical pose.
- Image in 3D, more closely reflecting clinical exam.
- Accurate spatial representation of body and naevi.

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2018 Grant Application for the ACRF ACEMID

# ACRF AUSTRALIAN CENTRE OF EXCELLENCE IN Melanoma Imaging & Diagnosis

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

THE UNIVERSITY OF SYDNEY

MONASH University

## Executive Committee

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Project & QLD Lead
The University of Queensland

**Prof Graham Mann**
NSW Lead
The University of Sydney

**Dr Victoria Mar**
VIC Lead
Monash University

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**Prof Monika Janda**
Research Program Committee Lead
The University of Queensland

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The University of Sydney

**Prof Pablo Fernandez Penas**
The University of Sydney

**A/Prof Chris McCormack**
Peter MacCallum Cancer Centre

**Prof Richard Scolyer**
The University of Sydney

**Prof Scott Menzies**
The University of Sydney

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**Prof Joanne Aitken**
Cancer Council Queensland

**A/Prof Anne Cust**
The University of Sydney

**A/Prof Rachael Morton**
The University of Sydney

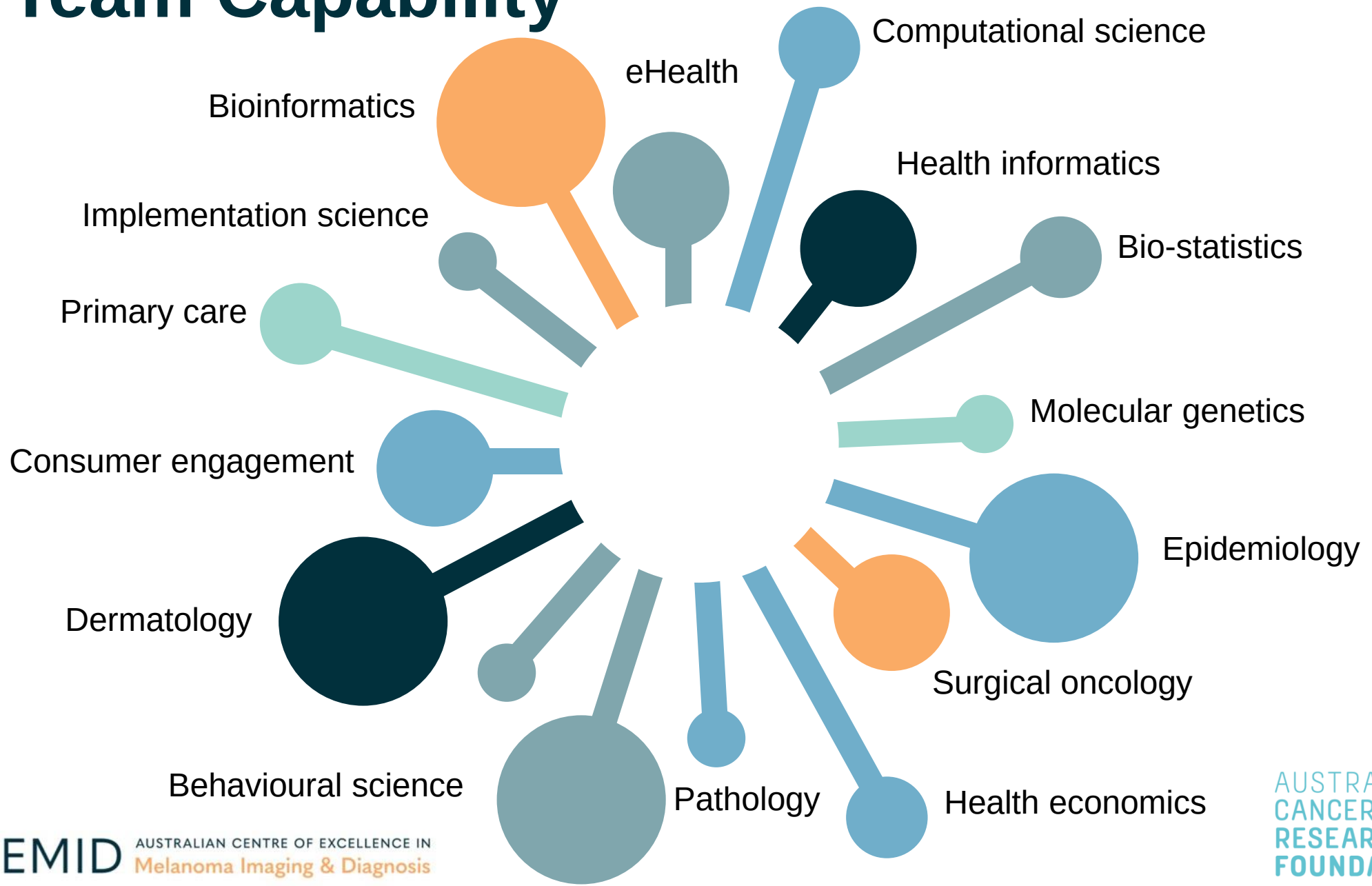
## Informatics

**Prof Len Gray**
The University of Queensland

**Dr Liam Caffery**
The University of Queensland

**Prof Rory Wolfe**
Monash University

# Team Capability



# Health Service Partners

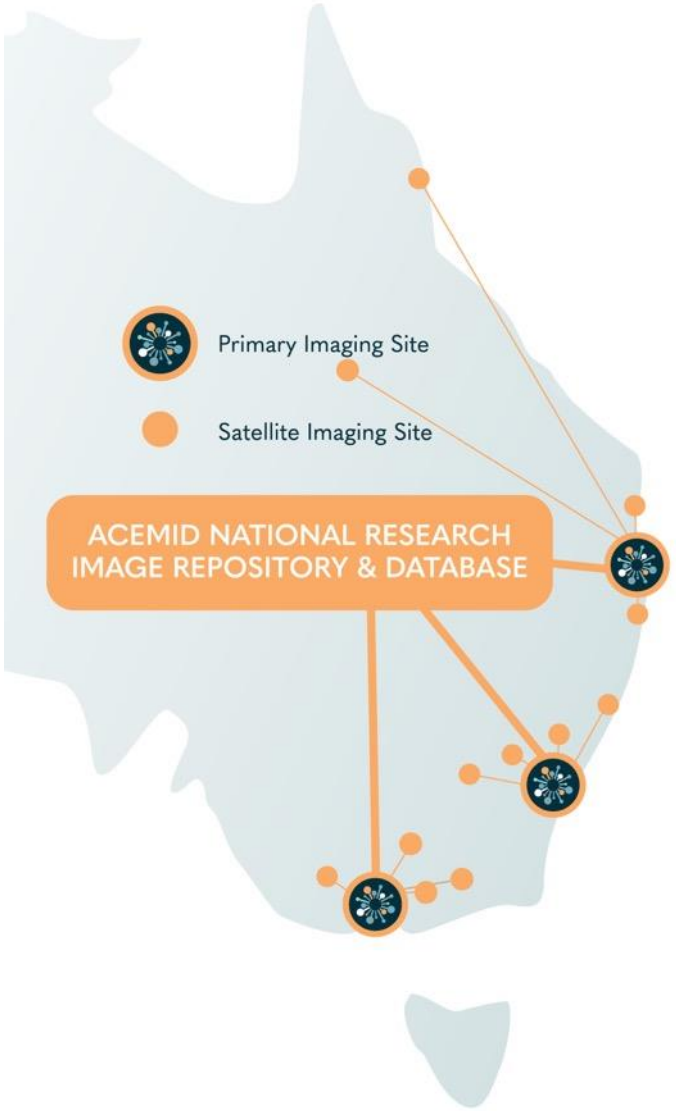
**Cash-support: $2,290,000**
**In-kind support: $6,332,522**

## QUEENSLAND

Cairns and Hinterland Queensland Government
Metro South Health Queensland Government
Gold Coast Health Queensland Government
eHealth Queensland Queensland Government
Queensland Government North West Queensland Health
Sunshine Coast Hospital and Health Service
Exceptional people. Exceptional healthcare.

## VICTORIA

skin&cancer foundation inc
healthy skin by dermatologists
AlfredHealth
Peter Mac
Peter MacCallum Cancer Centre
Victoria Australia
State Government Victoria
Department of Human Services




## NEW SOUTH WALES

Melanoma Institute Australia
NSW GOVERNMENT Health Sydney Local Health District
NSW GOVERNMENT Health Western Sydney Local Health District
NSW GOVERNMENT eHealth

## ADDITIONAL PARTNERS

Cancer Council Queensland
mpa MELANOMA PATIENTS AUSTRALIA
qcif
brisbane diamantina health partners
Innovative healthcare through partnerships
TRI TRANSLATIONAL RESEARCH INSTITUTE AUSTRALIA

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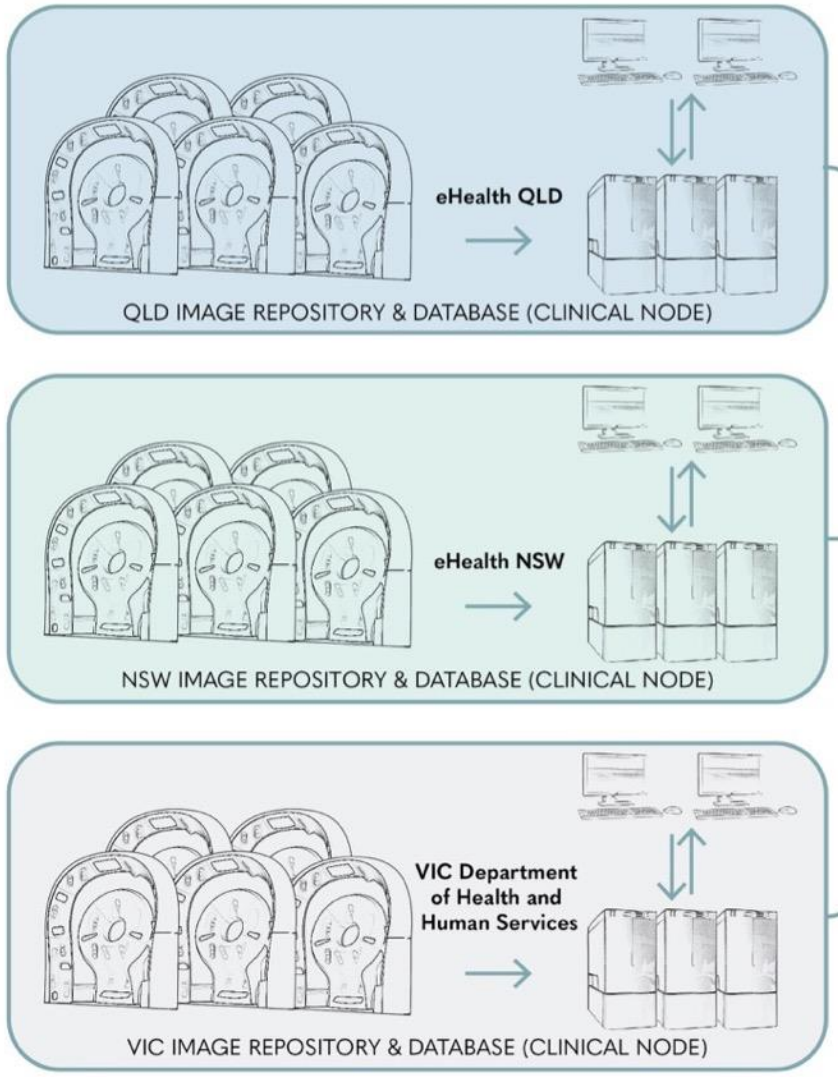
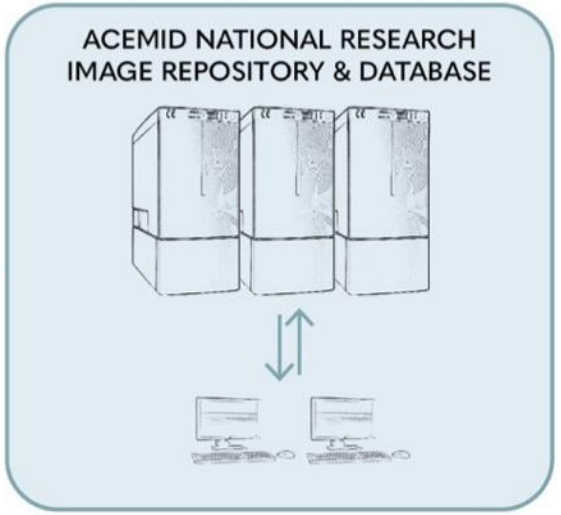
# Research & Clinical Network




- 3,000 visits / instrument / year.
- 100,000 3D avatars and >5M naevi over the next 3 years.
- 50% with 1 and 2 year follow-up imaging.




The world's largest and most comprehensive skin imaging database

# Mission Statement

**Mission**

**Transform melanoma early detection using total body surveillance to enhance individual lesion management**

**Research aims**

**Diagnostic Intelligence**
Improve early detection and risk stratification using total body images integrated with history, clinical phenotype and genotype.

**Health Service Evaluation**
Total body imaging will reduce unnecessary biopsies by better 'hit' rate, improving cost for patients and the healthcare system.

**Informatics**
Integrate total body imaging into a telehealth network and EMR through implementation of image standards.

**Critical infrastructure**

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ACRF funded telemedicine network of 15 total body imaging research nodes

**Outcomes**

- World's largest, most comprehensive skin imaging database.
- Reliable solutions for melanoma early detection.
- Facilitate artificial intelligence.

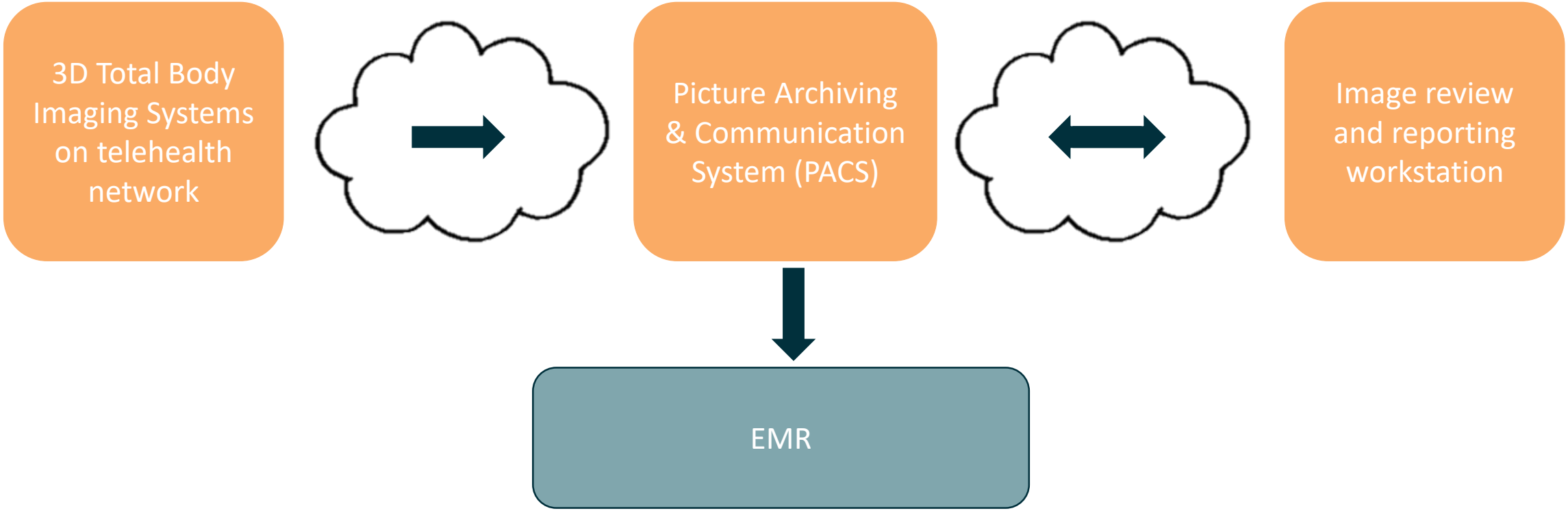
- Research-validated ACRF infrastructure underpinning the first nationwide melanoma screening trial.

# Clinical Implementation

Images acquired at remote sites in DICOM format

Image stored in DICOM repository

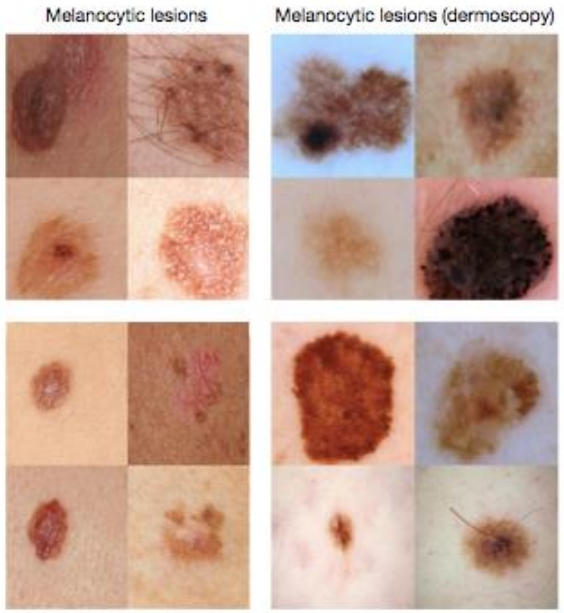
Dermatologist reviews images using DICOM format



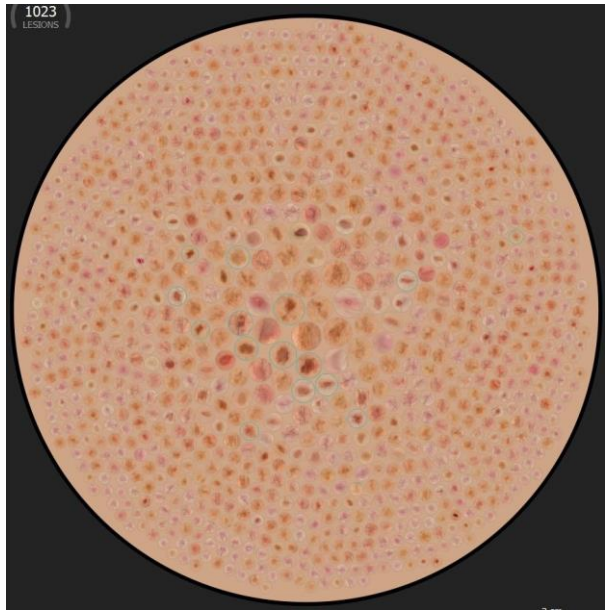

Referring or reporting clinician uses EMR to view images via enterprise image viewer

# Single Lesion vs Total Lesions Capture

**One lesion, one time-point, limited meta-data**




**All lesions, several time-points, comprehensive meta-data**




## Current status

- Lesion-focused analysis from individuals.
- Non-standard imaging.
- Limited / variable meta-data.
- No change.

## ACRF ACEMID capabilities

- Complete lesions assessment from all participants.
- Standardised and reproducible imaging.
- Extensive history, phenotype and genotype meta-data.
- Sequential imaging.

# Genetic Predisposition To Melanoma

3 Melanomas
87 Naevi
Dark brown hair
Brown eyes
Fair skin

Heterozygote for albinism

Tyr
PALB2
LIG1
MC1R r/r

DNA repair defect

MC1R WT/r
ATM
RAD54L
SETDB1
POLG

2 Melanomas
1 Naevi
Light brown hair
Blue eyes
Fair skin

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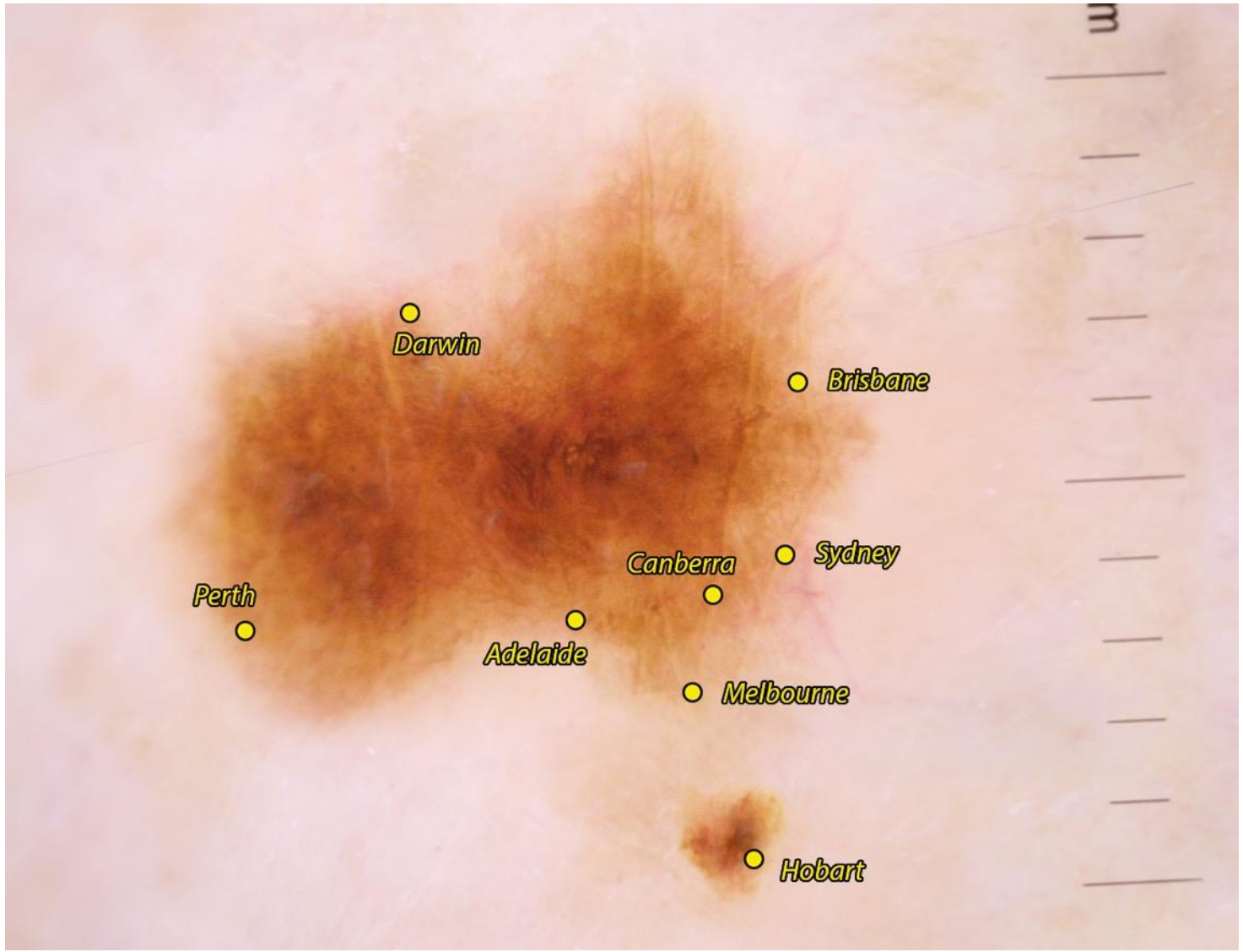
Darwin
Brisbane
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Sydney
Perth
Adelaide
Melbourne
Hobart