IMAGING BIOMARKERS ARE UNDERAPPRECIATED BUT HIGHLY PREDICTIVE PROGNOSTIC FACTORS FOR AGGRESSIVE BREAST CANCER SUBTYPES

Long-term Collaboration between the Taiwan Team and the Swedish Dalarna Breast Cancer series screening program
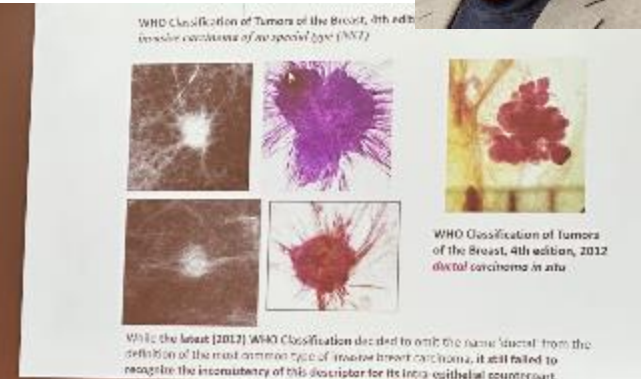
Pattaranan Munpolsri[1], László Tabár[2], Peter B. Dean[3]

[1] School of Dentistry, College of Oral Medicine, Taipei Medical University, Taipei, Taiwan

[2] Falun Central Hospital, Lasarettsvägen 10, 791 82 Falun, Sweden

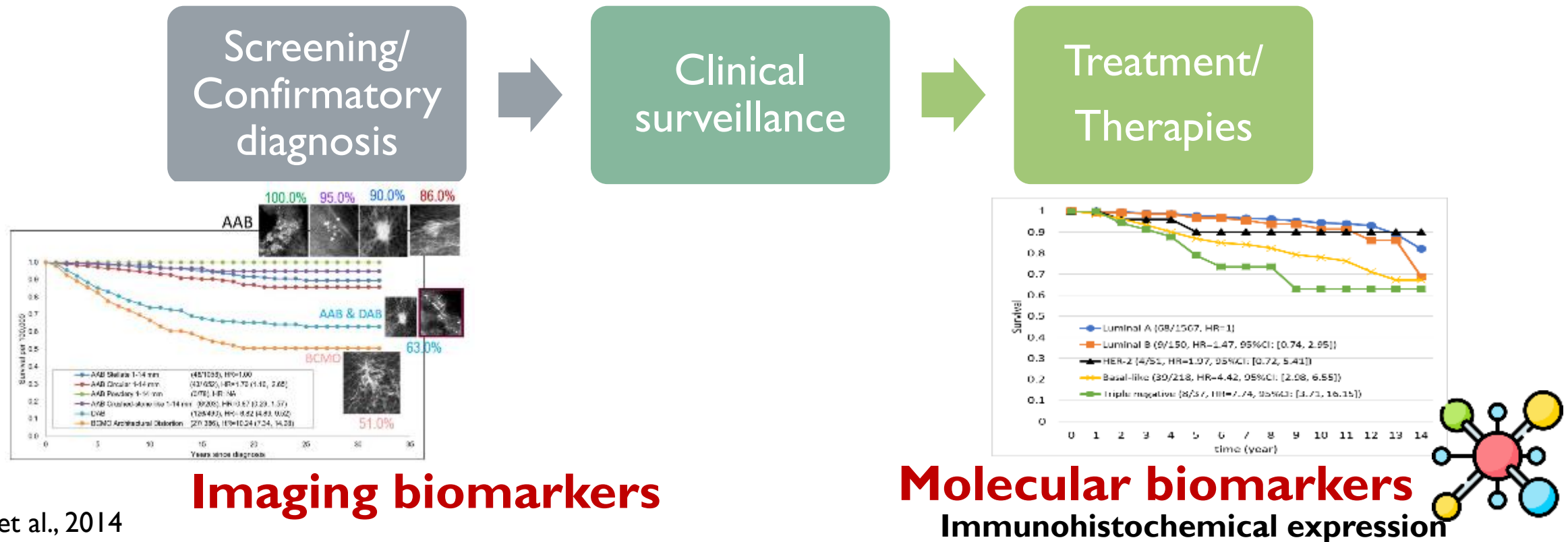[3] University of Turku, FI-20014 Turun Yliopisto, Finland

FEB, 2023@SWEDEN

INTRODUCTION

- Breast cancer survival has improved as a result of mammography screening and treatment guided by molecular biomarkers

Screening/ Confirmatory diagnosis → Clinical surveillance → Treatment/ Therapies

Imaging biomarkers

Molecular biomarkers
Immunohistochemical expression

Tabar, et al., 2014

IMAGING BIOMARKERS
## MAMMOGRAPHY TO CLASSIFYING BREAST CANCER

- **Acinar adenocarcinoma of breast cancer (AAB)**

Breast cancers originating from the terminal ductal lobular units: *In situ* and invasive acinar adenocarcinoma of the breast, AAB
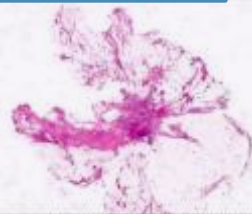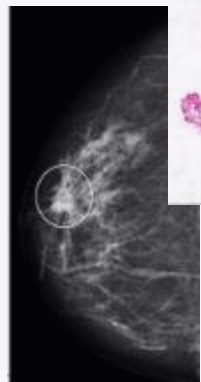
László Tabár[a,*], Peter B. Dean[b], F. Lee Tucker[c], Amy Ming-Fang Yen[d], Jean Ching-Yuan Fann[e], Abbie Ting-Yu Lin[f], Robert A. Smith[g], Stephen W. Duffy[h], Tony Hsiu-Hsi Chen[i]
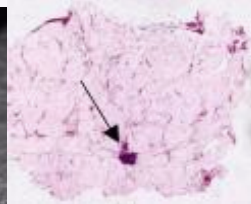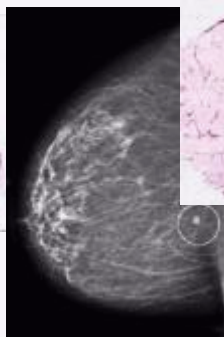
Powdery
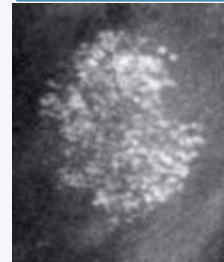
Stellate/spiculated

Circular/oval-shape

Crushed stone-like

- **Ductal adenocarcinoma of the breast, DAB**

Imaging biomarkers of breast cancers originating from the major lactiferous ducts: Ductal adenocarcinoma of the breast, DAB

László Tabár[a,*], Peter B. Dean[b], F. Lee Tucker[c], Tony Hsiu-Hsi Chen[d], Robert A. Smith[e], Stephen W. Duffy[f], Sherry Yueh-Hsia Chiu[g], May Mei-Sheng Ku[d], Chiao-Yun Fan[d], Amy Ming-Fang Yen[h]
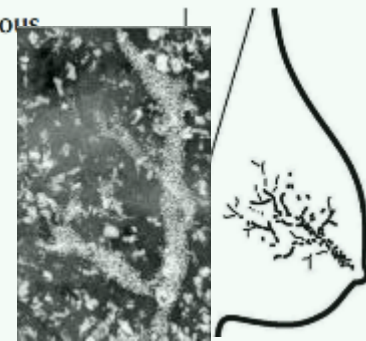
- **Diffusely Infiltrating Breast Cancers, BCMO**

A new approach to breast cancer terminology based on the anatomic site of tumour origin: The importance of radiologic imaging biom...

László Tabár[a,*], Peter B. Dean[b], F. Lee Tucker[c], Amy Ming-Fang Yen[d], Sa... Grace Hsiao Hsuan Jen[e], Jackson Wei-Chun Wang[e], Robert A. Smith[f], Ste... Tony Hsiu-Hsi Chen[e]
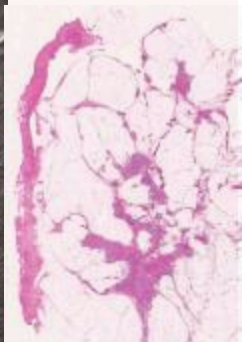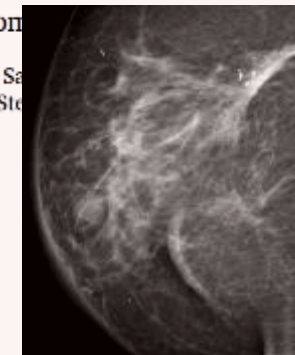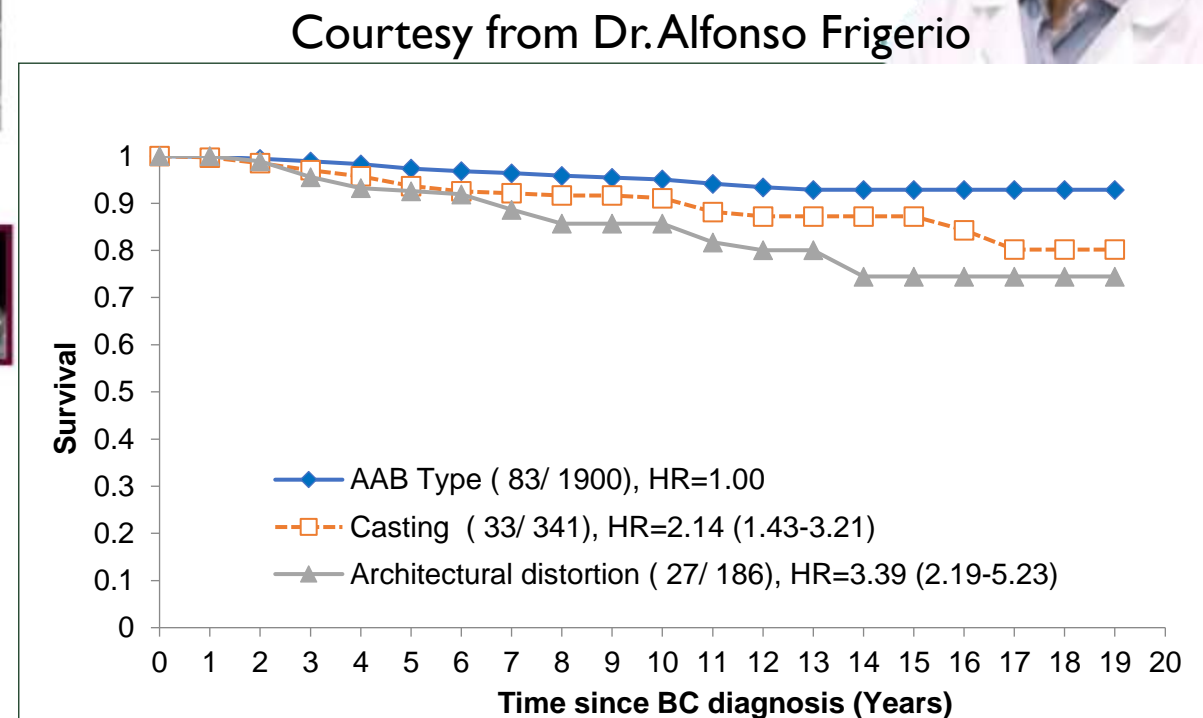
LONG-TERM OUTCOME BY IMAGING BIOMARKERS

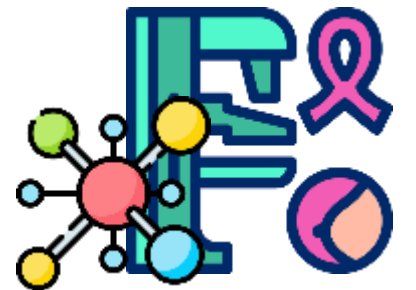**Survival of breast cancer in Falun, 1977-2010**
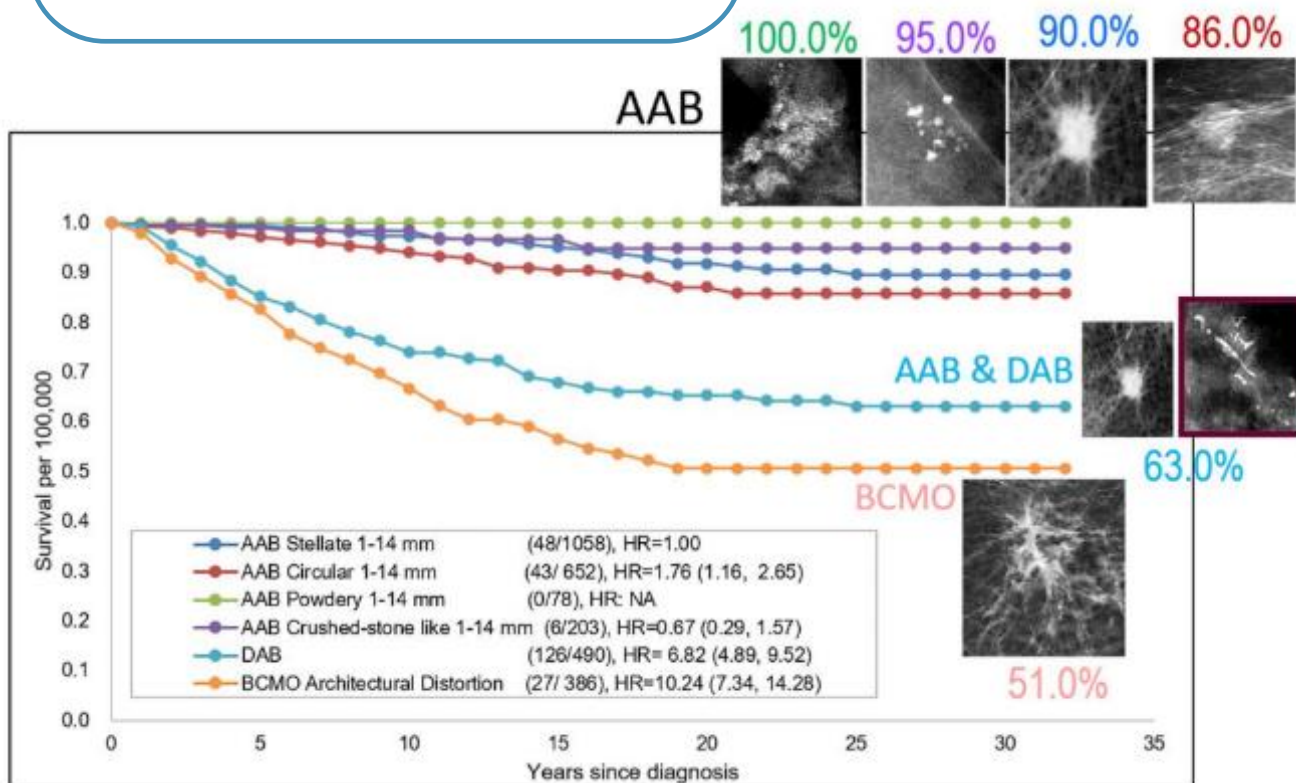
Survival of breast cancer in Turin, 1992-2009
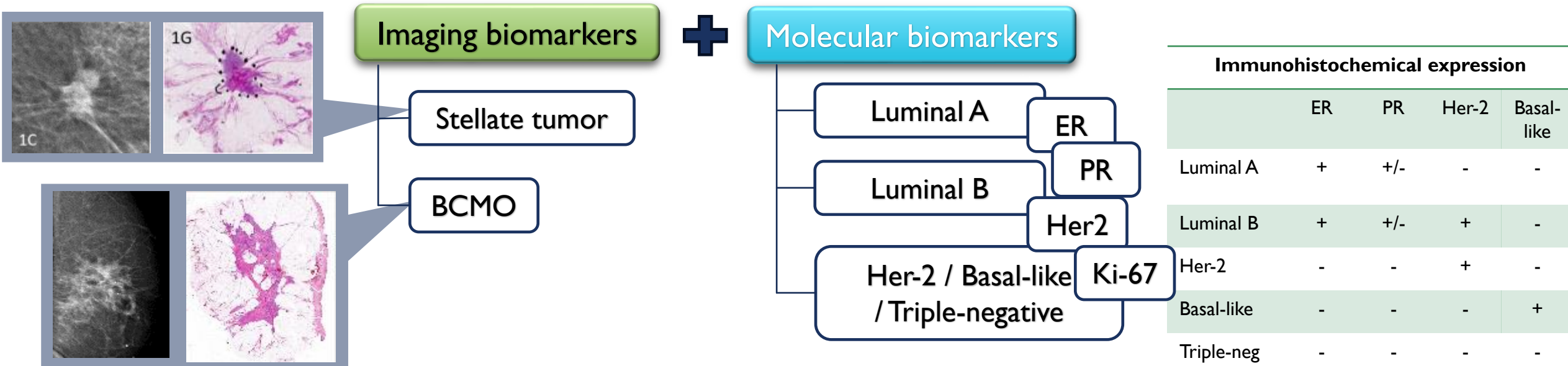

Courtesy from Dr. Alfonso Frigerio

OBJECTIVE

To show how imaging biomarkers can enhance the prognostic value of the currently used molecular biomarkers

METHOD

The consecutive series of breast cancer patients between 2008 and 2019 from Dalarna, Sweden

Imaging biomarkers **+** **Molecular biomarkers**

- Stellate tumor
- BCMO

- Luminal A
- Luminal B
- Her-2 / Basal-like / Triple-negative

ER
PR
Her2
Ki-67

Immunohistochemical expression

	ER	PR	Her-2	Basal-like
Luminal A	+	+/-	-	-
Luminal B	+	+/-	+	-
Her-2	-	-	+	-
Basal-like	-	-	-	+
Triple-neg	-	-	-	-

Tibor tot, Clinical breast cancer, 2011

Statistical Analysis

- To present the survival by imaging and molecular biomarkers using Kaplan Meier method and Cox model
- To compute the predictive survival base on molecular biomarkers to different mammography featured cancers
- To compare the magnitude of the area under the curve (AUC) of the receiver operating characteristic curve (ROC) across imaging biomarkers
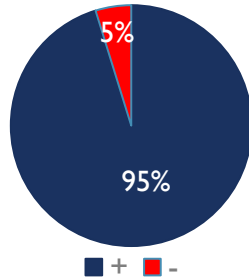
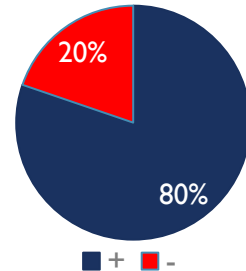# THE DISTRIBUTION OF BREAST BIOMARKER BY MAMMOGRAPHIC FEATURES

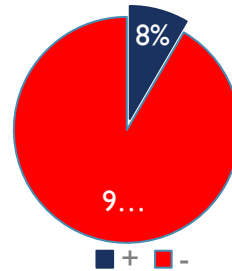**ICSN2023**
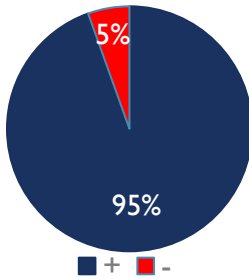Cancer screening: in the present, the future

	ER	PR	Ki-67

Stellate 1-14 mm

ER: 5% -, 95% +
PR: 20% -, 80% +
Ki-67: 8% +, 9…% -

Stellate 15+ mm

ER: 5% -, 95% +
PR: 22% -, 78% +
Ki-67: 24% +, 76% -
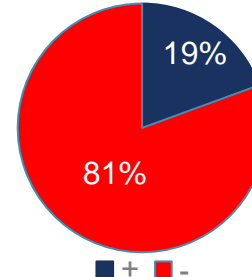
BCMO

ER: 7% -, 93% +
PR: 33% -, 67% +
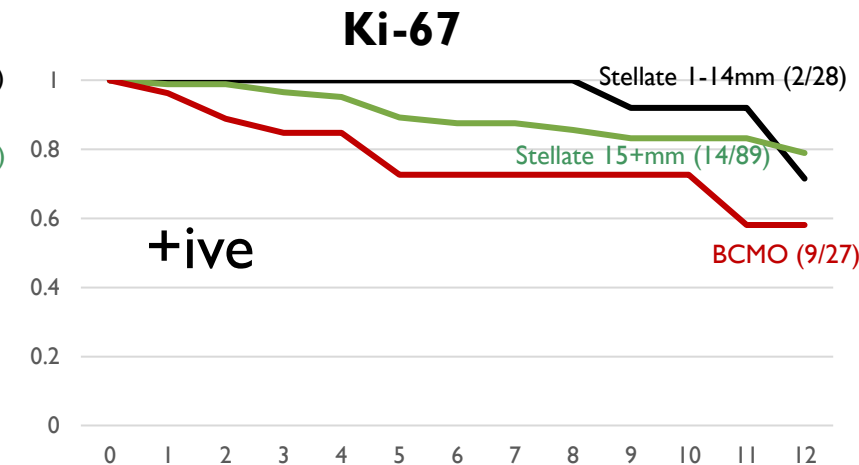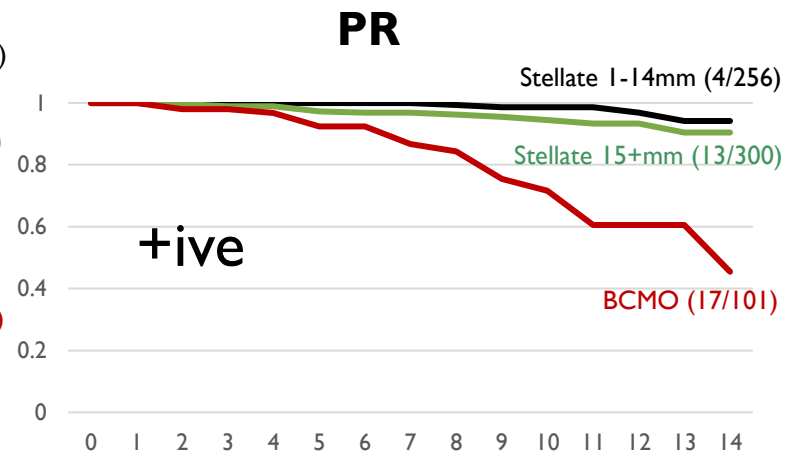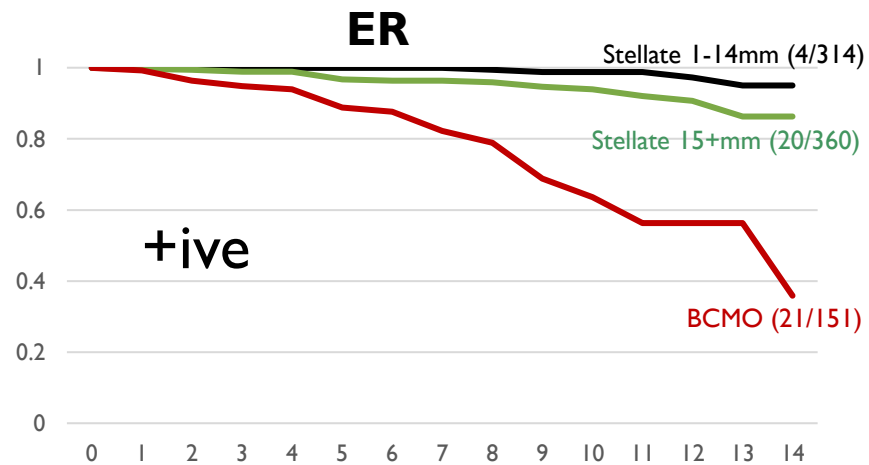Ki-67: 19% +, 81% -

Legend: ■ +   ■ -
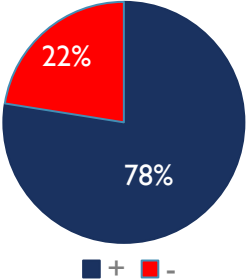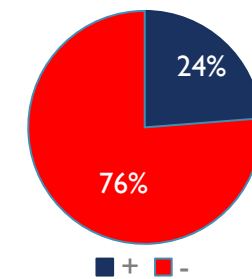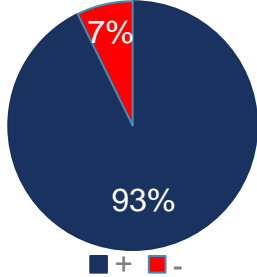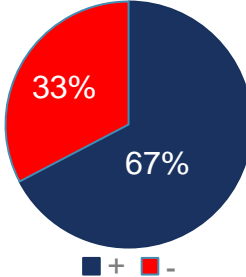
Several biomarkers have previously been recognized as good predictors of poor outcome.
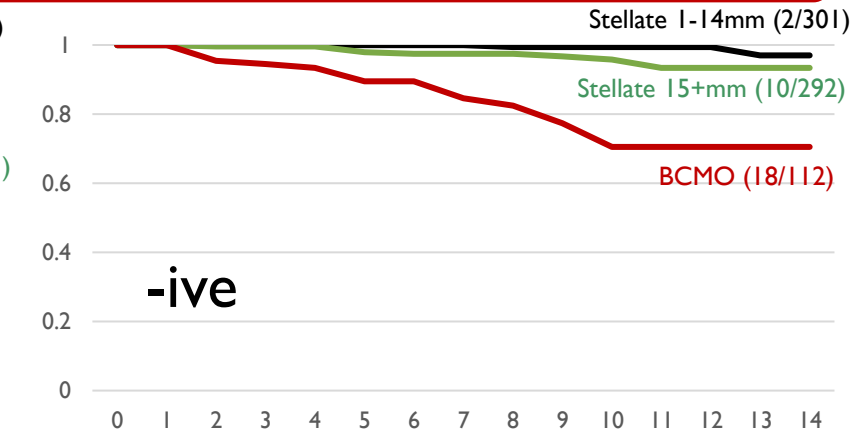
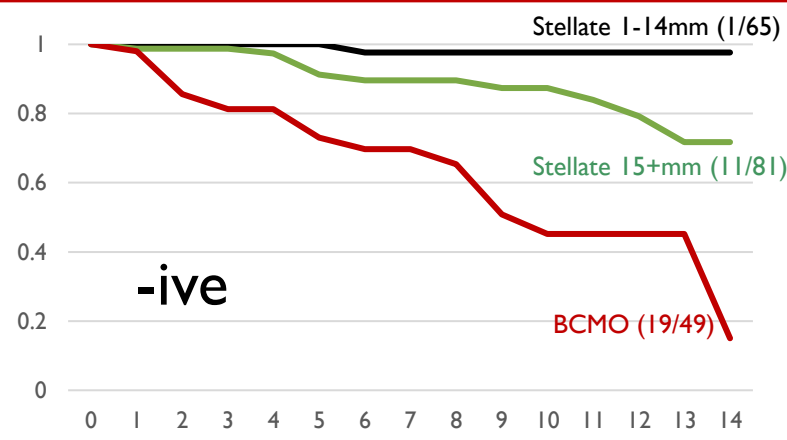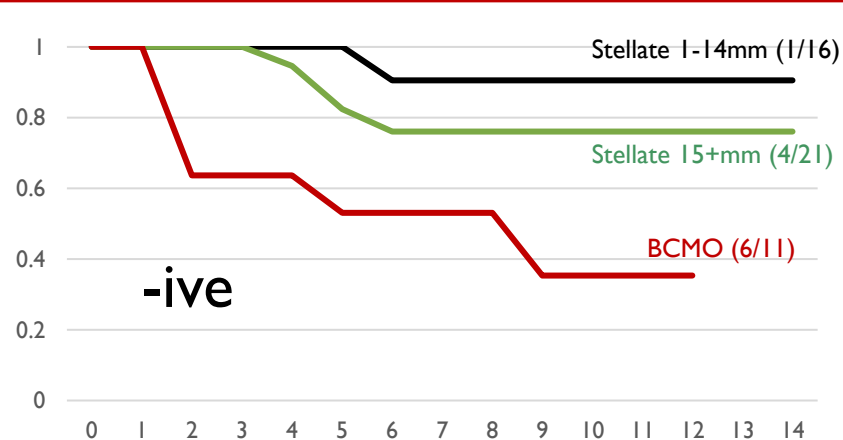However, can we equally predict long-term outcome in different mammography featured breast cancer?

SURVIVAL BY MOLECULAR AND IMAGING BIOMARKER

ER

Stellate 1-14mm (4/314)
Stellate 15+mm (20/360)
+ive
BCMO (21/151)

PR

Stellate 1-14mm (4/256)
Stellate 15+mm (13/300)
+ive
BCMO (17/101)

Ki-67

Stellate 1-14mm (2/28)
Stellate 15+mm (14/89)
+ive
BCMO (9/27)

Given the same molecular biomarkers, there still exists big discrepancy between imaging biomarker groups.

Stellate 1-14mm (1/16)
Stellate 15+mm (4/21)
-ive
BCMO (6/11)

Stellate 1-14mm (1/65)
Stellate 15+mm (11/81)
-ive
BCMO (19/49)

Stellate 1-14mm (2/301)
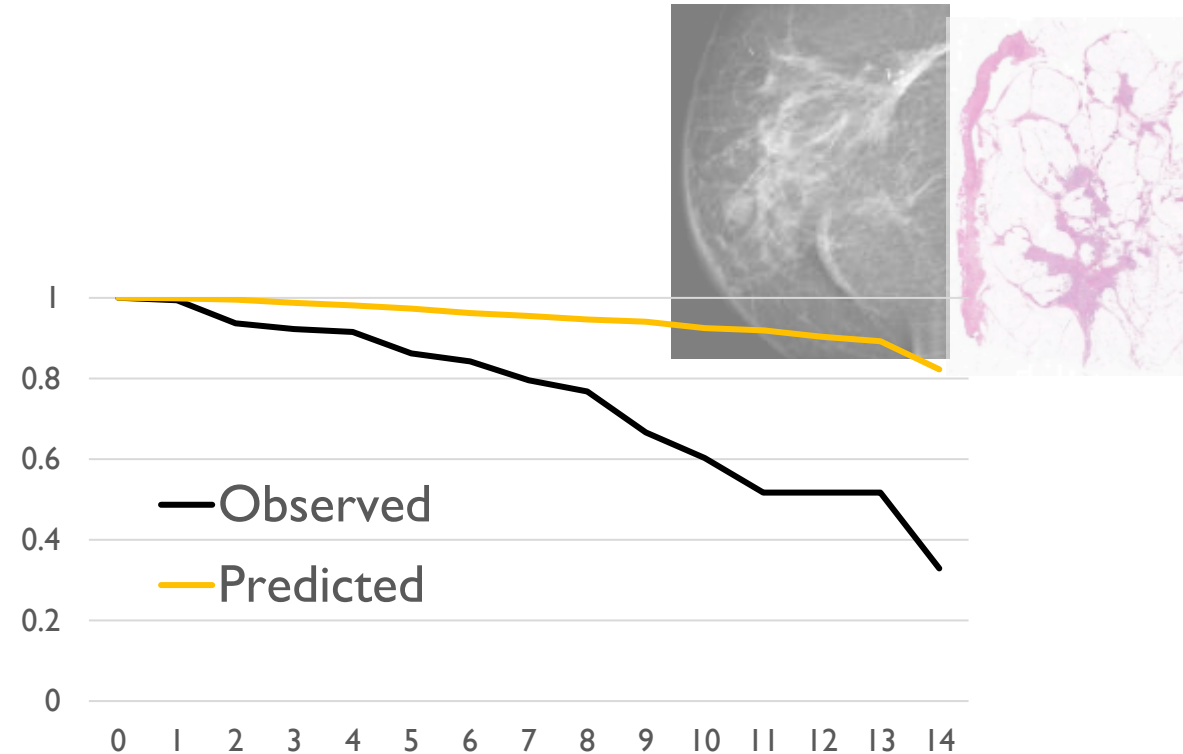Stellate 15+mm (10/292)
-ive
BCMO (18/112)

PREDICTED VS OBSERVED SURVIVAL IN STELLATE AND BCMO CANCERS

Stellate/spiculated
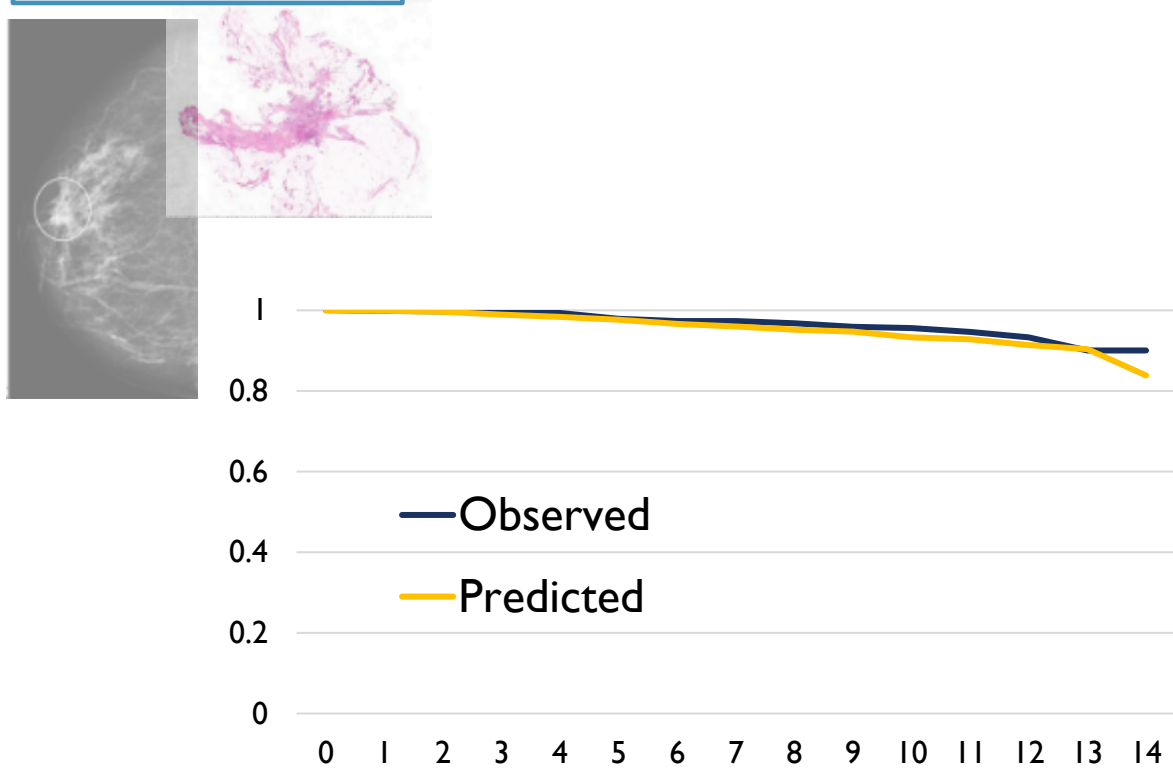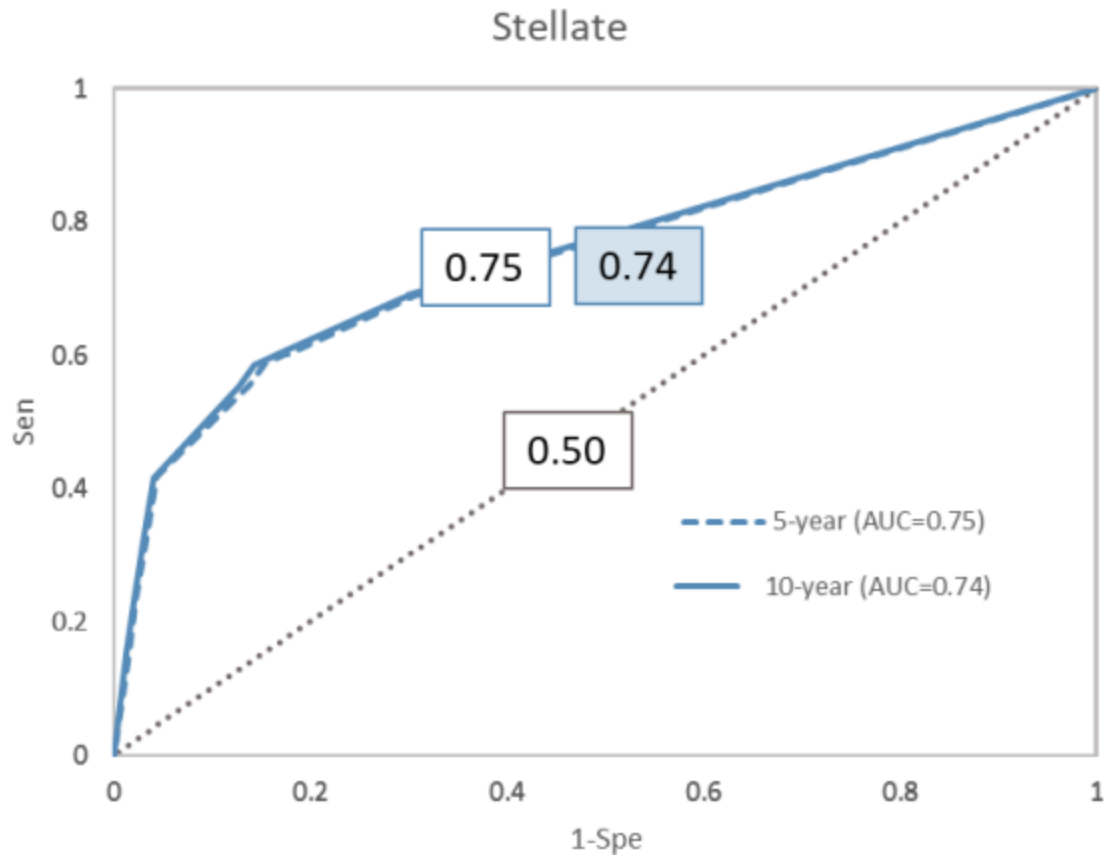
BCMO

Good predictivity in stellate cancers

Poor predictivity in BCMO

THE RECEIVER OPERATING CURVES (ROC) FOR PREDICTING THE SURVIVAL USING MOLECULAR BIOMARKERS IN STELLATE AND BCMO CANCERS
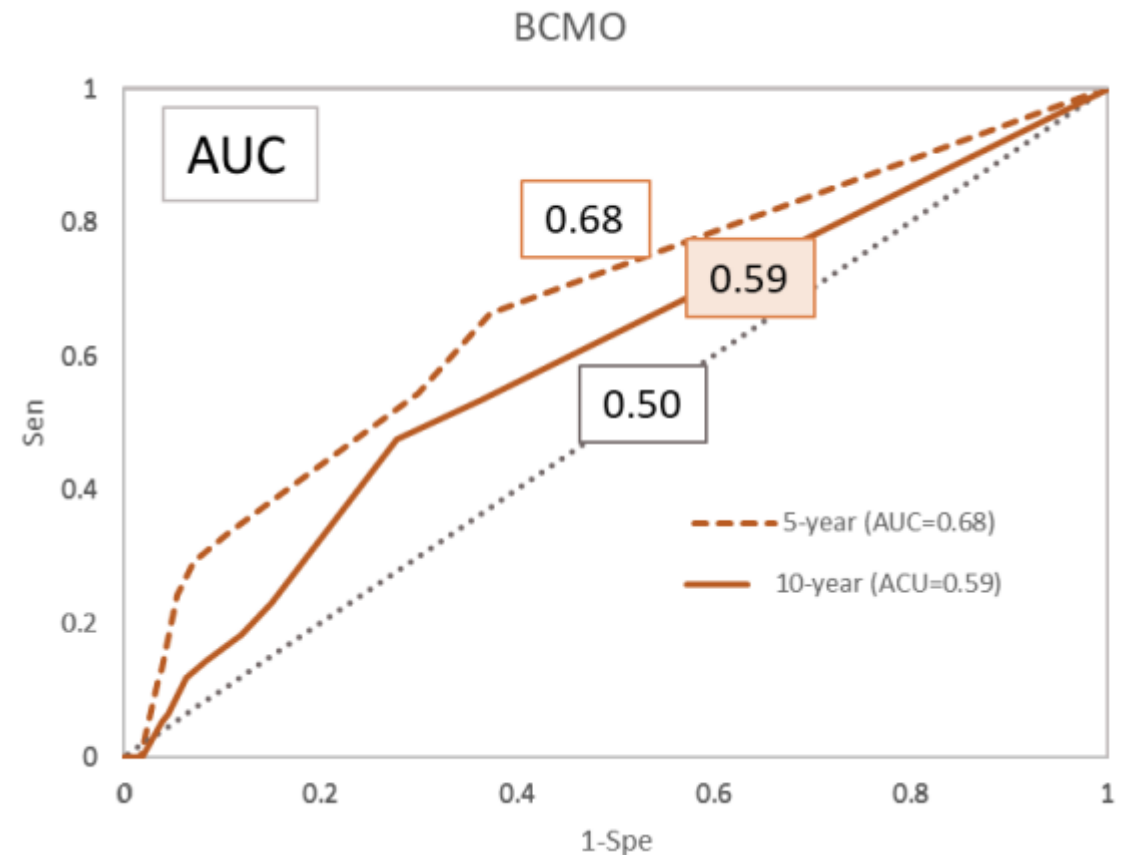
Molecular biomarkers predict stellate cancers fairly.

But being a poor predictors for BCMO.

Stellate

- 5-year (AUC=0.75)
- 10-year (AUC=0.74)

BCMO

AUC

- 5-year (AUC=0.68)
- 10-year (ACU=0.59)

CONCLUSIONS

- Imaging biomarkers with the evolution of mammographic features (BCMO) provides additional value to predict the prognosis of breast cancer with the previously developed molecular biomarkers

- Make a better use of imaging biomarker can avoid under- and over-treatment of heterogeneous types of breast cancer.

Thank You for
Your Attention