



How to find breast cancer when it is still small

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30-year experience with mammographic screening:
what have we learned?

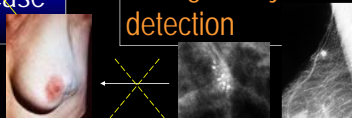
Paradigm shift

Traditional emphasis


- Application of various therapeutic methods to advanced disease

New emphasis

Arrests disease progression to advanced stage through early detection




Breast cancer is a progressive disease



Sojourn time

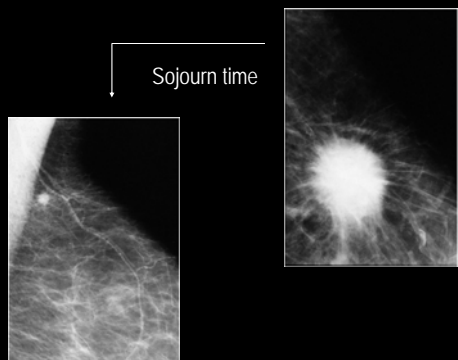
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Mammographically detectable Clinically detectable

Preclinical, detectable phase

Preclinical detectable phase



Sojourn time

A new paradigm

A window of opportunity during the preclinical detectable phase

The tumor has not yet spread viable metastases, therefore curable by local treatment alone



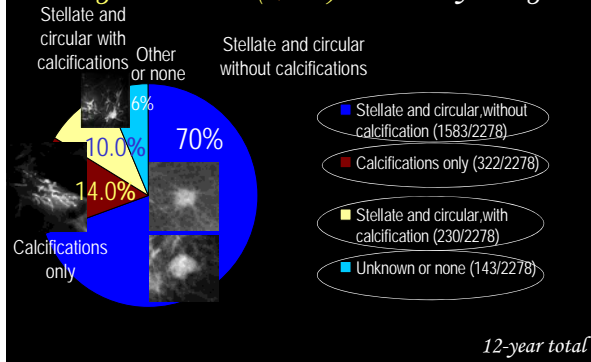
Conclusion

The decisive factor is whether the treatment is given *early or late* in the natural history of the disease

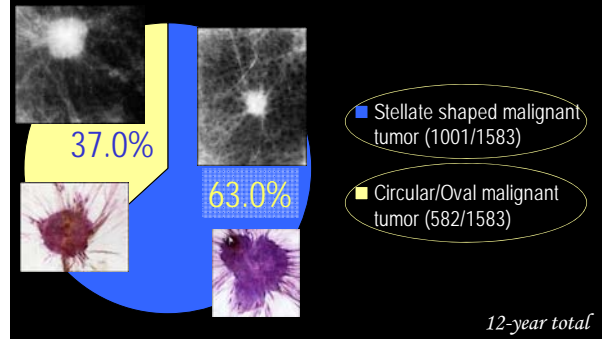
rather than which treatment choice is offered to breast cancer patients.

What to look for?

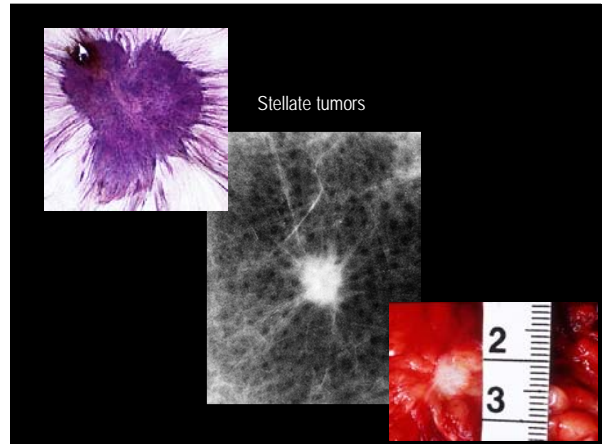
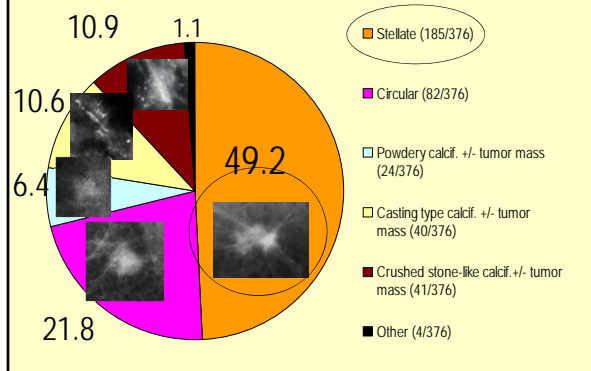
Mammographic appearance of histologically malignant lesions (2,278). Women of all ages.



Ratio of stellate / circular malignant tumors without associated calcifications



Frequency (%) of mammographic findings in women aged 40-69 years with 1-9 mm invasive breast cancers (1977-2001).



Outcome of patients with 1-9 mm tumors

- The disease tend to be localized to the breast
- The outcome is very good

Circular/oval tumors

Aim of perception: Asymmetric densities

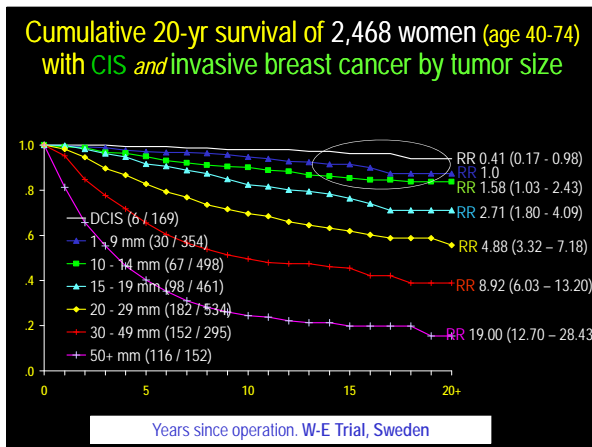
- Circular / oval
- Stellate
- Nonspecific asymmetric densities *with or without* architectural distortion

Aim of perception

Microcalcifications with or without tumor mass

Mammographic screening aims to detect the invasive cancers while

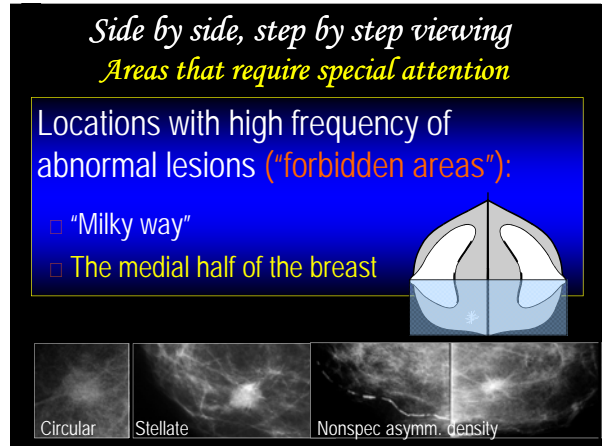
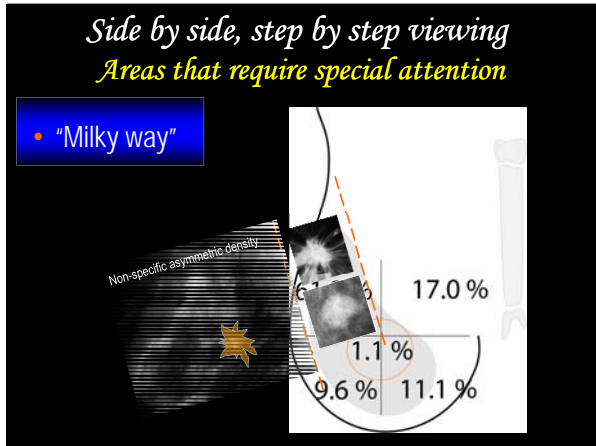
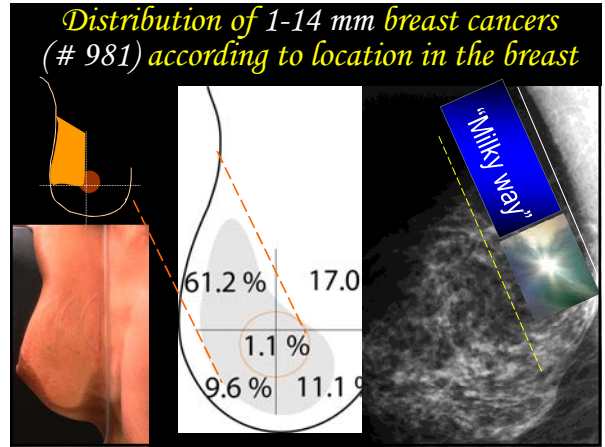
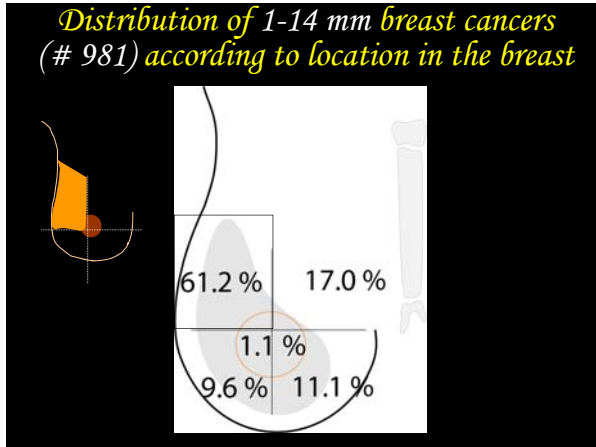
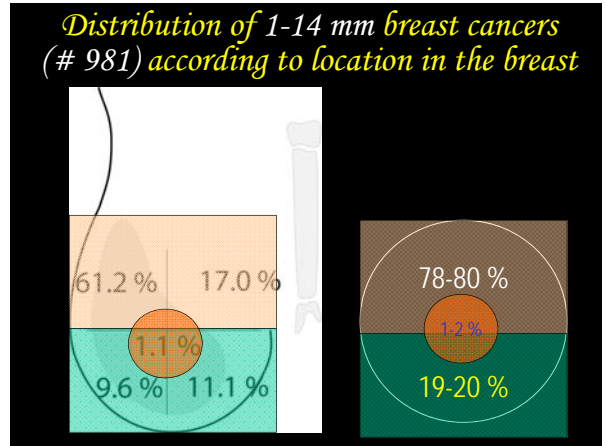
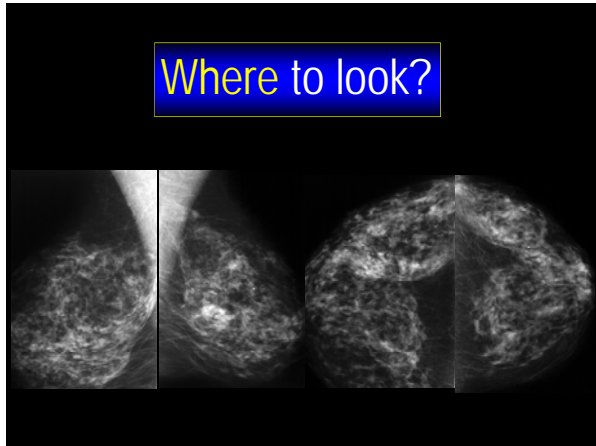
- They are small (<10 mm, <15 mm)
- Node negative



The relative benefit of downwards stage shifting

- 95 % of the mortality benefit originates from downwards stage shifting of invasive breast cancers.

Eur J Cancer. 2003 Aug;39(12):1746-54



Side by side, step by step viewing
Areas that require special attention

61.2%	17.0%
1.1%	11.1%
9.6%	

The medial half of the breast

Side by side, step by step viewing
Areas that require special attention

The medial half of the breast

Side by side, step by step viewing
Areas that require special attention

Locations with high frequency of abnormal lesions ("forbidden areas");

- ❑ "Milky way"
- ❑ The medial half of the breast
- ❑ Retroglandular clear space ("no man's land")

Side by side, step by step viewing
Areas that require special attention

The retroglandular clear space ("no man's land")

Side by side, step by step viewing
Areas that require special attention

Locations with high frequency of abnormal lesions ("forbidden areas");

- "Milky way"
- The medial half of the breast
- Retroglandular clear space ("no man's land")
- The retroareolar area

Side by side, step by step viewing
Areas that require special attention

The retroareolar area

Side by side, step by step viewing
Areas that require special attention

The retroareolar area

Aim of perception
 Disruption of the harmonic structure

Parenchymal contour change

Aim of perception
 Disruption of the harmonic structure

Parenchymal contour change

Aim of perception
 Disruption of the harmonic structure

Parenchymal contour retraction (tent sign)

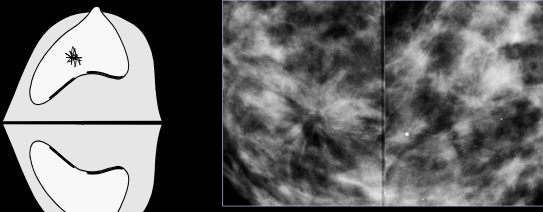
Aim of perception
 Disruption of the harmonic structure

Parenchymal contour retraction (tent sign)

Aim of perception
 Disruption of the harmonic structure


Architectural distortion

Aim of perception
Disruption of the harmonic structure



- ▣ Architectural distortion

Aim of perception
Disruption of the harmonic structure

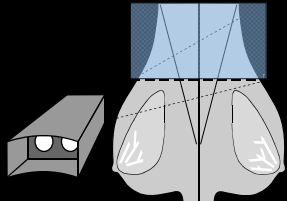


- ▣ Architectural distortion

VIEWING TECHNIQUE

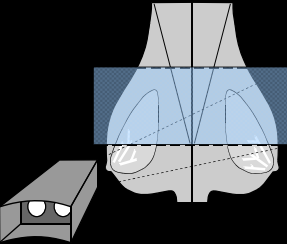


Side by side, step by step viewing
Perception can be enhanced by:



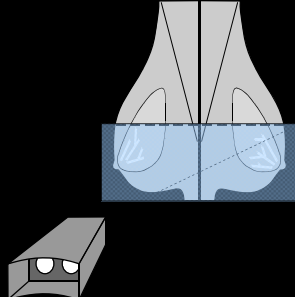
- ▣ Elimination of extraneous light

Side by side, step by step viewing
Perception can be enhanced by:



- ▣ Decreasing peripheral distractions

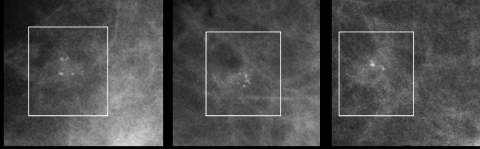
Side by side, step by step viewing
Perception can be enhanced by:



- ▣ Magnification of image detail

Side by side, step by step viewing
Practical notes

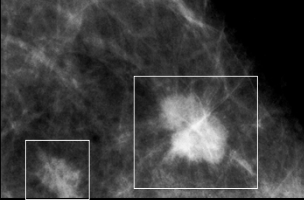
Comparison with previous examinations



Next to last exam. Previous exam. Current exam.

Side by side, step by step viewing
Practical notes

After finding one lesion, do not stop looking!



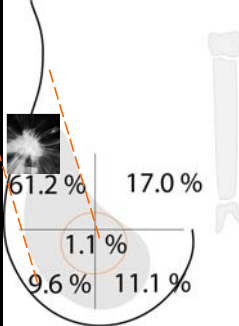
Side by side, step by step viewing
Practical notes

Good mammography technique:

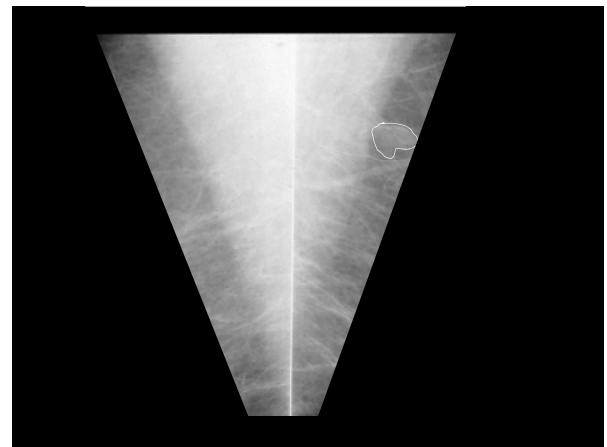
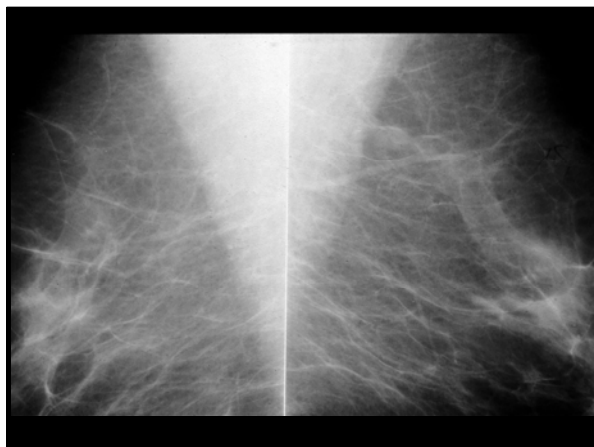
- ▣ Proper positioning
- ▣ Adequate compression
- ▣ High contrast
- ▣ High resolution

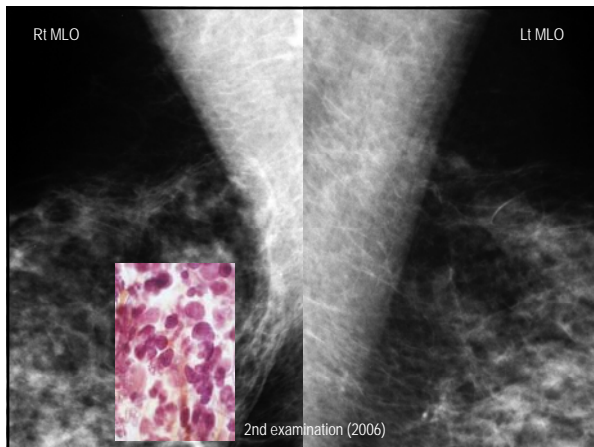
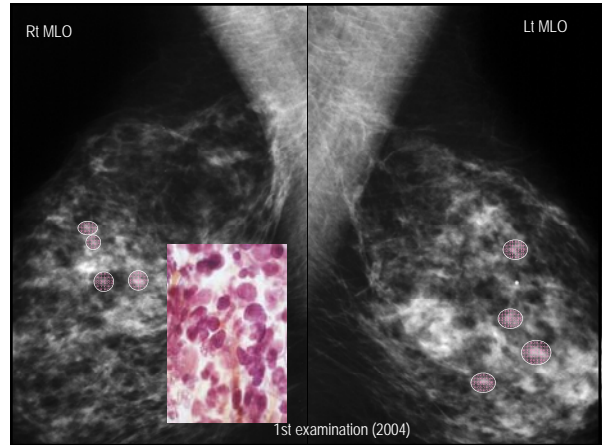
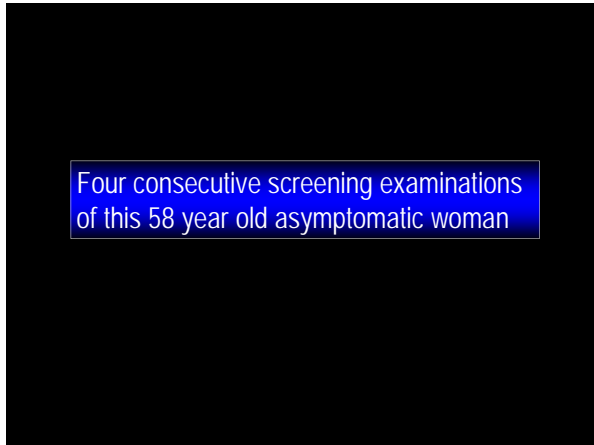
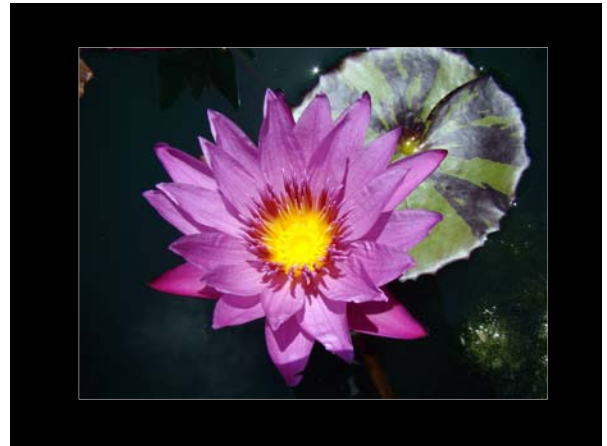
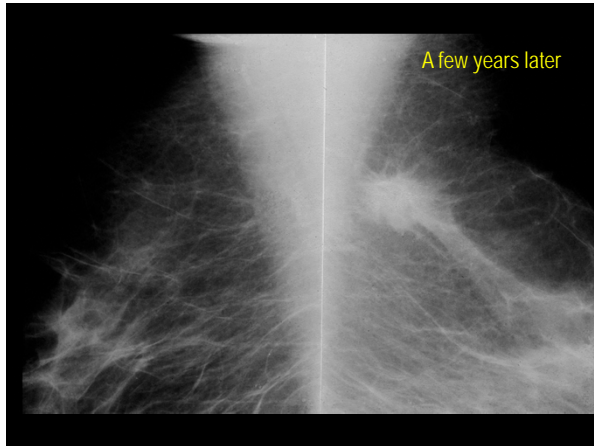
Side by side, step by step viewing
Areas that require special attention

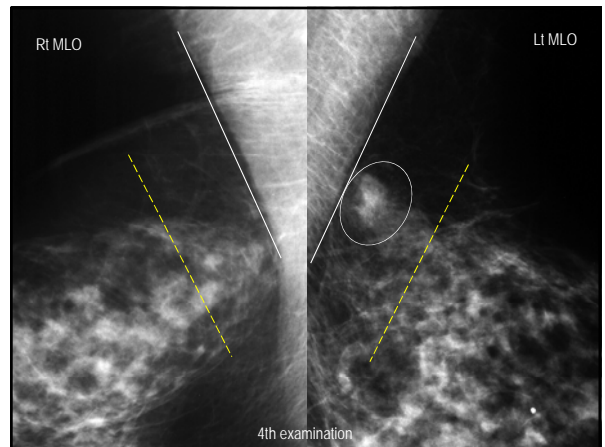
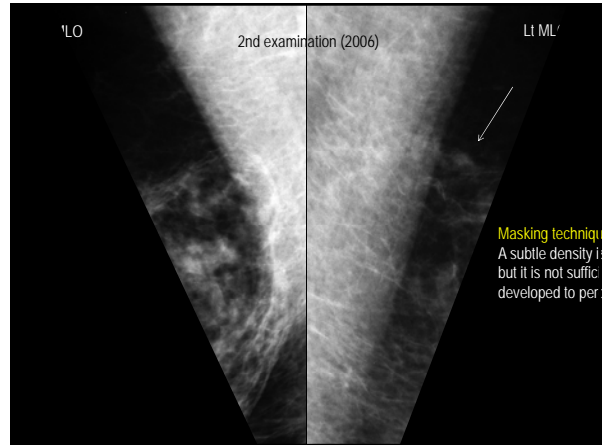
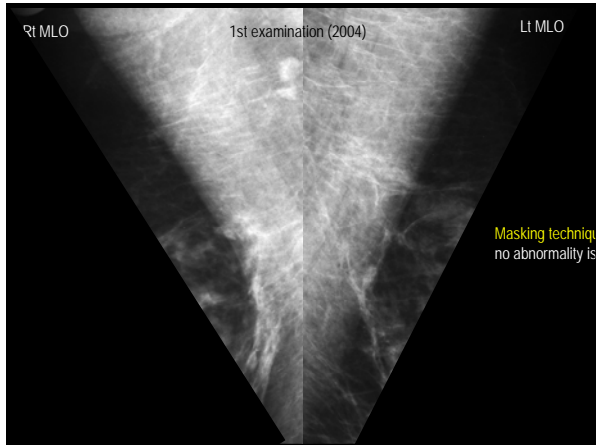
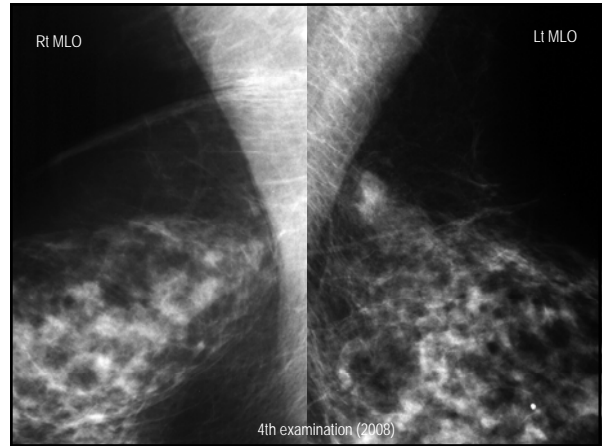
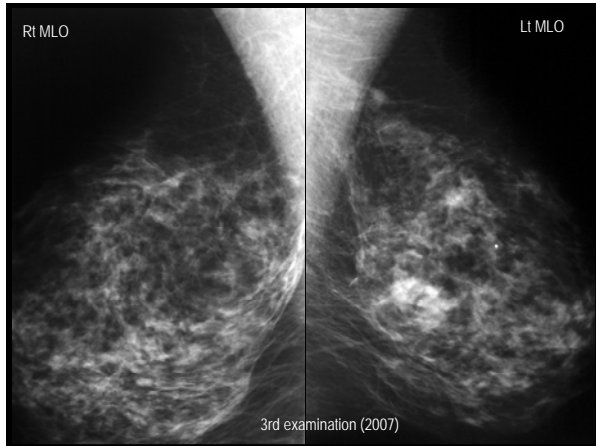
▣ "Milky way"

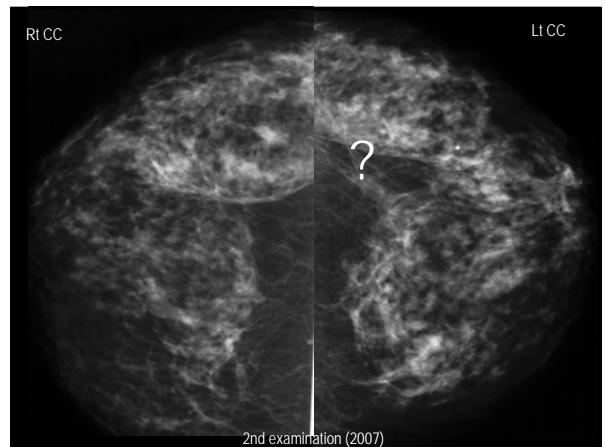
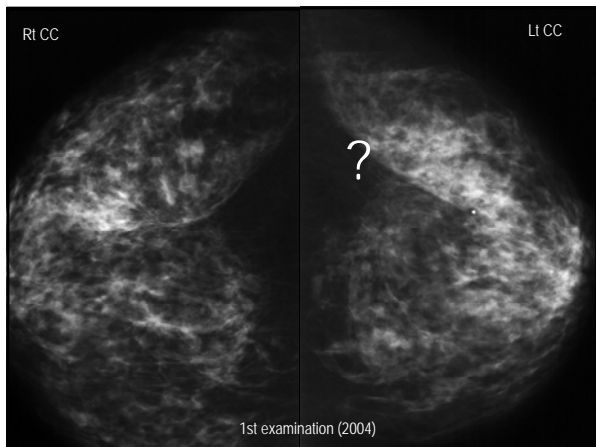
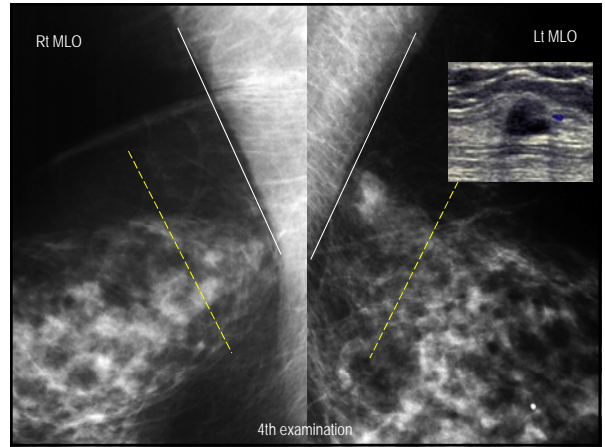
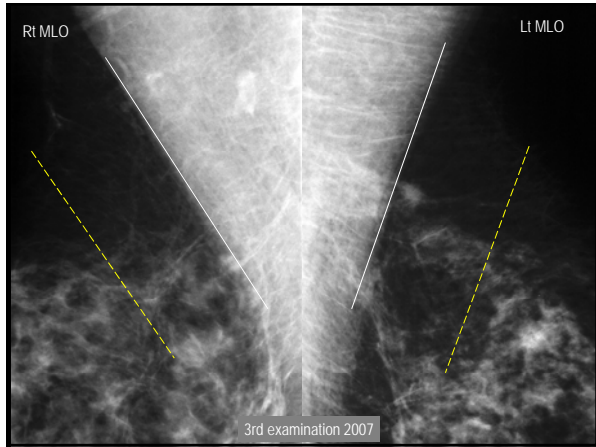
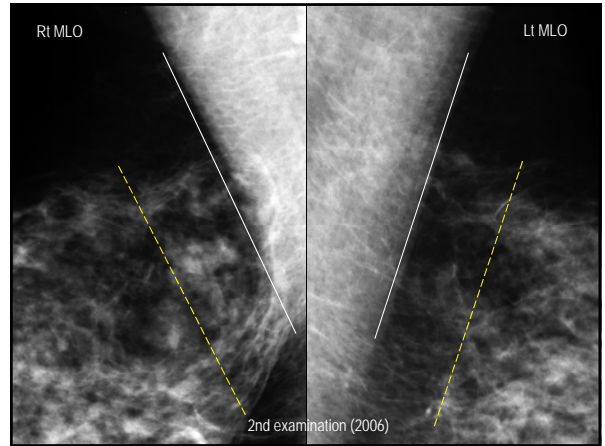
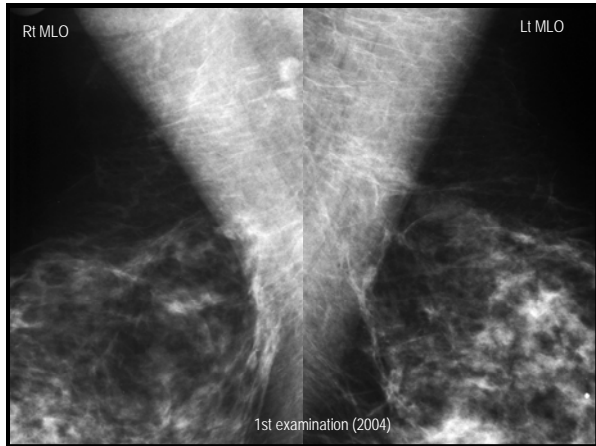


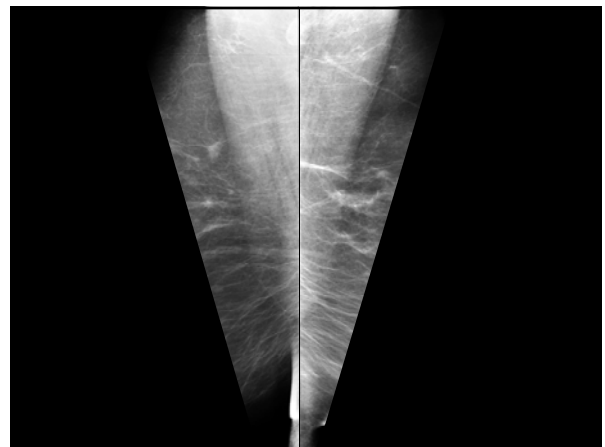
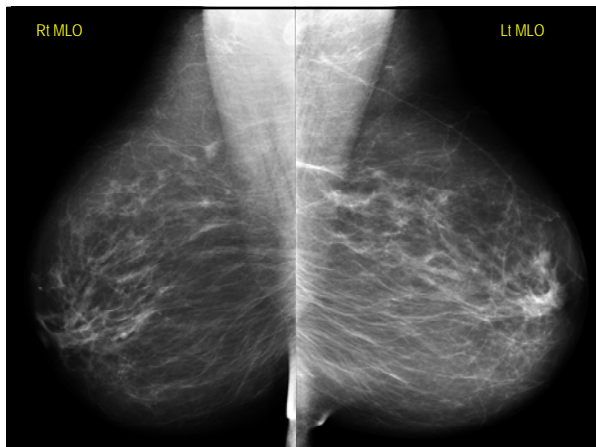
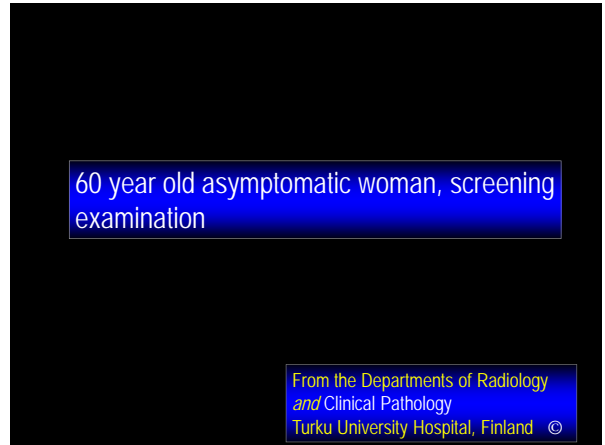
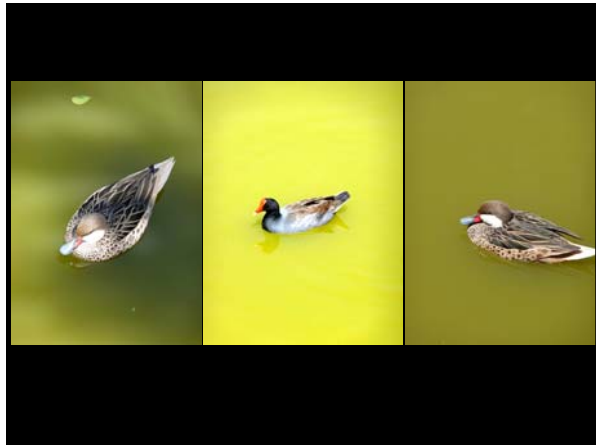
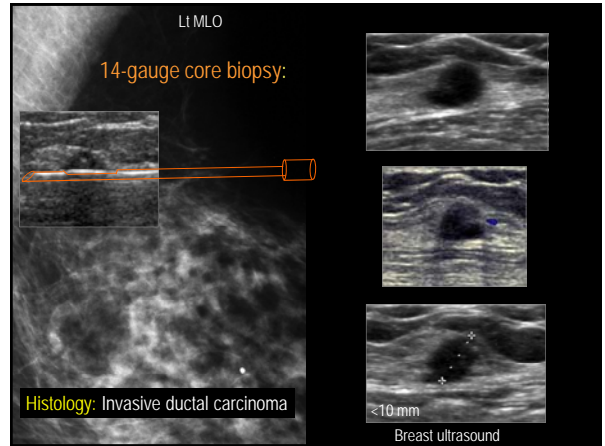
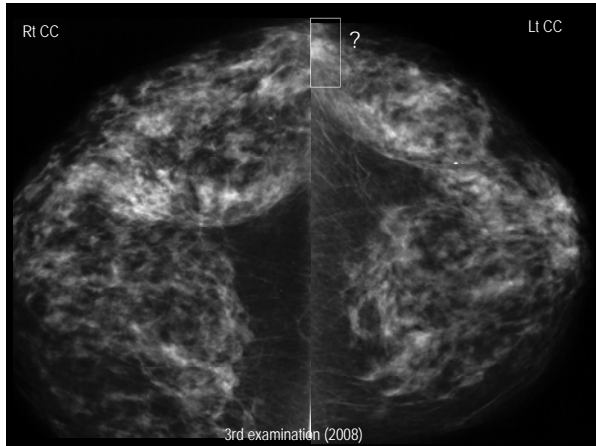
61.2 %	17.0 %
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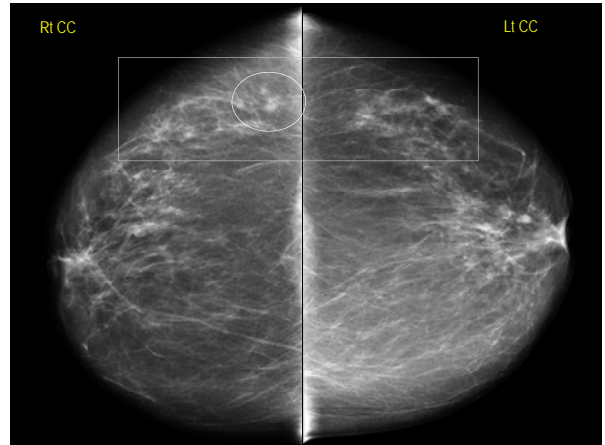
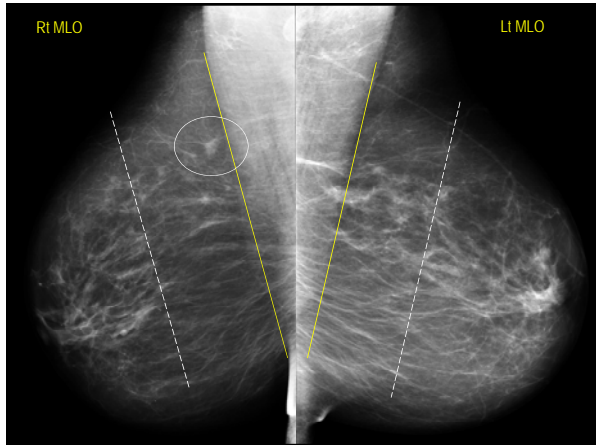
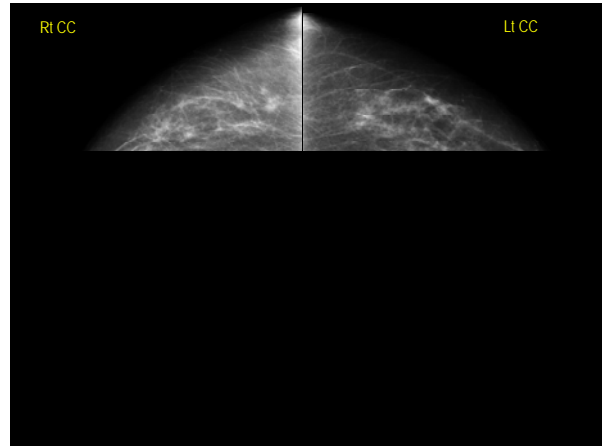
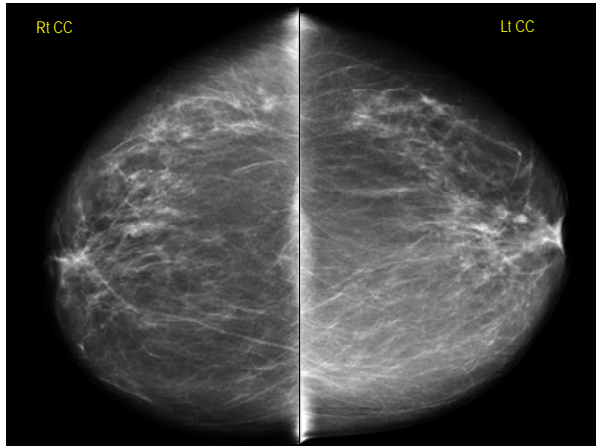









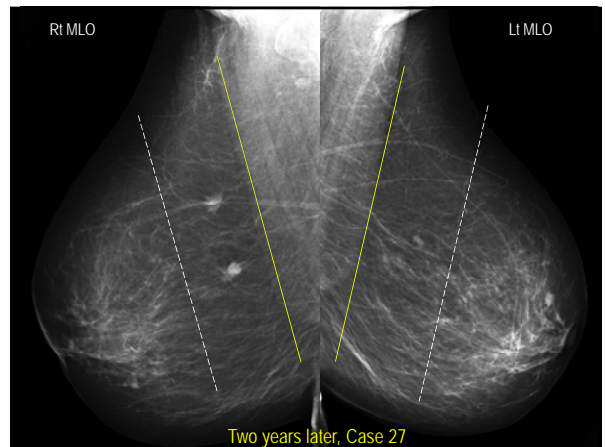


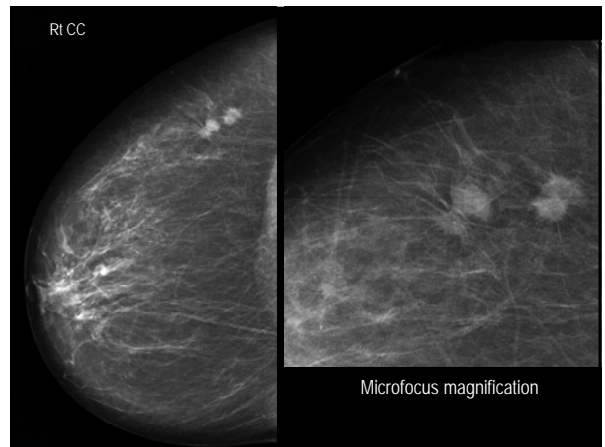
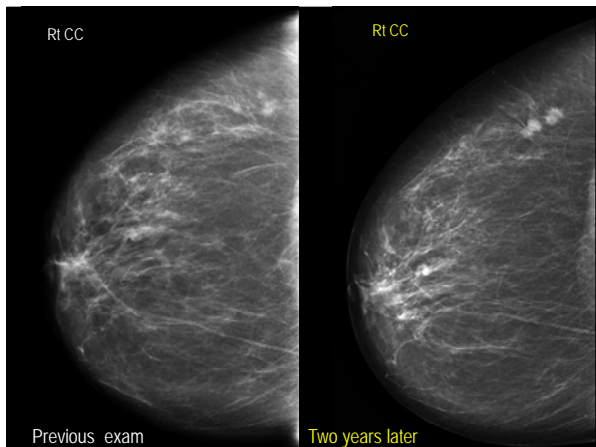
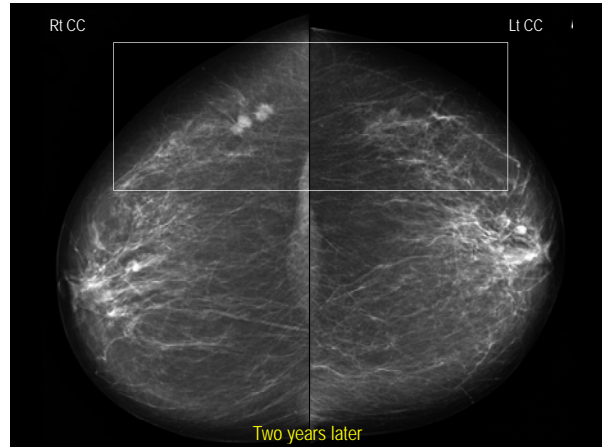
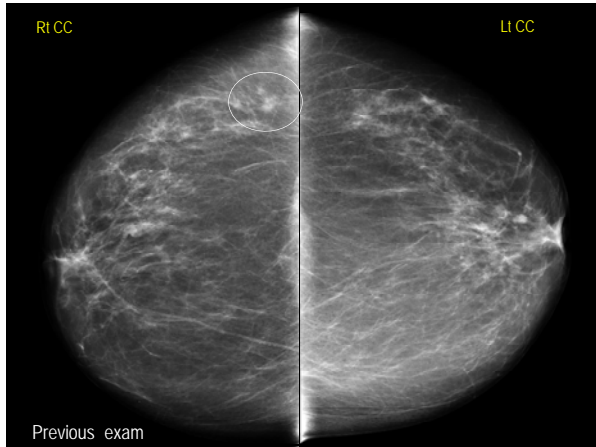
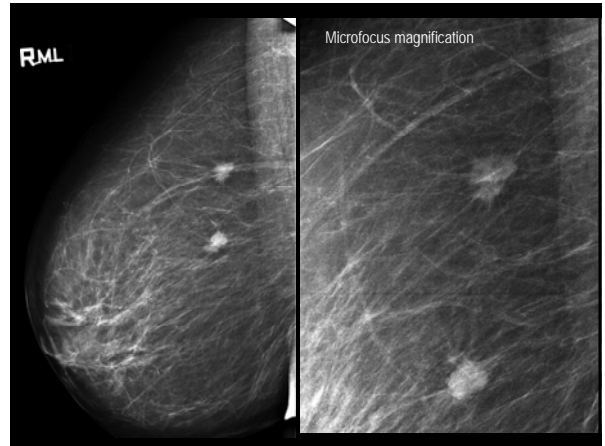
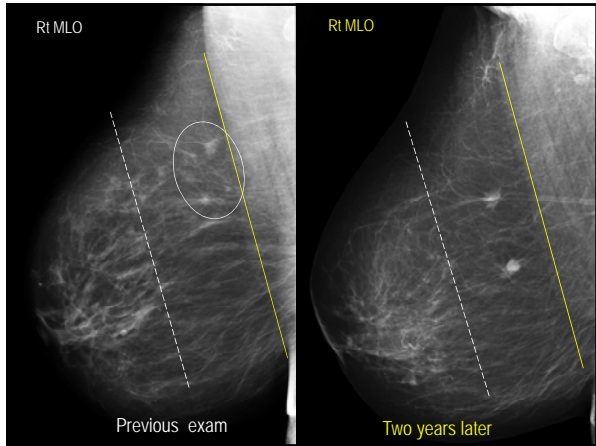


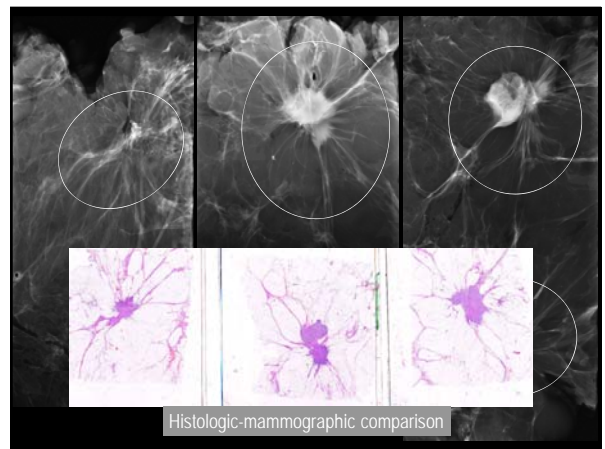
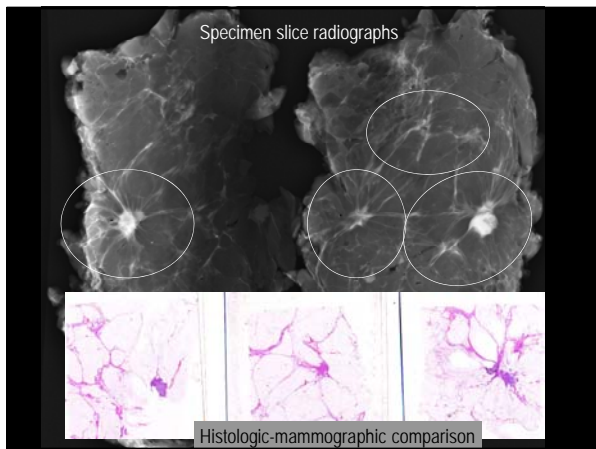
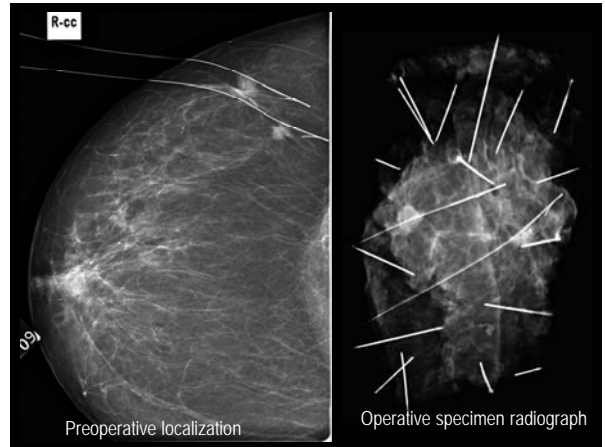
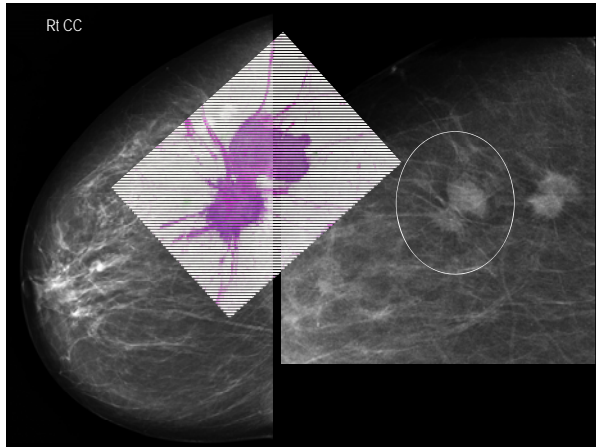
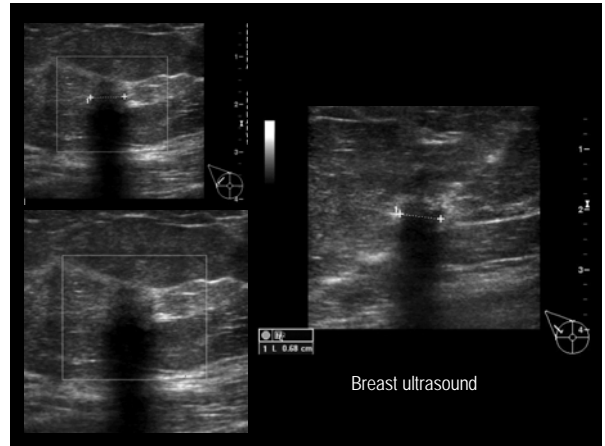
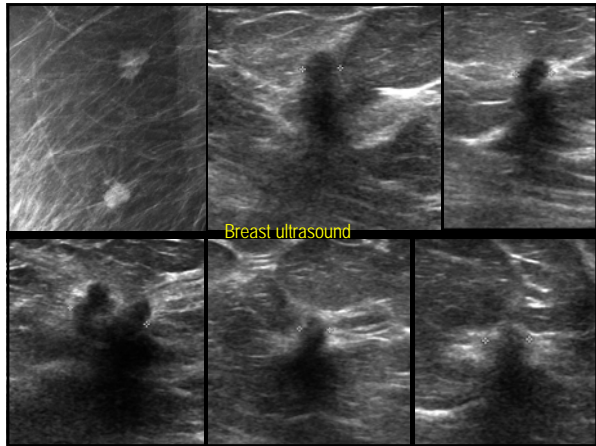
Two years later

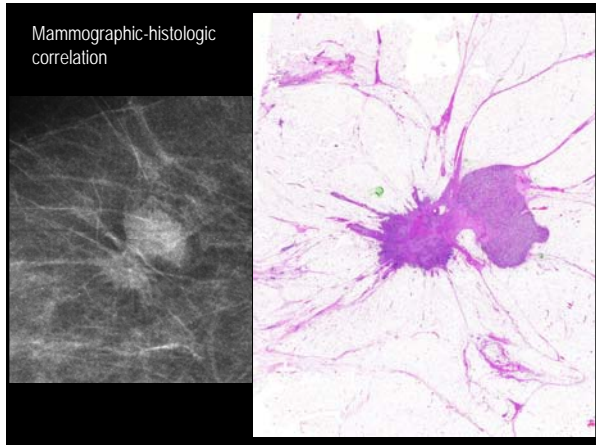
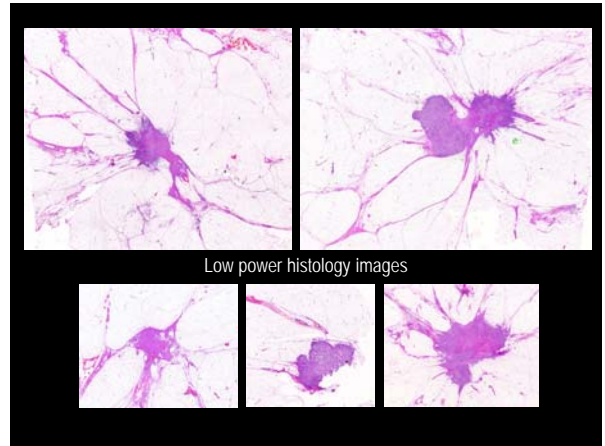
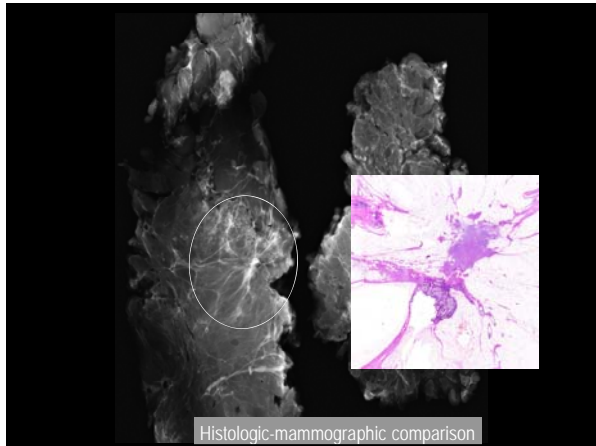


Now 62 year old, called back from mammography screening for assessment of multiple asymmetric densities in the upper-outer quadrant of her right breast.



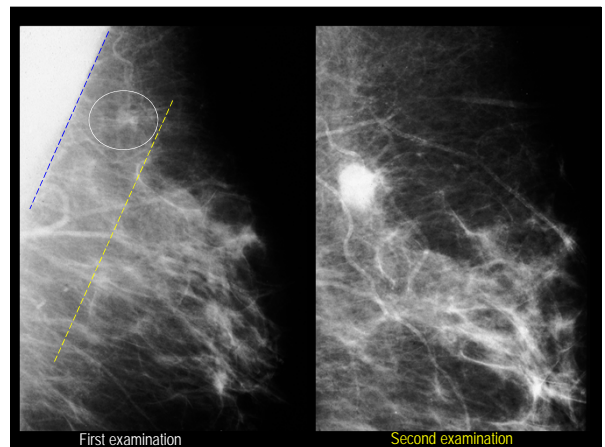
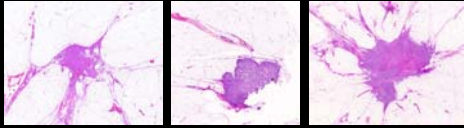


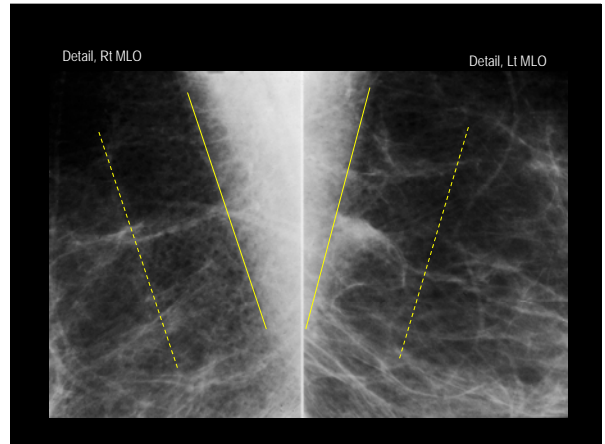
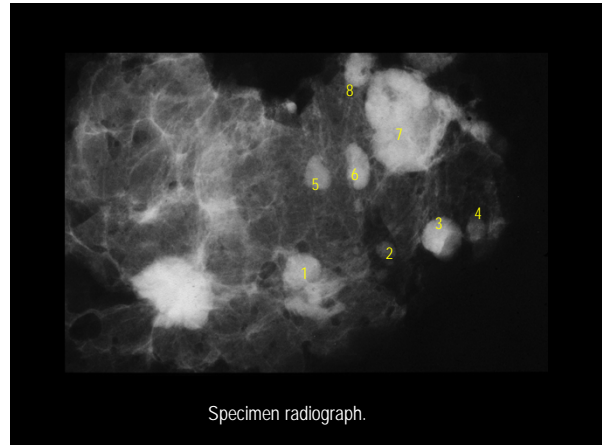
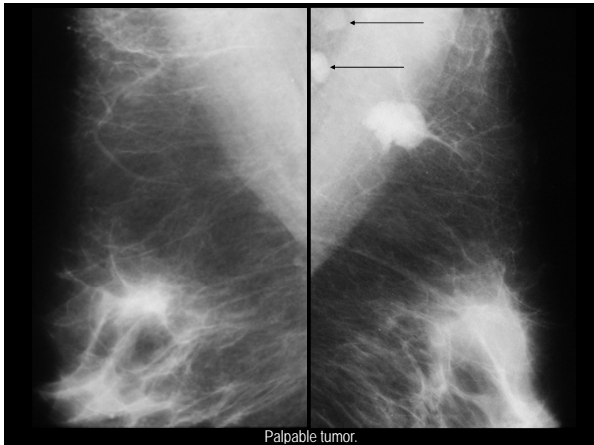
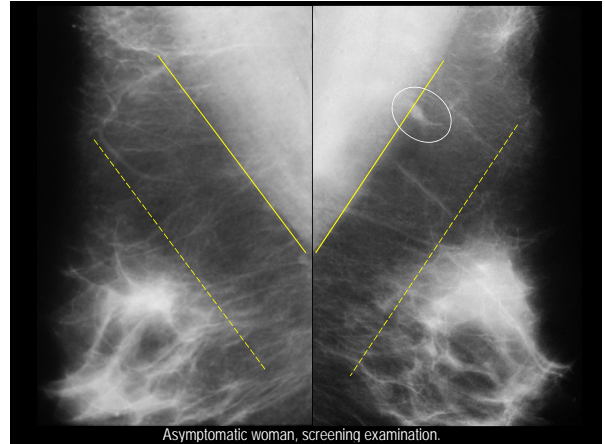


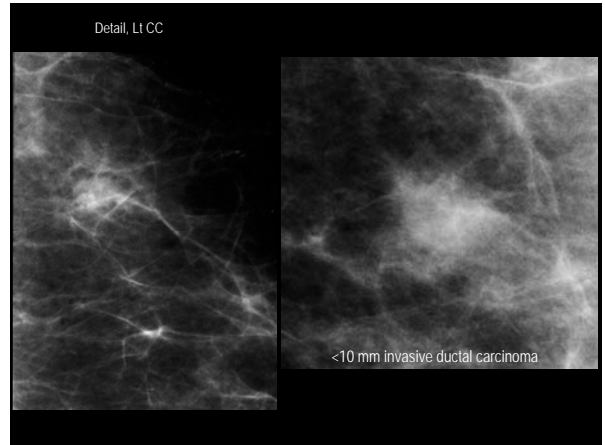
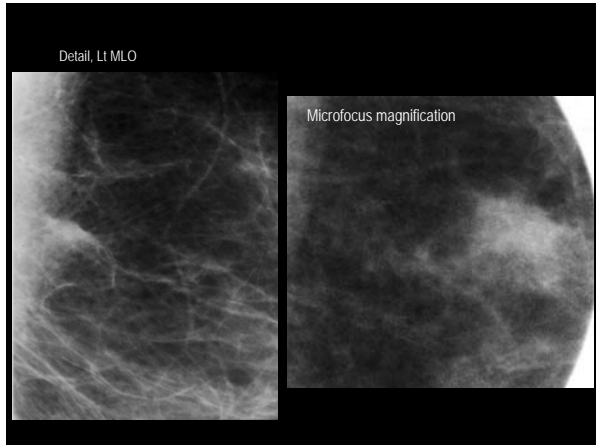
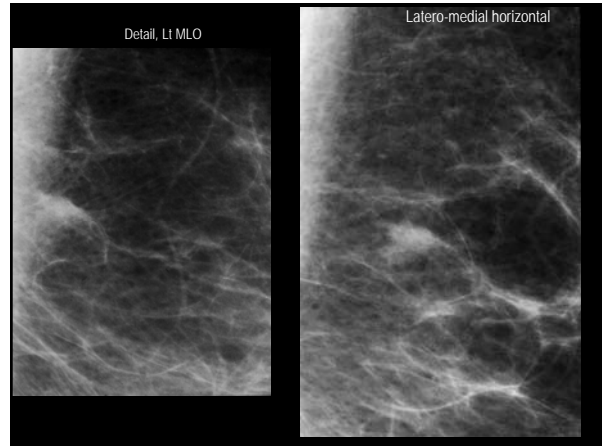
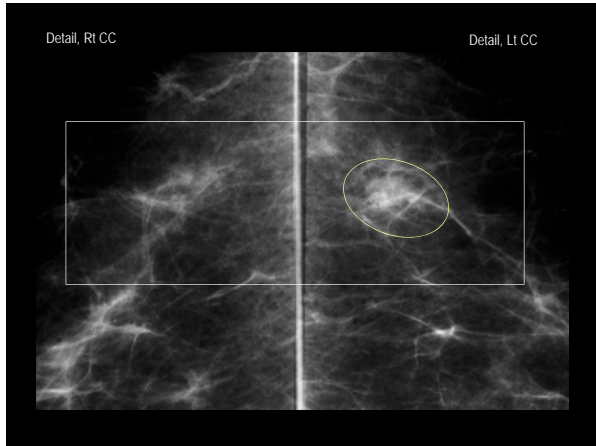


Histology

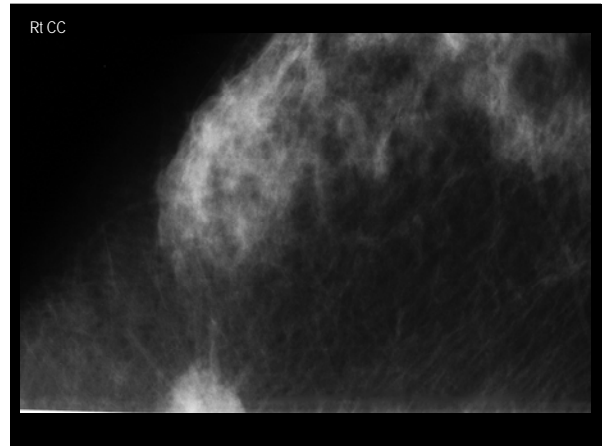
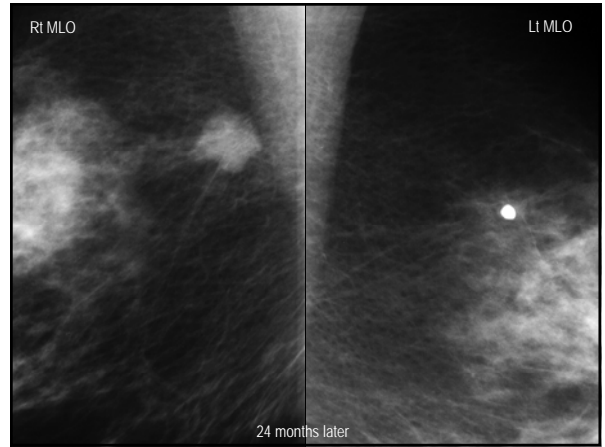
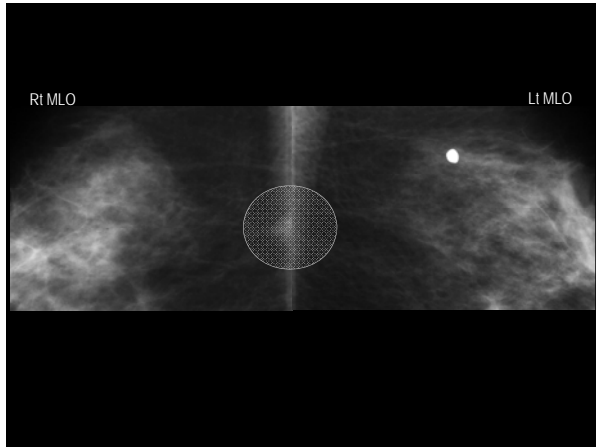
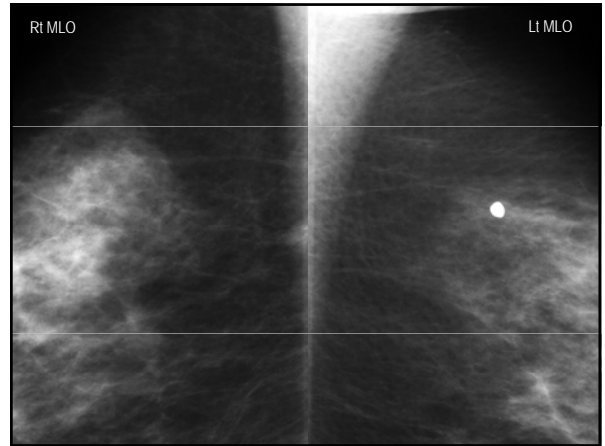
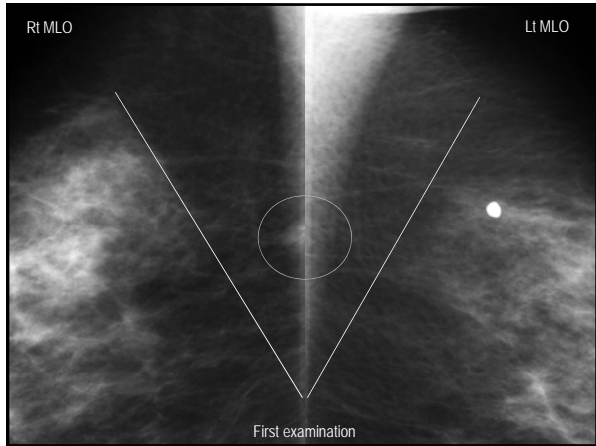
Three independent invasive breast cancer foci measuring 15x9 mm, 6x7 mm and 8 mm are associated with 11x7 mm *in situ* cancer. ER-ve, PR-ve, Her-2 pos, Prolif index 21%. The foci are well and moderately differentiated. pN 1/18

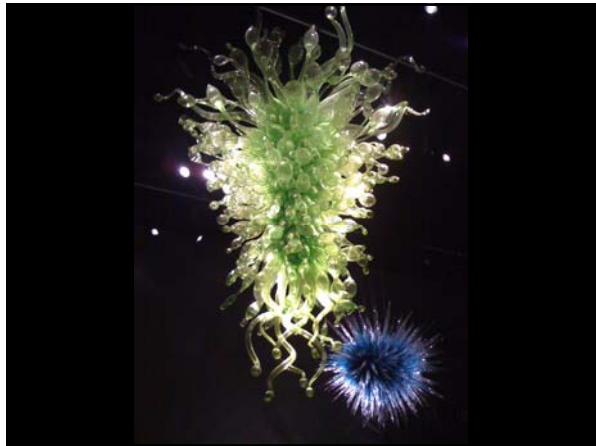






66 year old asymptomatic woman, screening examination

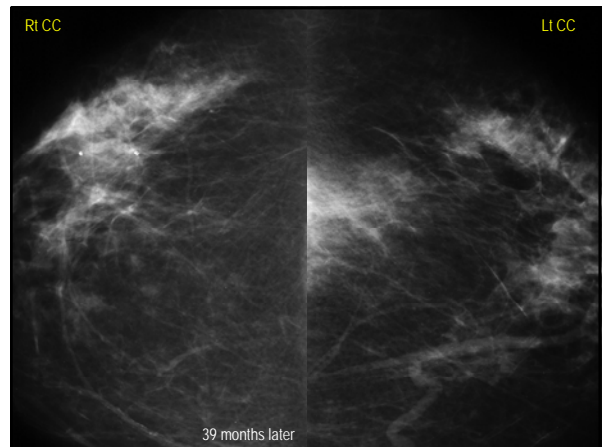
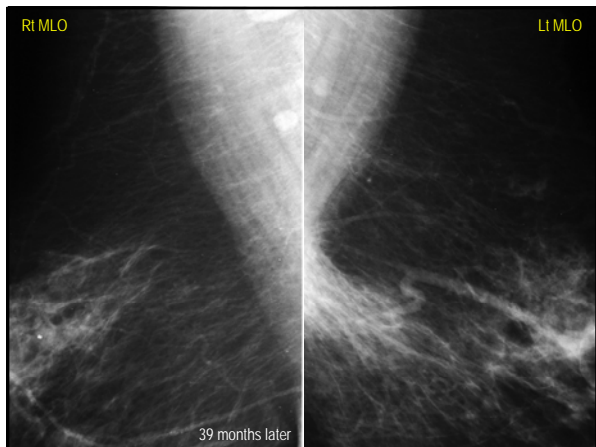
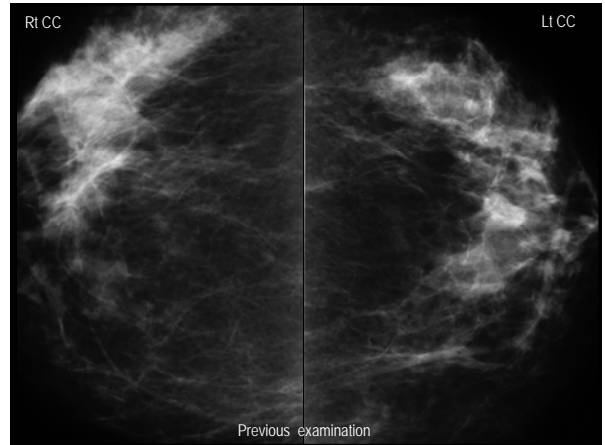
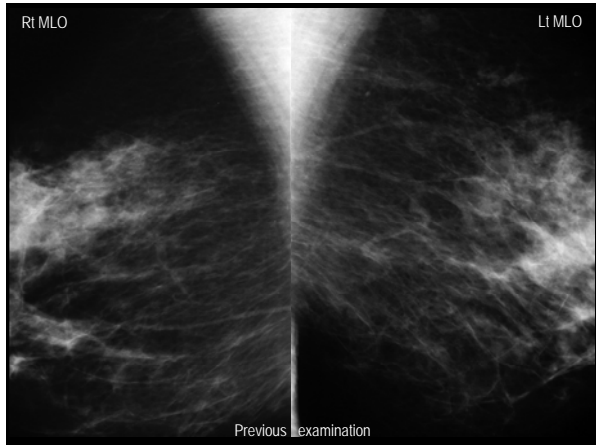


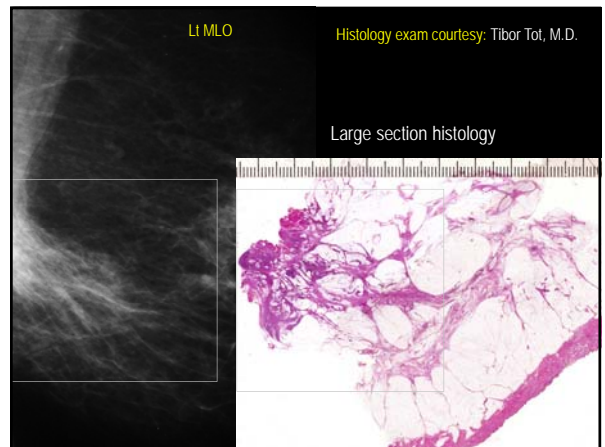
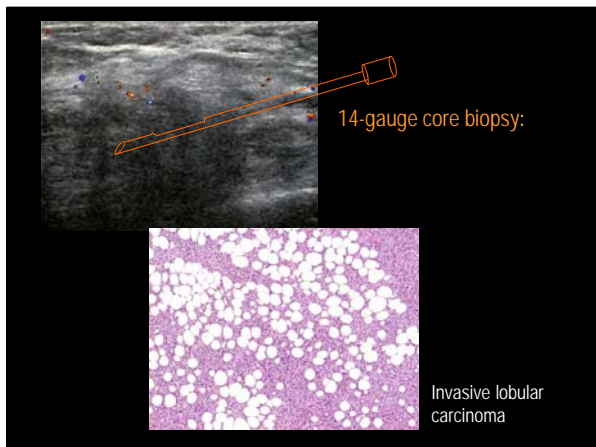
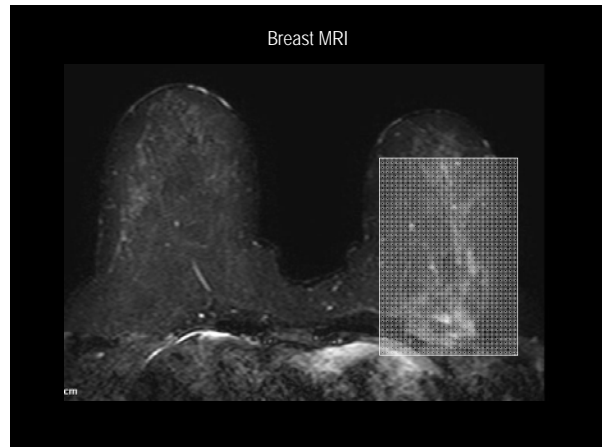
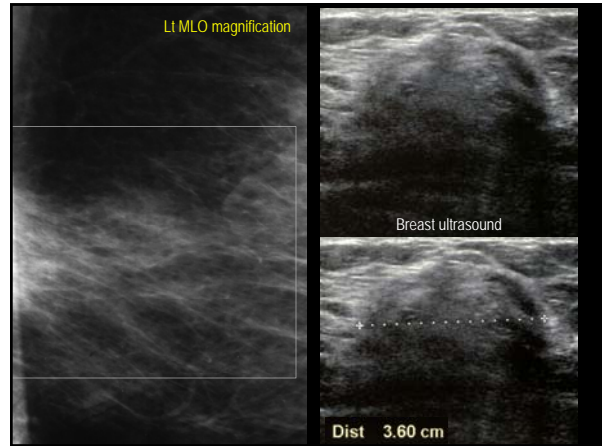
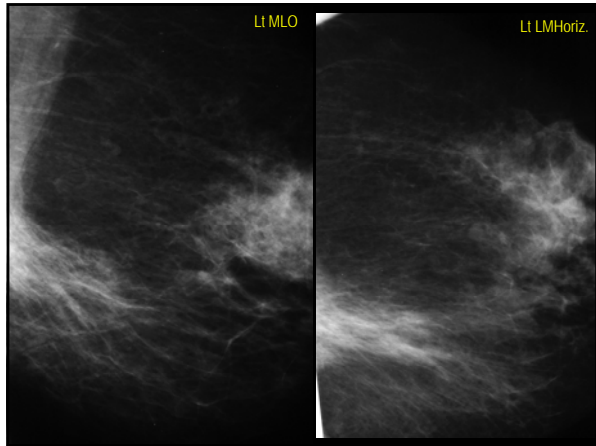


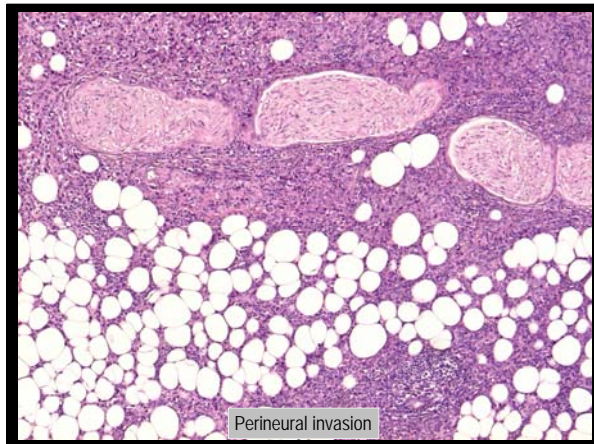
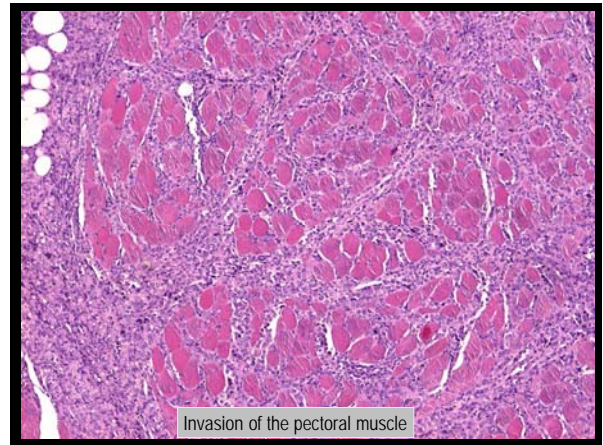
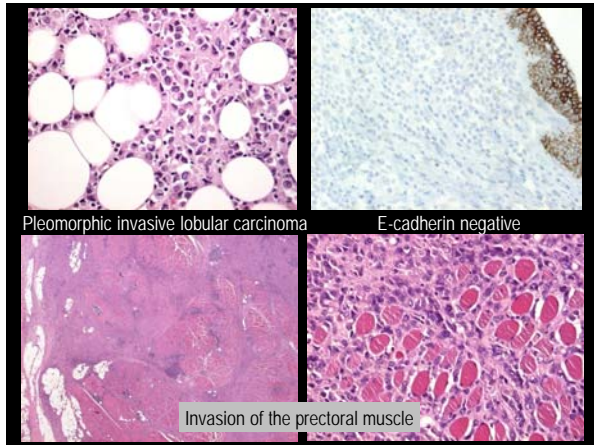
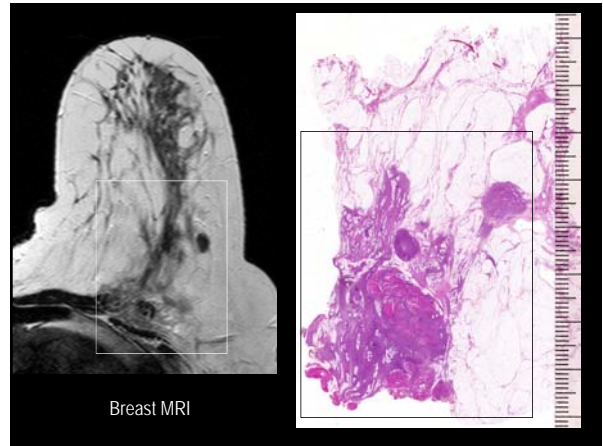
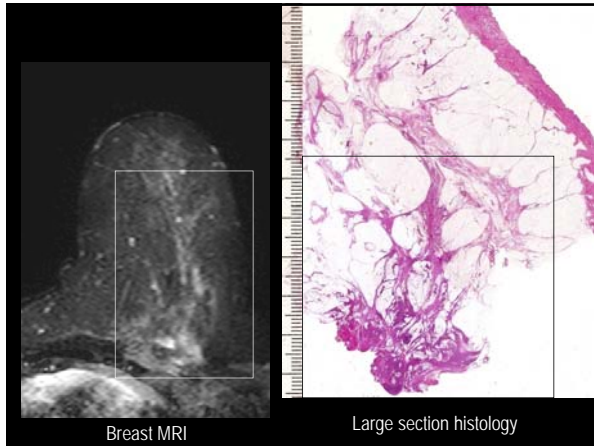
69 year old woman, called back from mammography screening for assessment of the asymmetric density in her left breast.

From the Departments of Mammography and Clinical Pathology

Case courtesy: Nadja Lindhe, M.D. Falun Central Hospital, Sweden





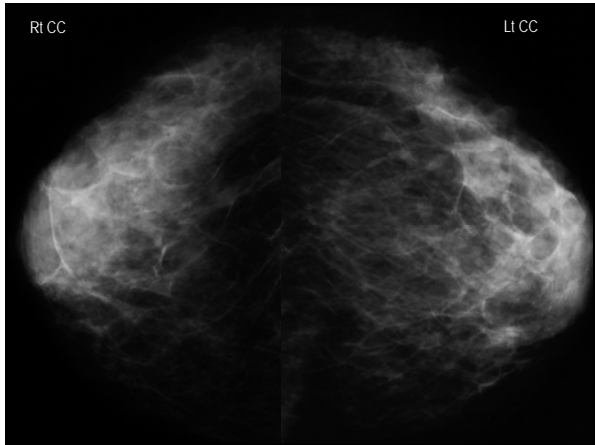
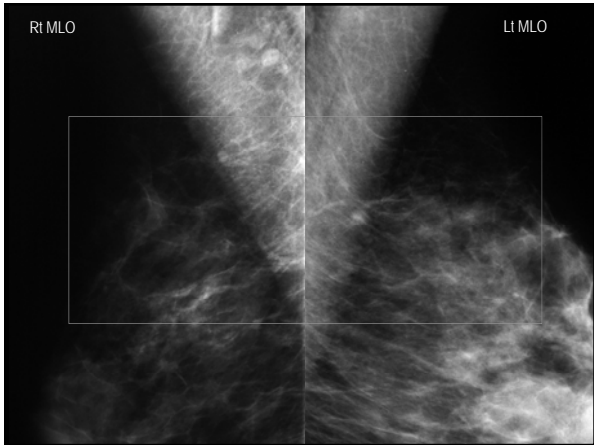


Histology

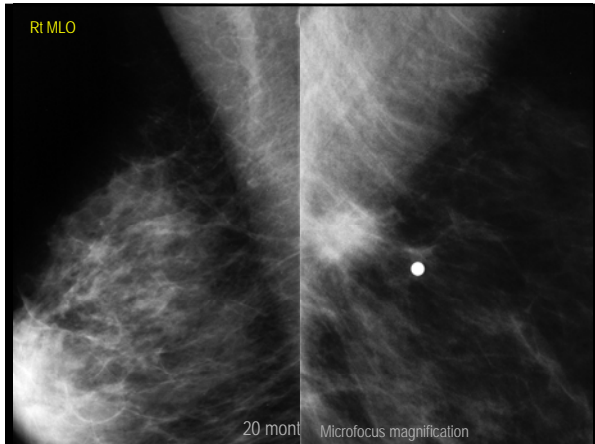
70x40 mm area with diffuse pleomorphic invasive lobular carcinoma. The largest individual focus measures 50x30 mm. There is associated LCIS. Extensive muscle and perineural invasion. No LVI demonstrated, pN 0/1

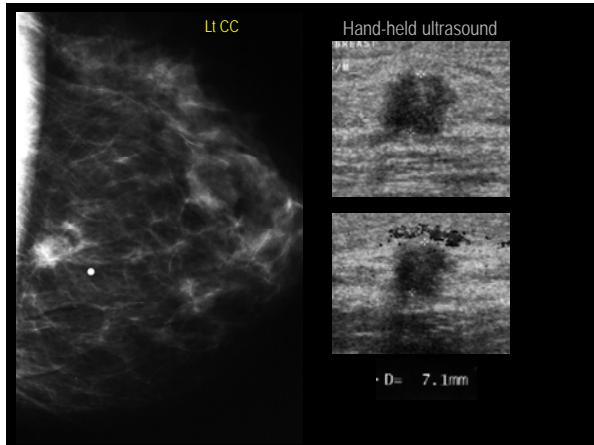
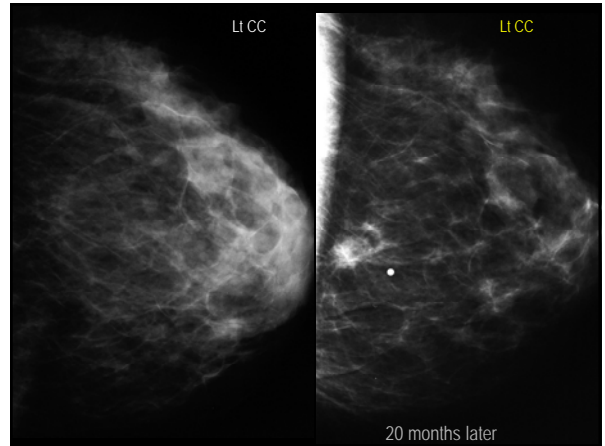
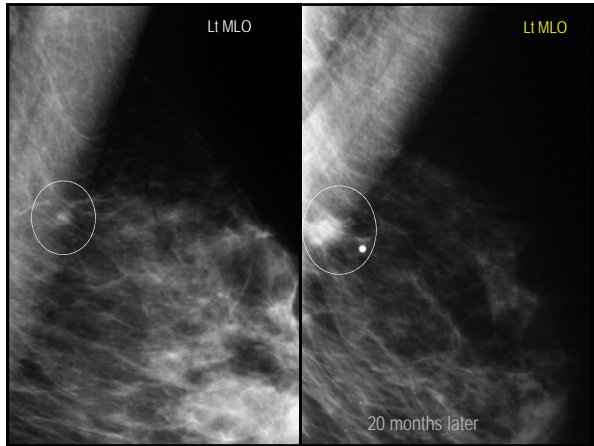


57 year old asymptomatic woman, screening examination



59 year old at the next screening, still asymptomatic. She was called back for assessment of the asymmetric density in the upper-outer quadrant of her left breast.



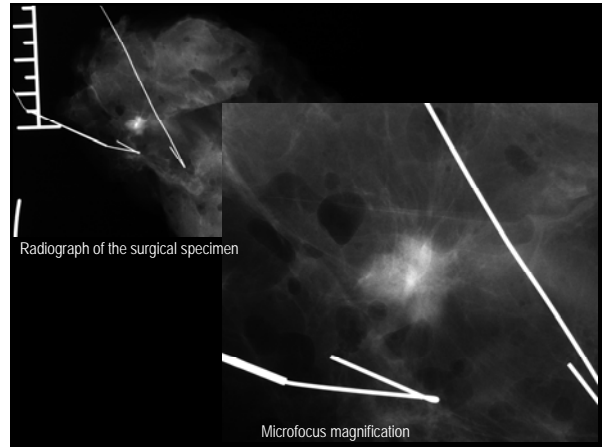
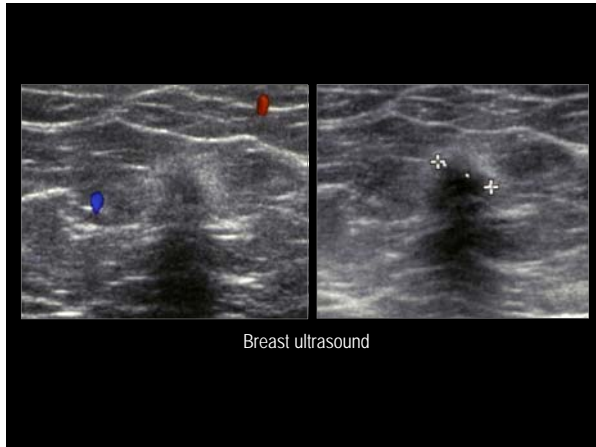
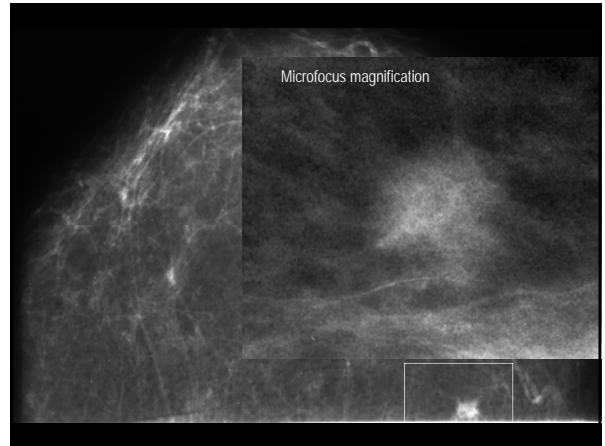
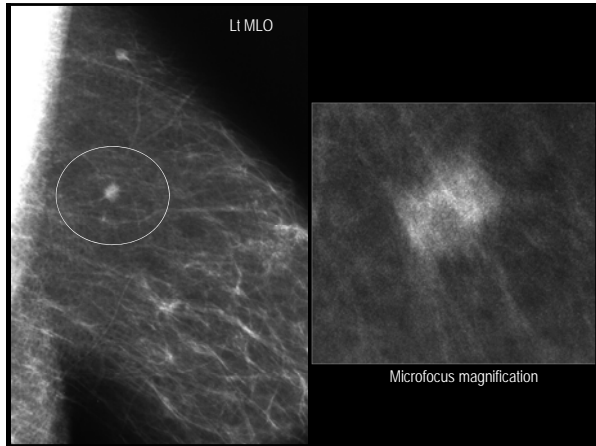


Histology
10x7 mm moderately differentiated ductal and lobular carcinoma
pN 0/6



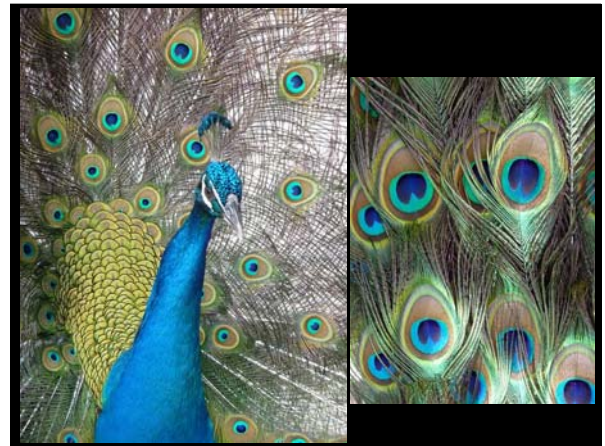
64 year old woman, called back from mammography screening for assessment of the tiny lesion in the upper-inner quadrant of her left breast.

From the Departments of Mammography and Clinical Pathology
Falun Central Hospital, Sweden



Histology

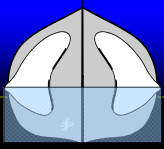
7X6 mm solitary invasive ductal carcinoma.
pN 0/2



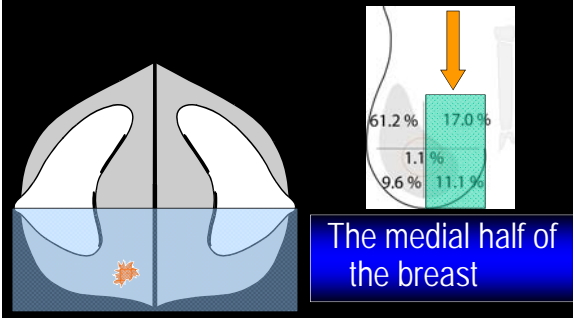
Side by side, step by step viewing
Areas that require special attention

Locations with high frequency of abnormal lesions ("forbidden areas"):

- "Milky way"
- The medial half of the breast



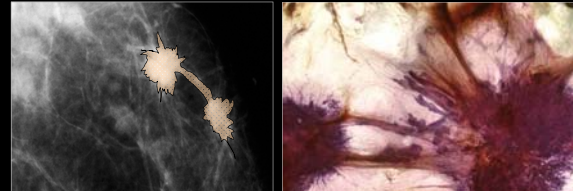
Side by side, step by step viewing
Areas that require special attention



The medial half of the breast

61.2%	17.0%
1.1%	11.1%
9.6%	

Side by side, step by step viewing
Areas that require special attention



The medial half of the breast

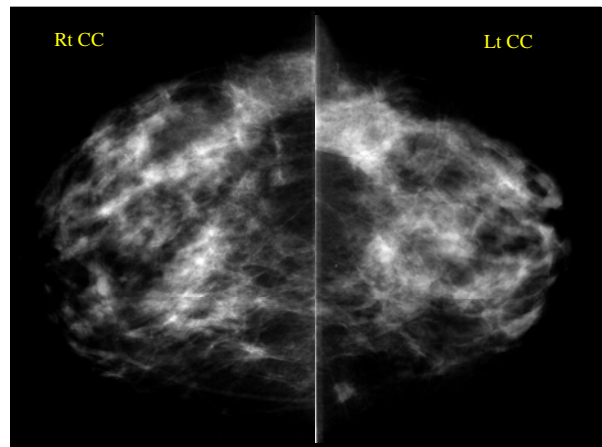
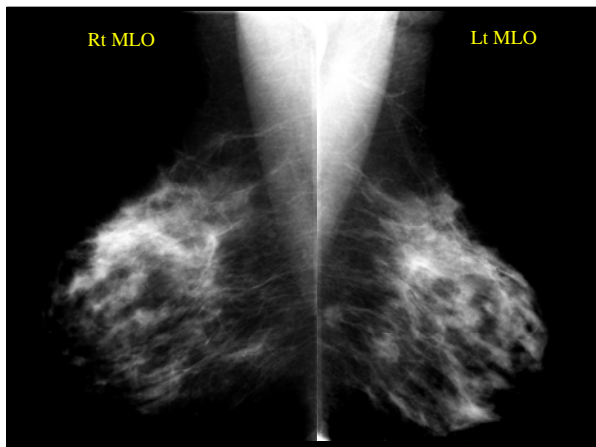
Perception case

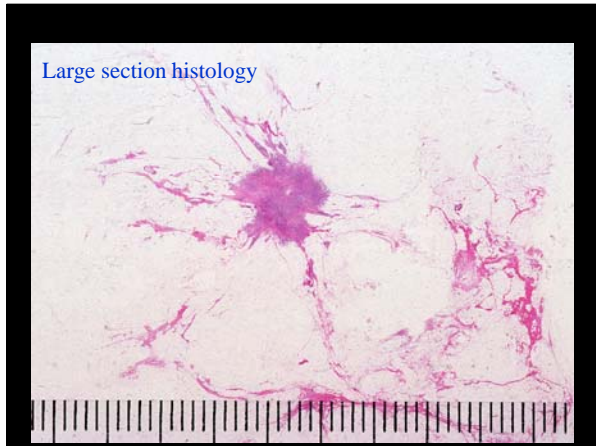
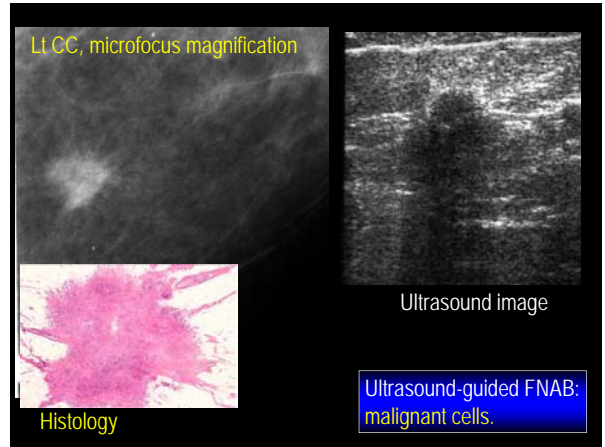
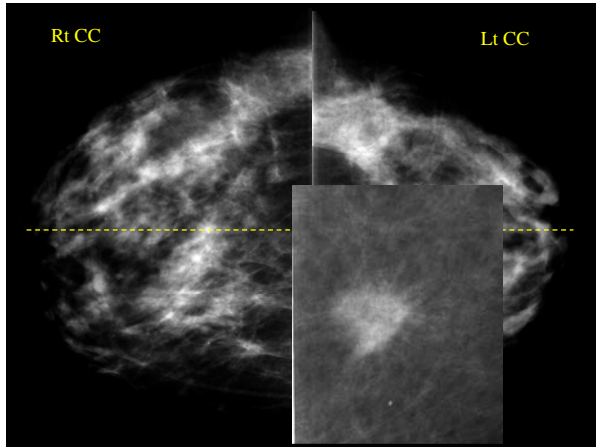
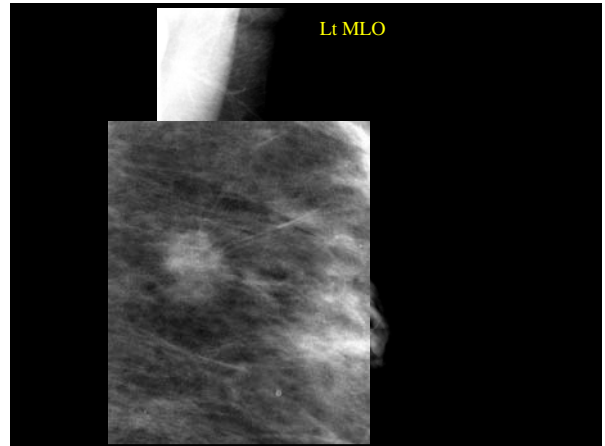
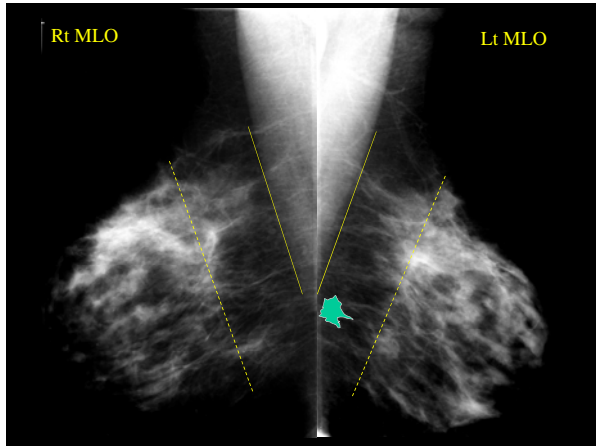
Age: 55

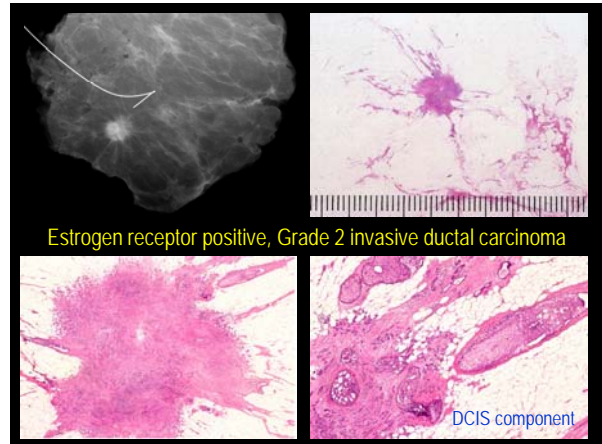
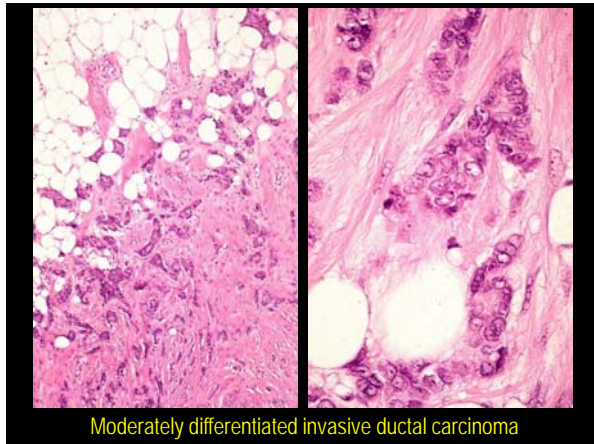
Asymptomatic, screening case.

History: no family history of breast cancer.

Clinical breast examination: normal.





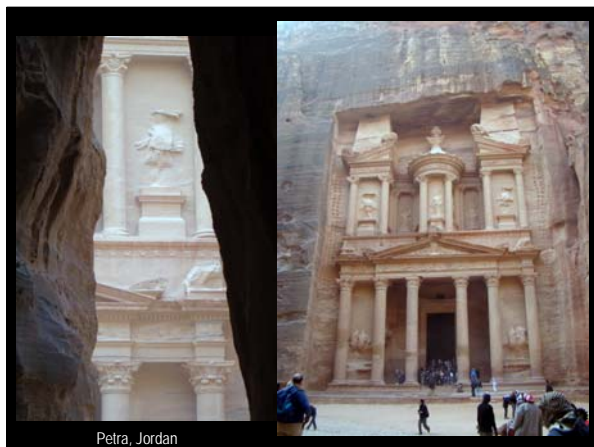


Histology

7x5 mm moderately differentiated invasive ductal carcinoma.
Estrogen receptor positive. pNX

A mammographically occult, 10 mm Grade 2 CIS is associated with the invasive tumor

Tumor-free margin. 14 mm

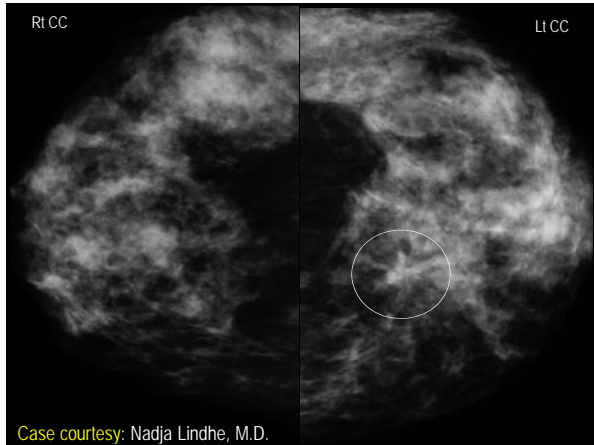
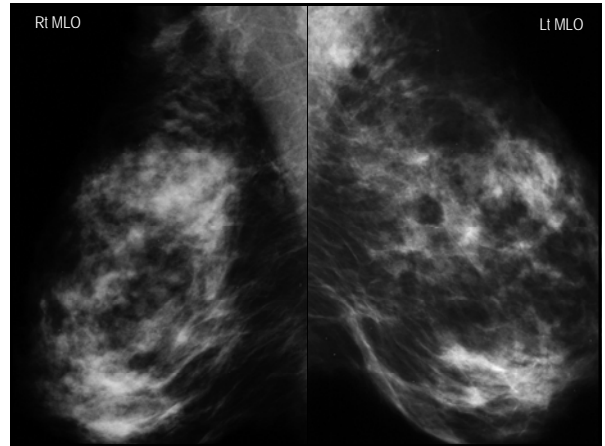


Breast ultrasound, while inferior in revealing calcifications, excels in demonstrating invasive tumors regardless of the nature of the surrounding tissue,

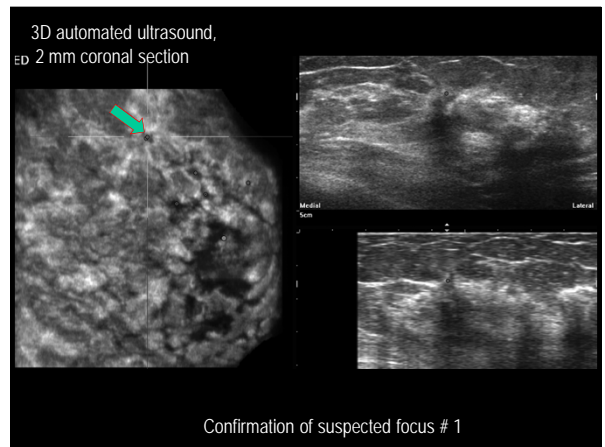
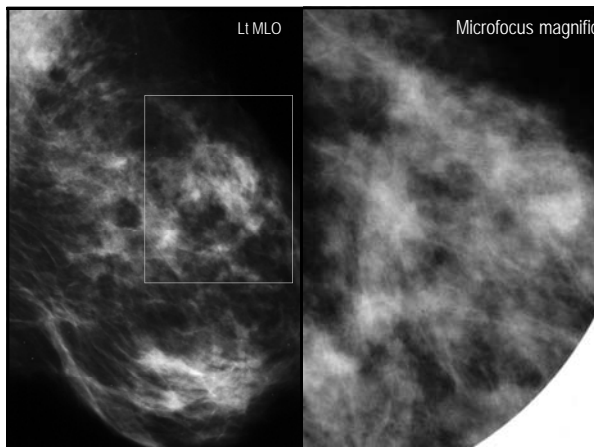
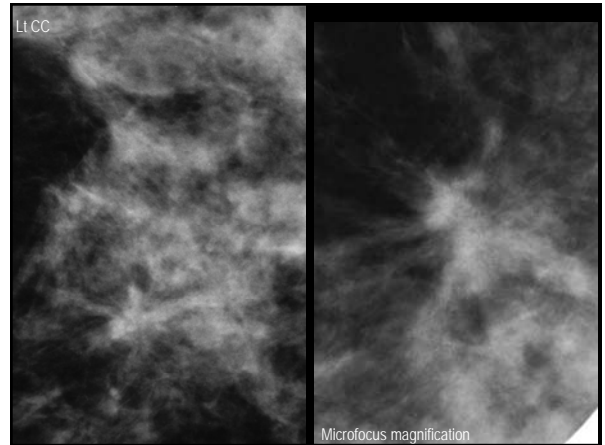
and has thus become an invaluable complementary imaging tool

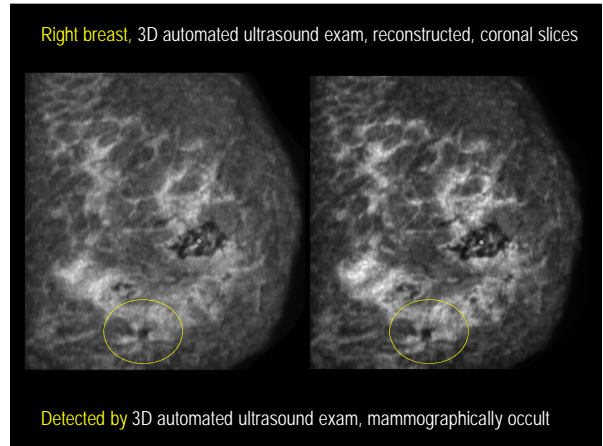
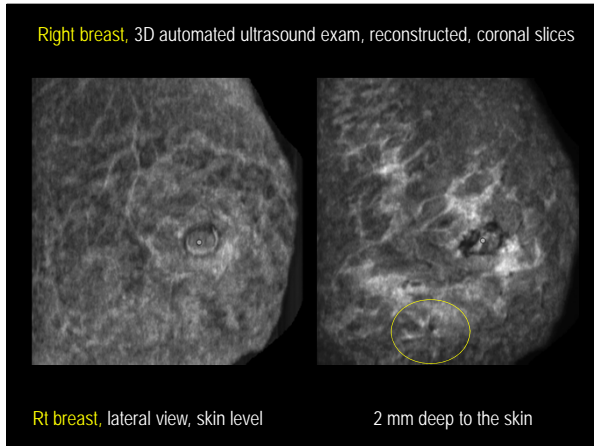
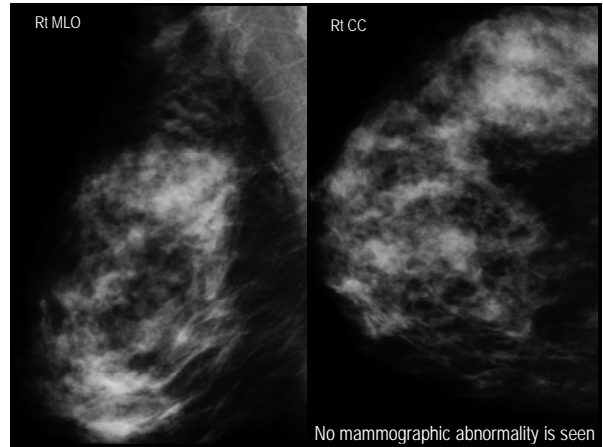
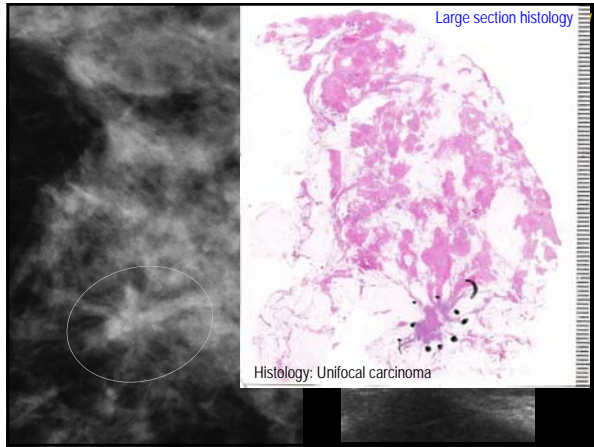
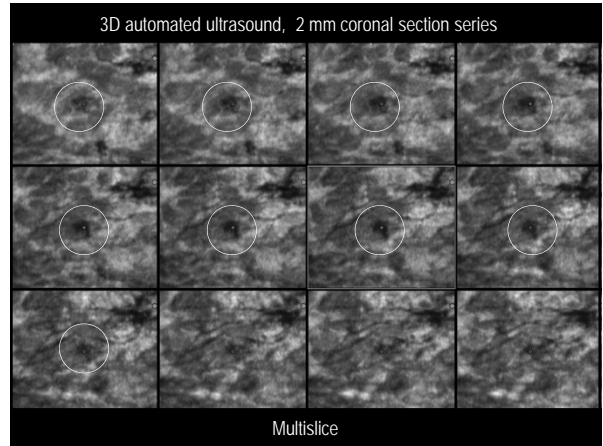
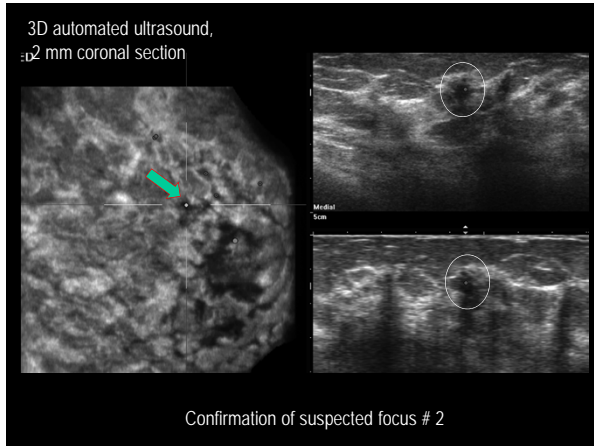
49 year old woman, called back from mammography screening for assessment of a stellate lesion in the medial portion of the left breast.

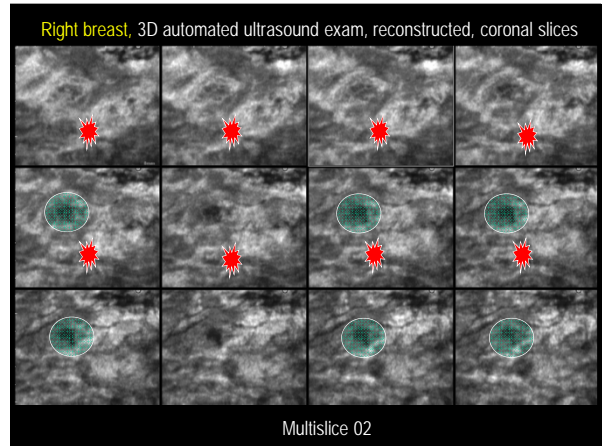
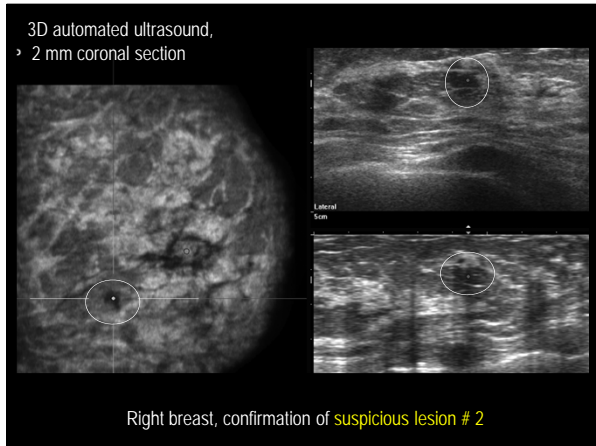
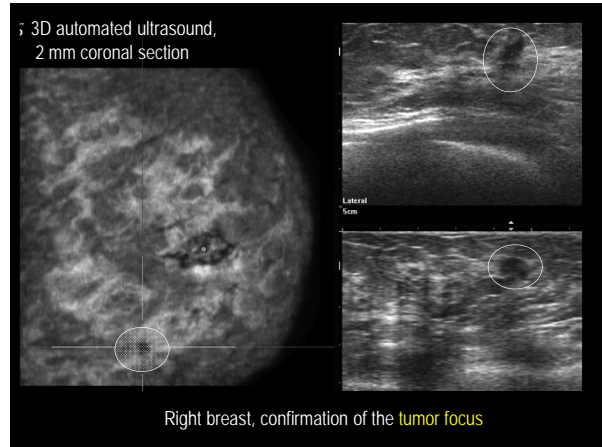
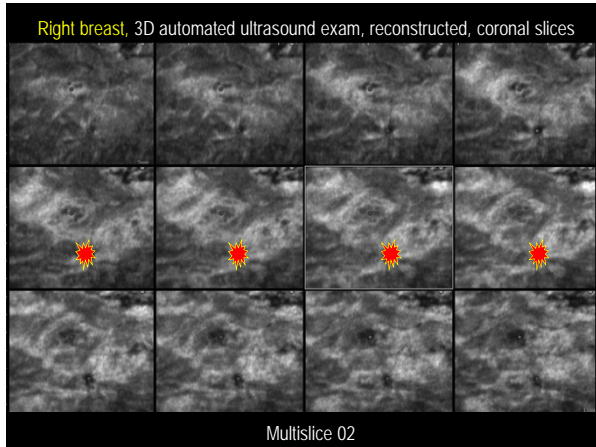
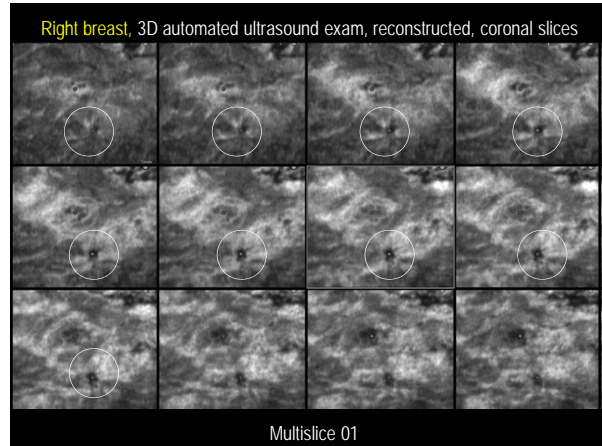
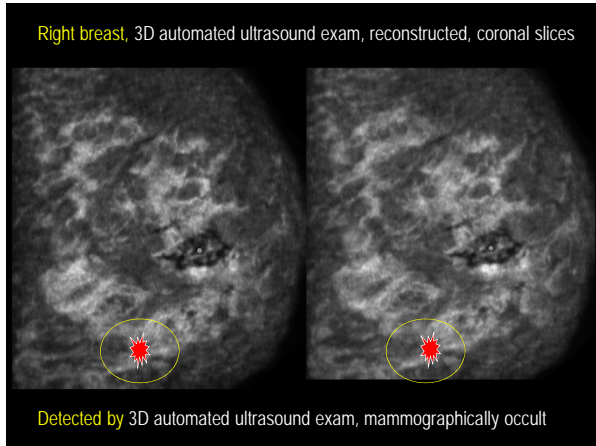
From the Departments of Mammography and Clinical Pathology Falun Central Hospital, Sweden

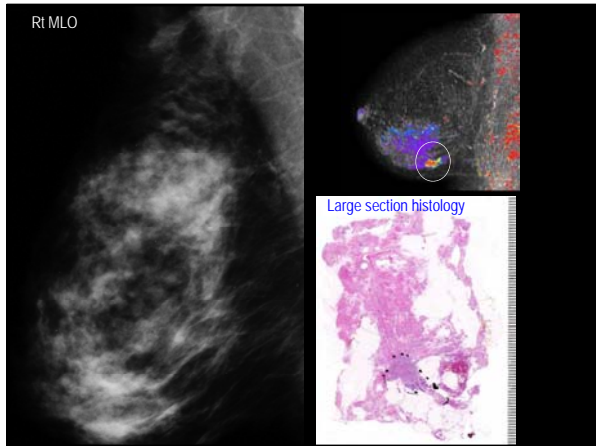
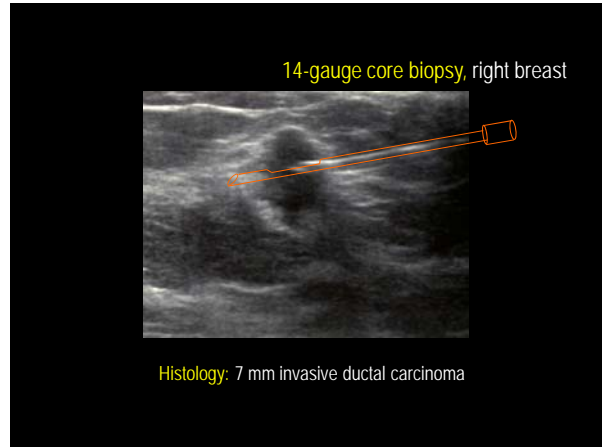
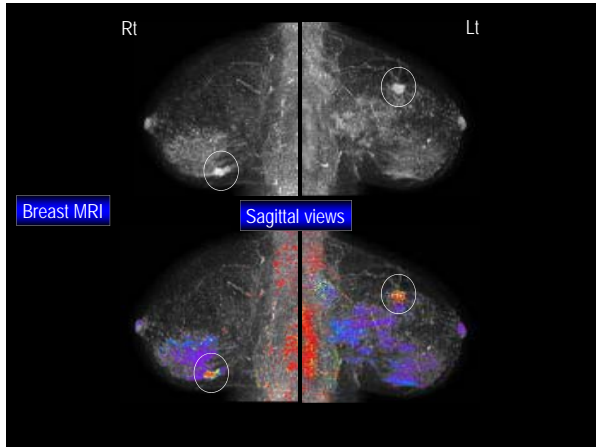
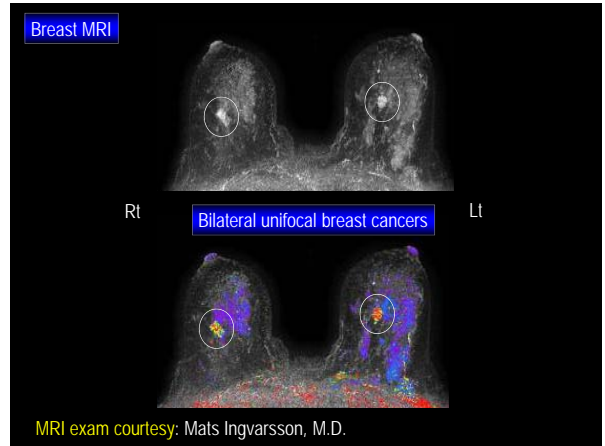
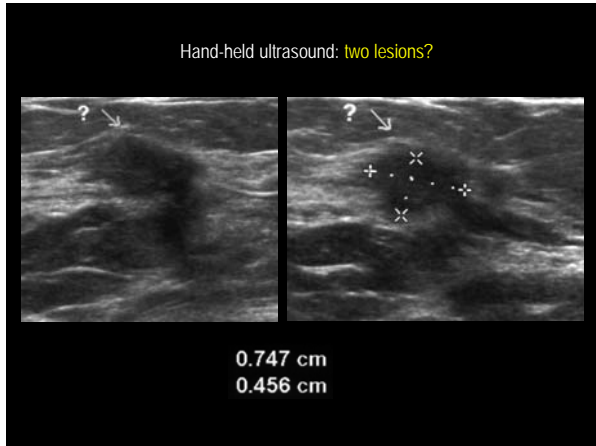


Case courtesy: Nadja Lindhe, M.D.







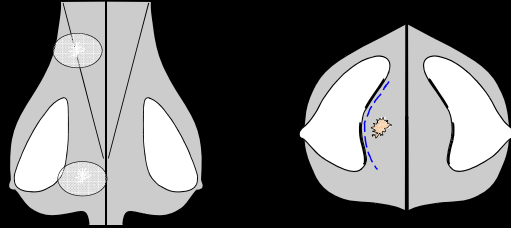


Side by side, step by step viewing
Areas that require special attention

Locations with high frequency of abnormal lesions ("forbidden areas");

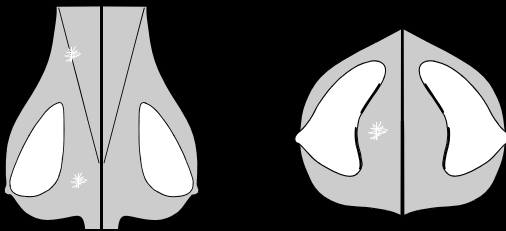
- ❑ "Milky way"
- ❑ The medial half of the breast
- ❑ Retroglandular clear space ("no man's land")

Side by side, step by step viewing
Areas that require special attention



The retroglandular clear space
("no man's land")

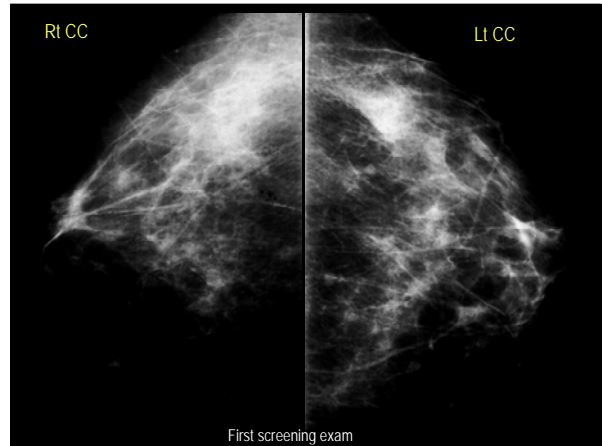
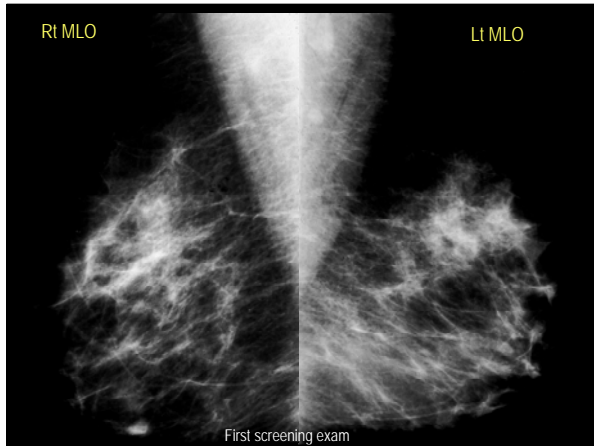
Side by side, step by step viewing
Areas that require special attention

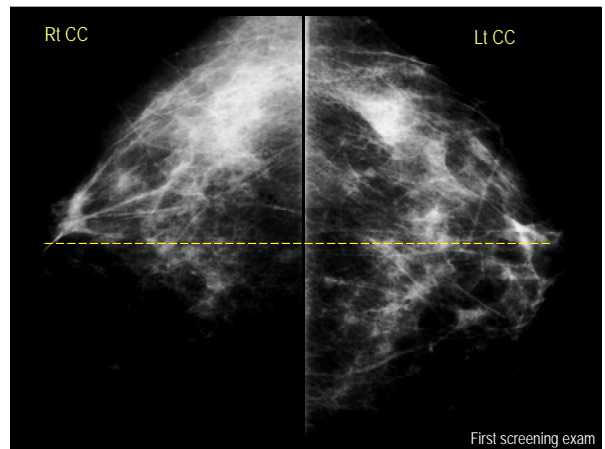
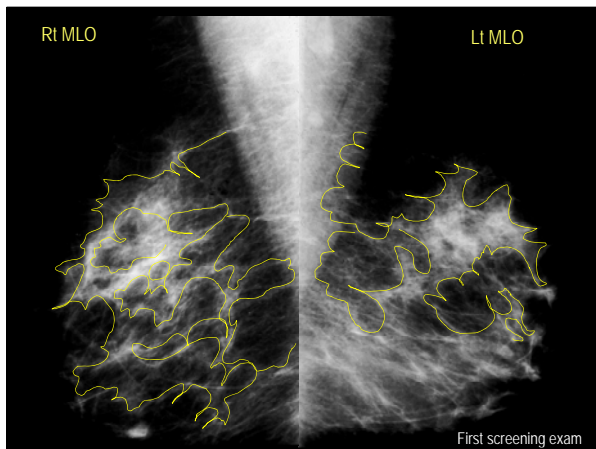
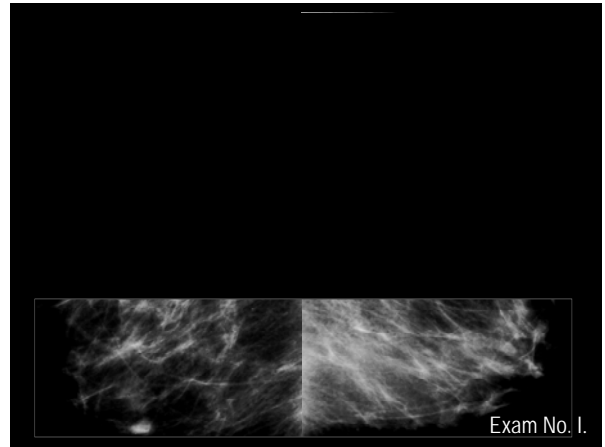
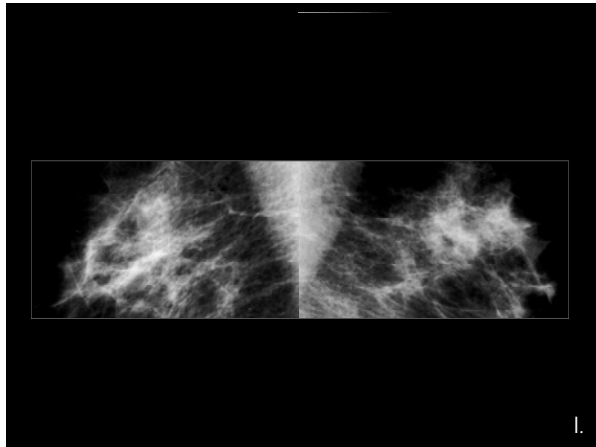
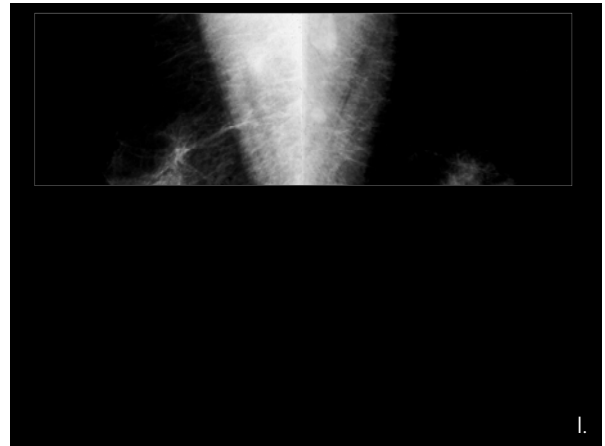
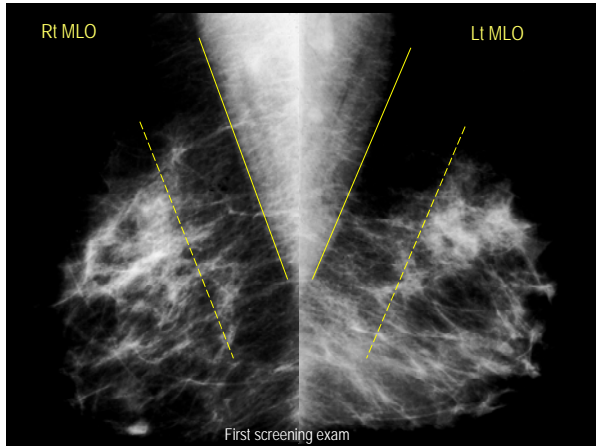


The retroglandular clear space
("no man's land")

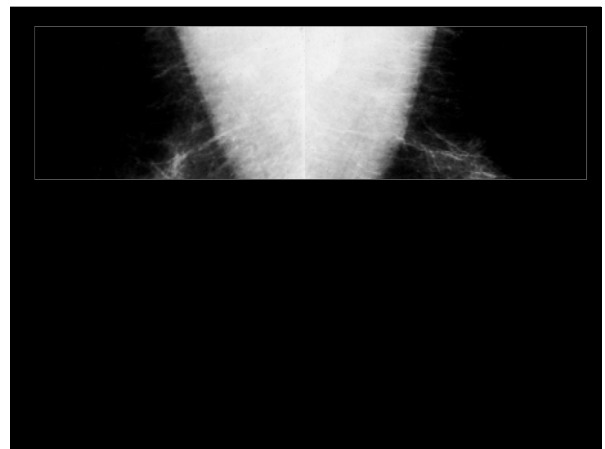
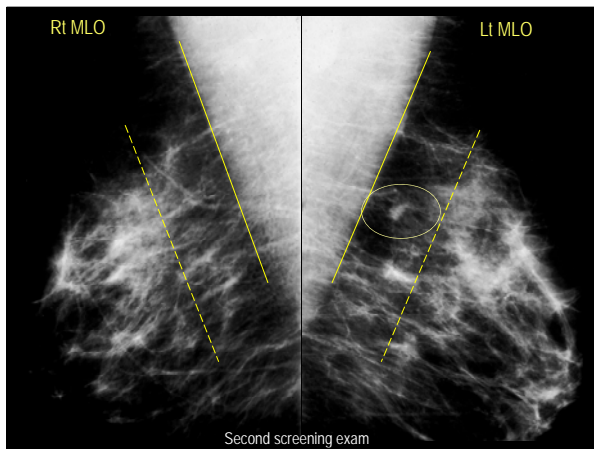
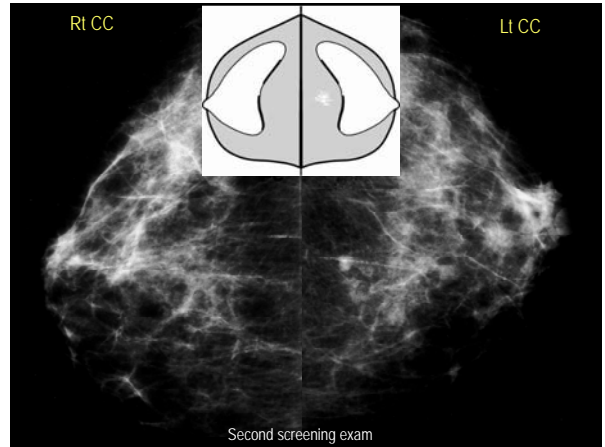
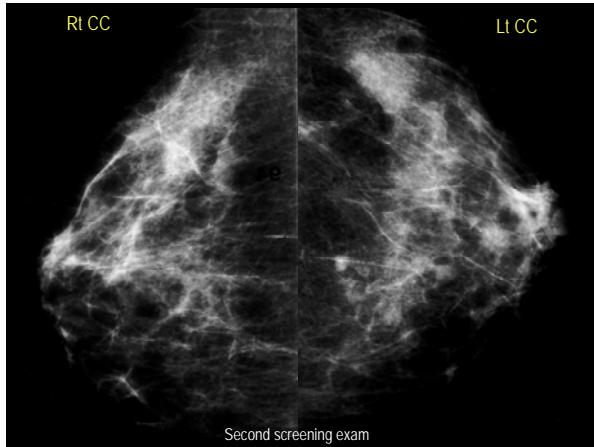
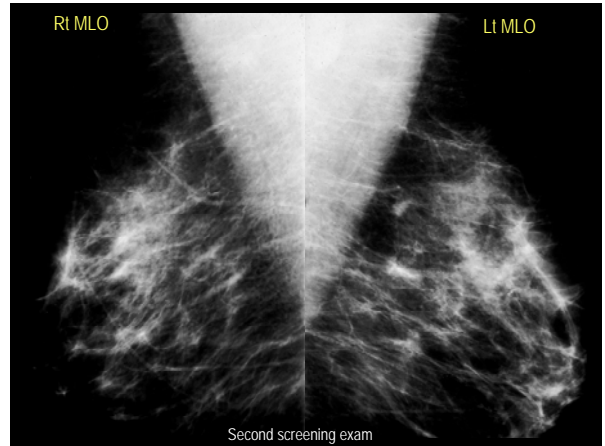
Perception case

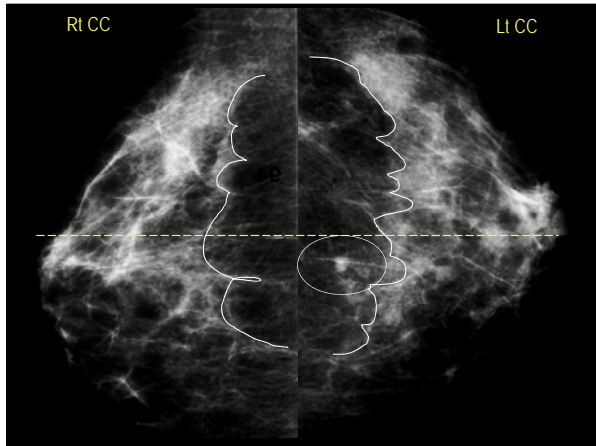
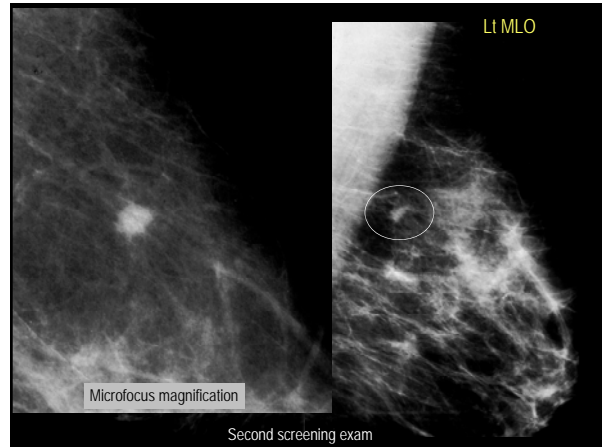
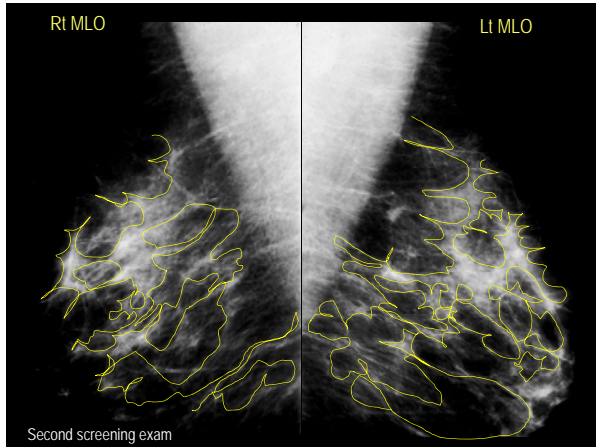
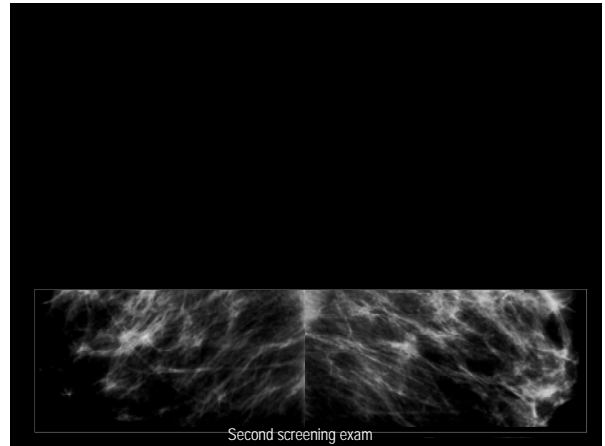
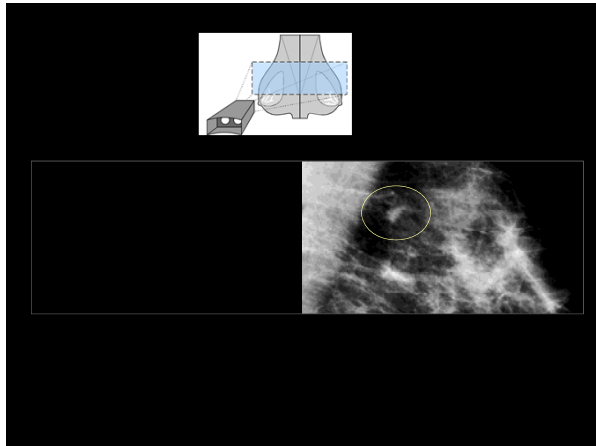
65-year old asymptomatic woman, called back from screening for assessment of the mammographic finding





Second screening examination
two years later, still asymptomatic.



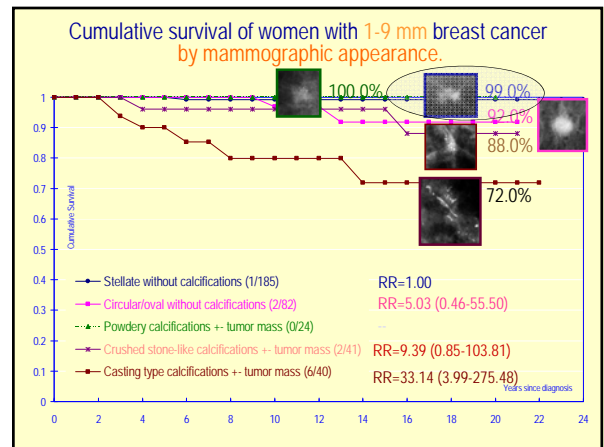
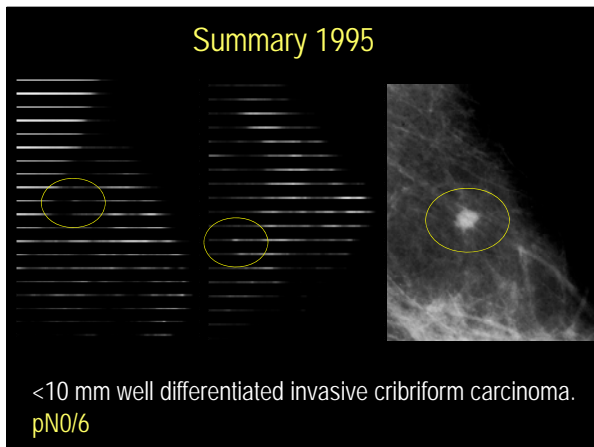
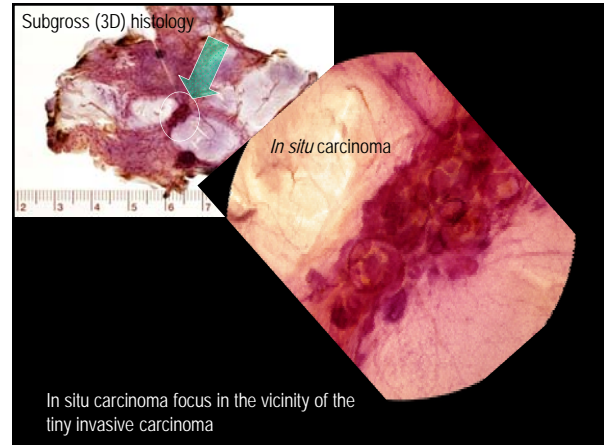
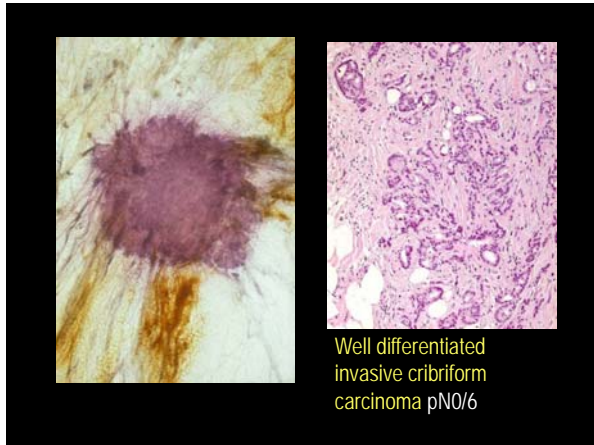
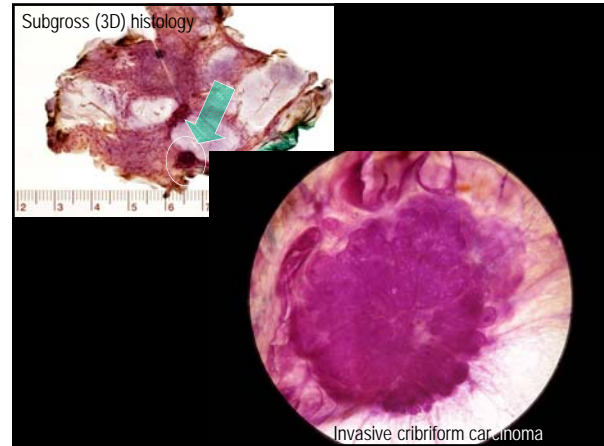
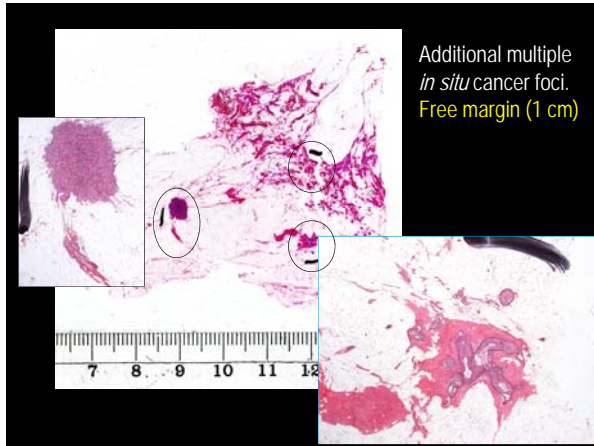


Summary of diagnosis and treatment 1995

Segmentectomy, surgical removal of 6 axillary lymph nodes and postoperative irradiation

The slide contains two images: a gross pathology specimen on the left and a histology slide on the right. The gross specimen is a dark, irregularly shaped mass with a white line and arrows pointing to a specific area. The histology slide shows a pink and purple stained tissue section with a ruler below it for scale.

Histology (1995): 6 mm well differentiated invasive cribriform cancer and Grade 1 *in situ* carcinoma. pN 0/6



Treatment: Segmentectomy and postoperative irradiation

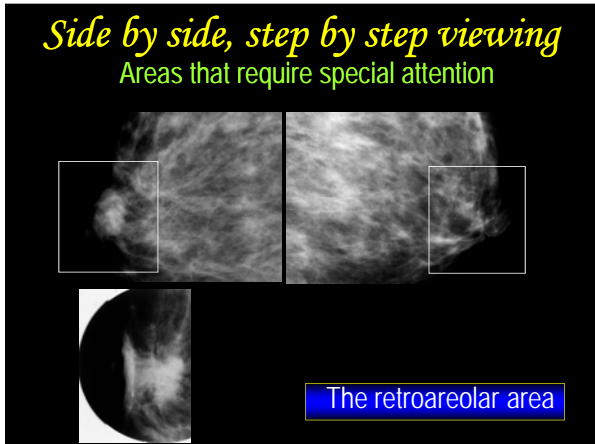
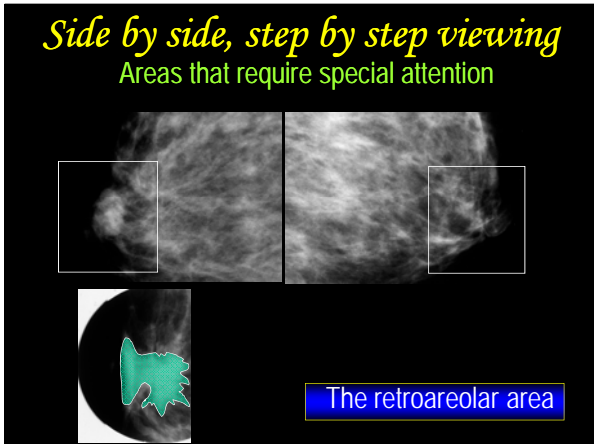
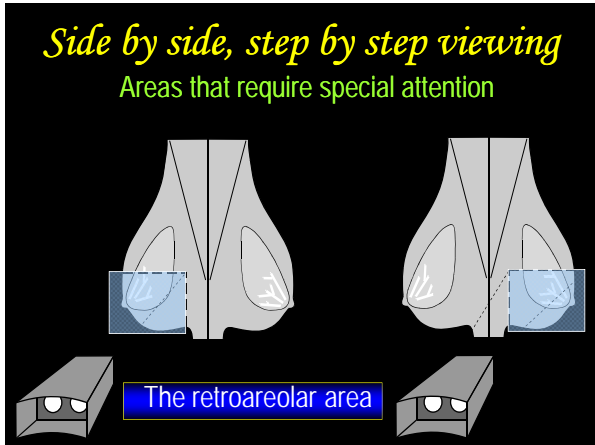
Outcome: No sign of recurrence was appreciated at the yearly follow up exams during the first *twelve-years of follow up*



Side by side, step by step viewing
Areas that require special attention

Locations with high frequency of abnormal lesions ("forbidden areas"):

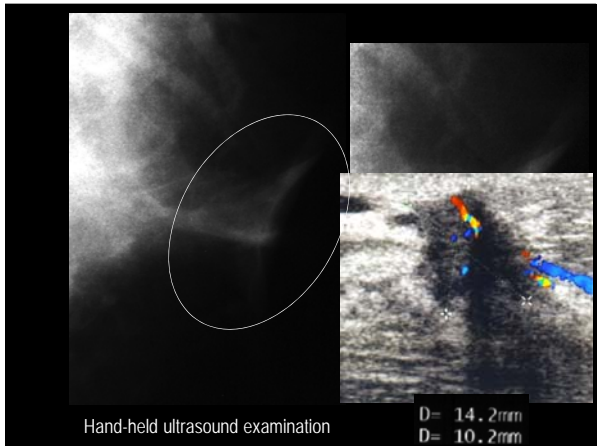
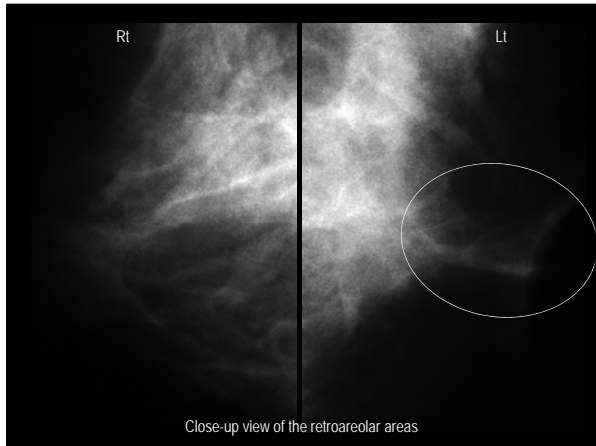
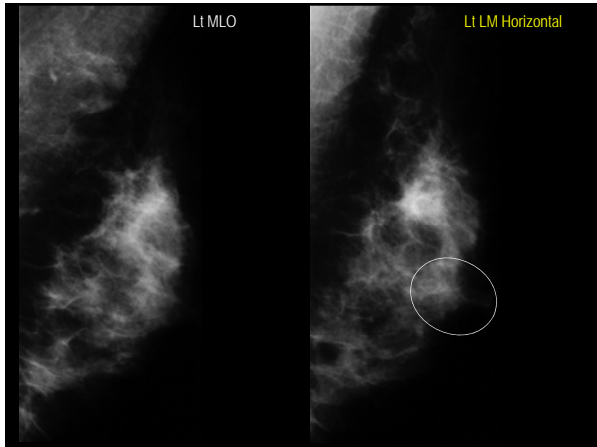
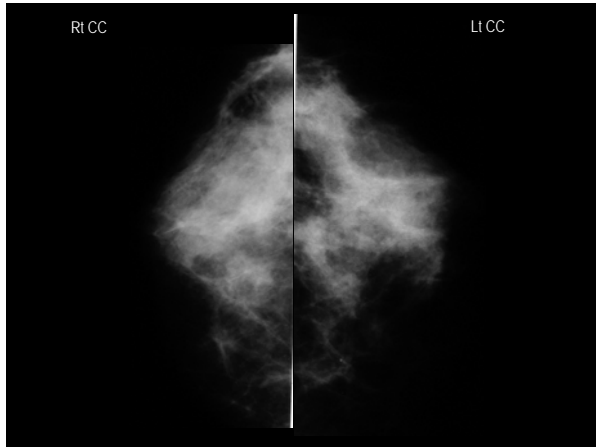
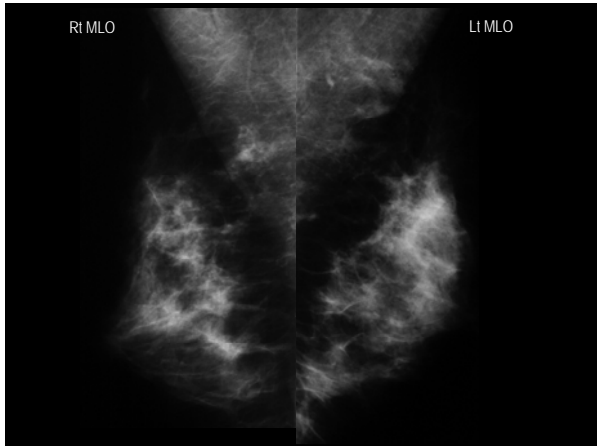
- "Milky way"
- The medial half of the breast
- Retroglandular clear space ("no man's land")
- The retroareolar area

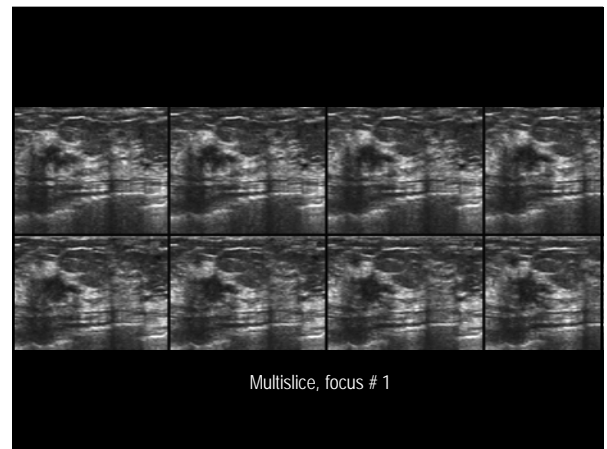
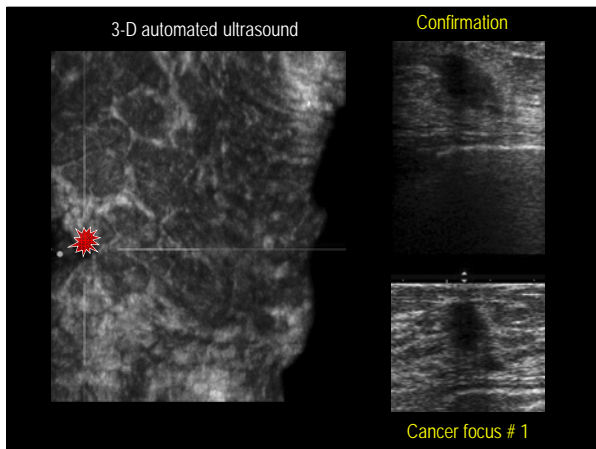
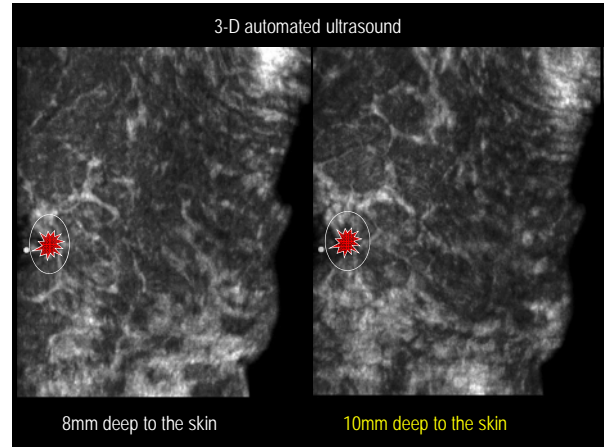
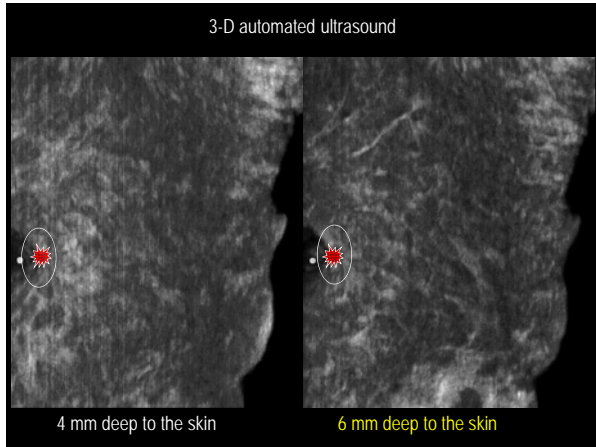
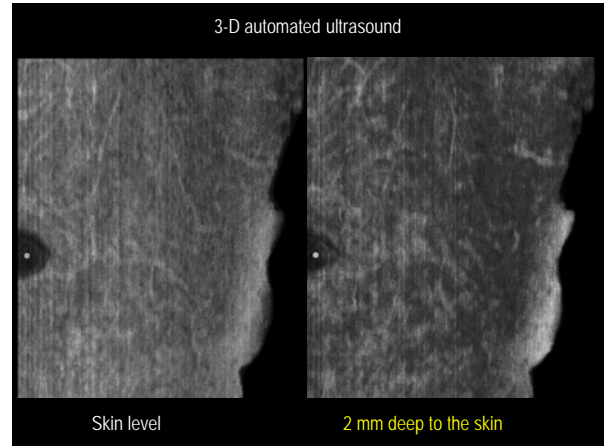
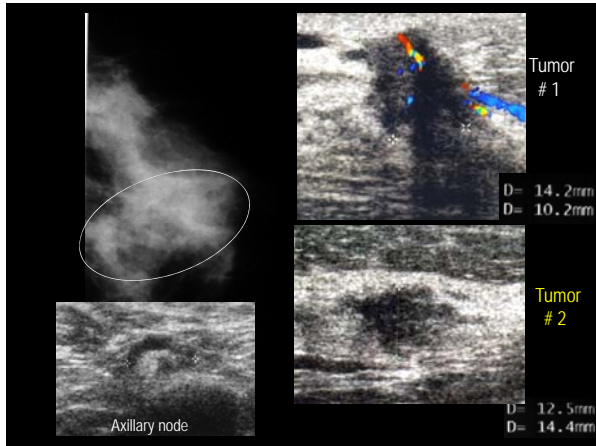


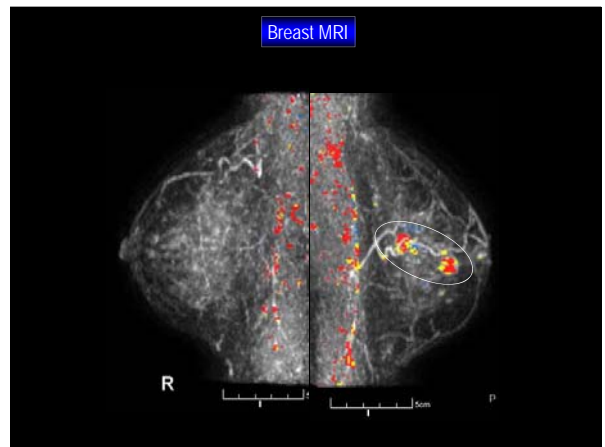
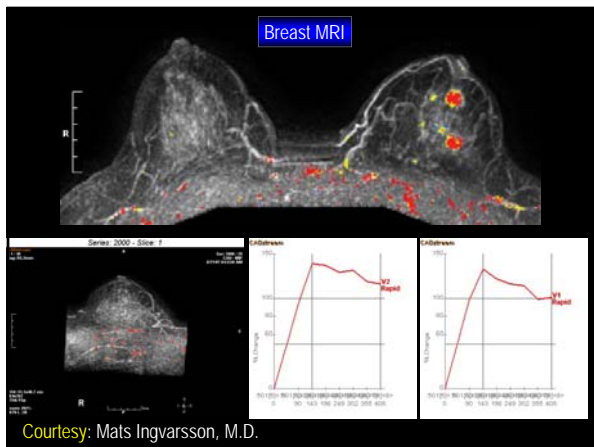
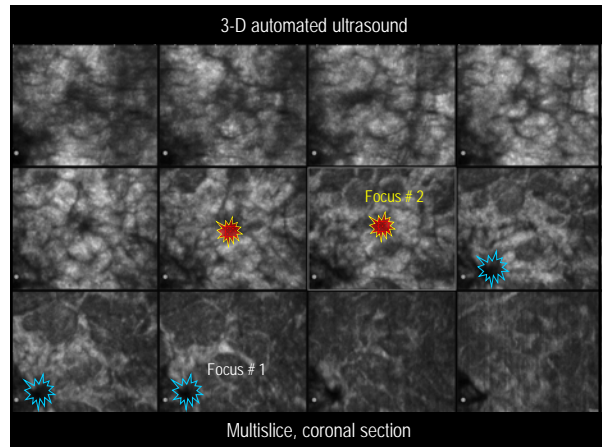
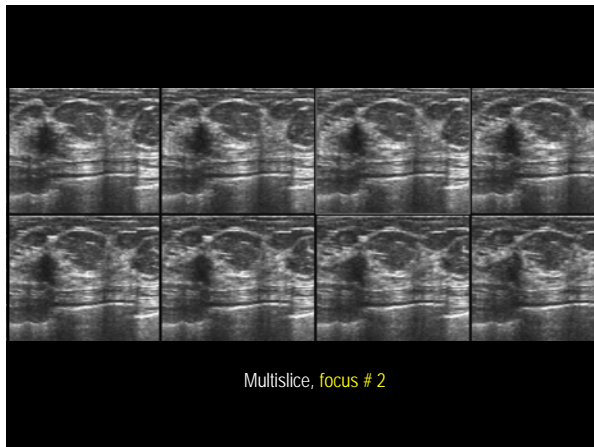
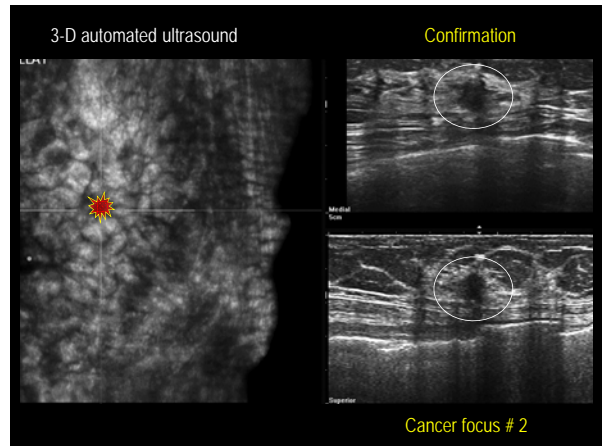
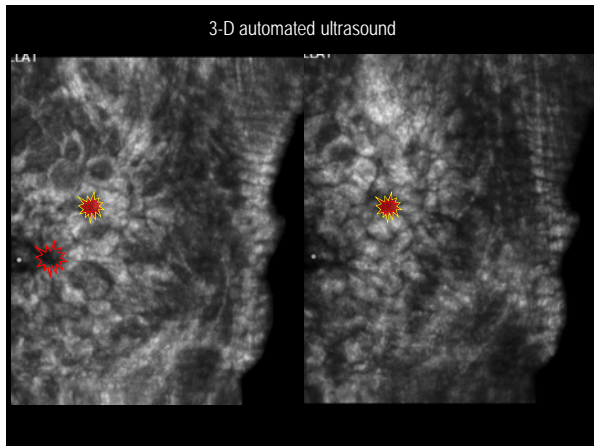
A 48 year old woman, who noticed a gradual, slight retraction of her *left nipple*.

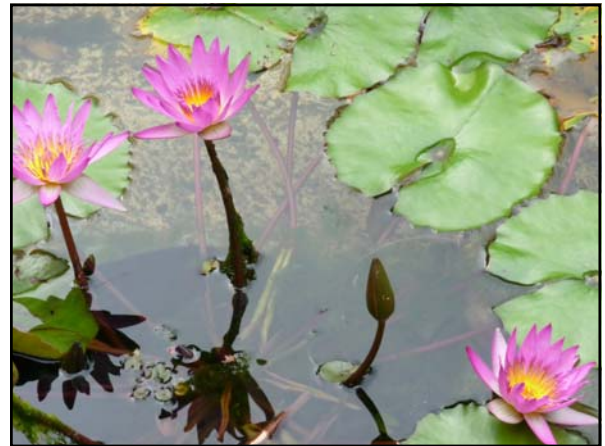
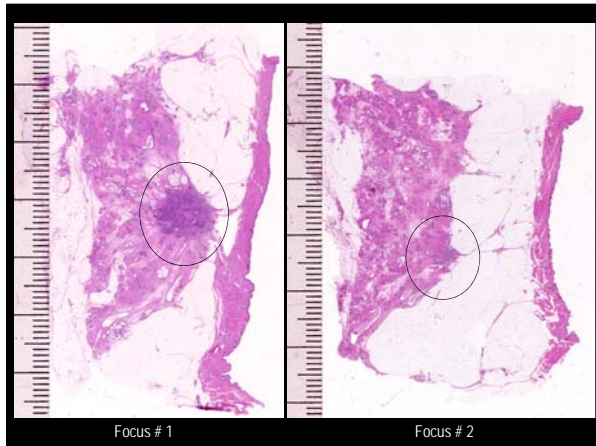
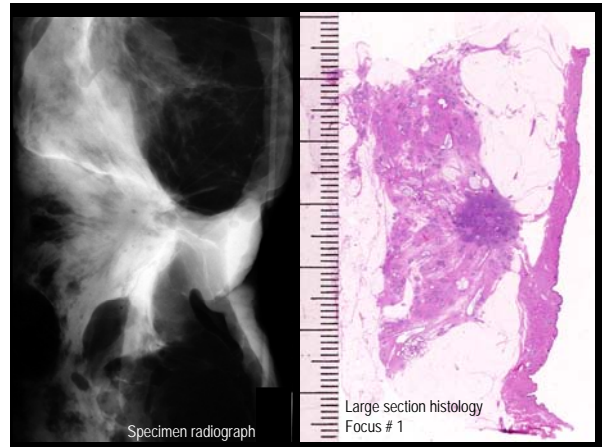
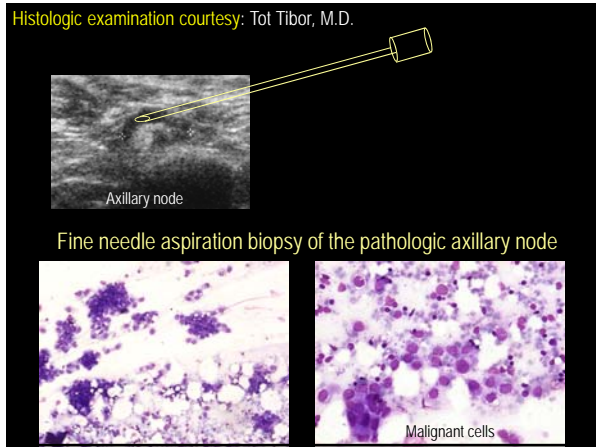
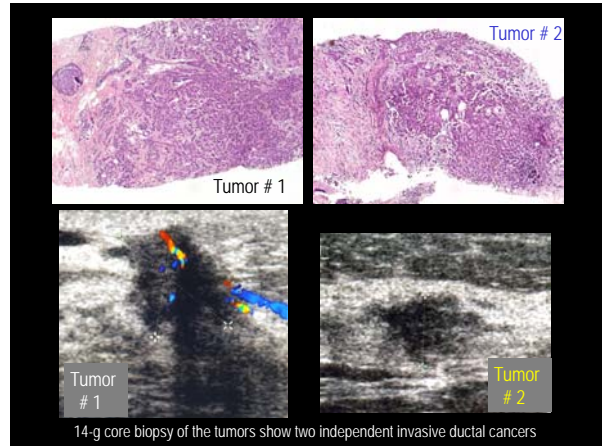
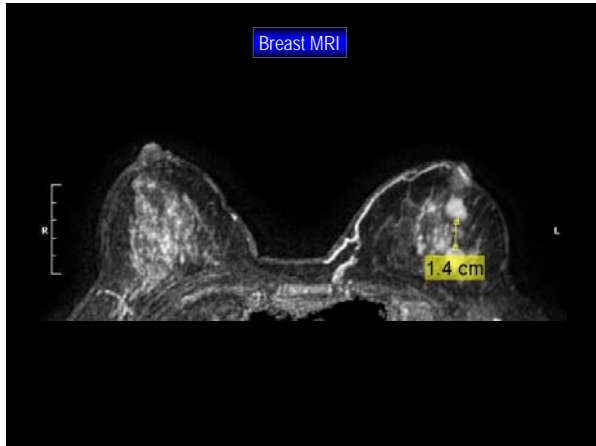
Clinical breast examination confirmed the retraction of the left nipple. No definite tumor mass was palpable though.

From the Departments of Mammography and Clinical Pathology
Falun Central Hospital, Sweden ©









Aim of perception
Disruption of the harmonic structure

Parenchymal contour change

Aim of perception
Disruption of the harmonic structure

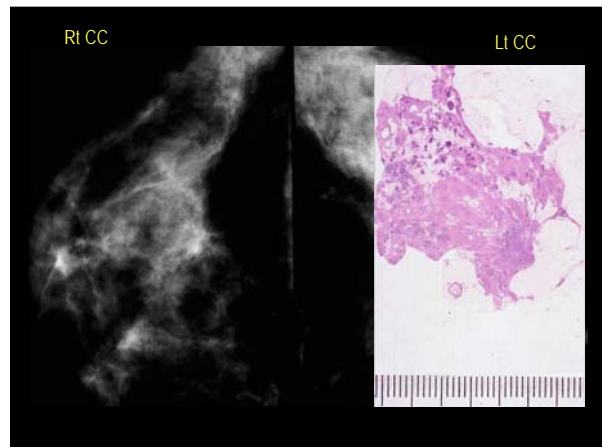
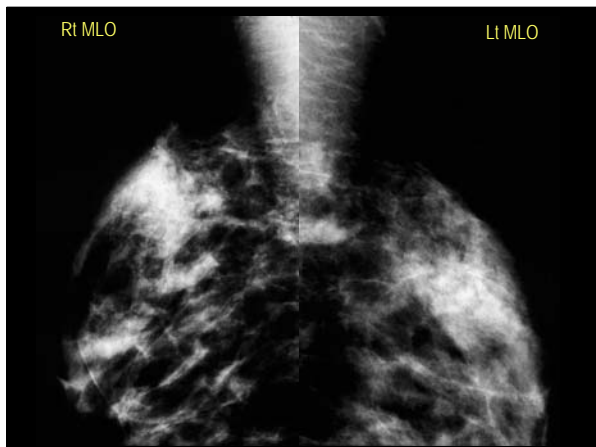
Parenchymal contour change

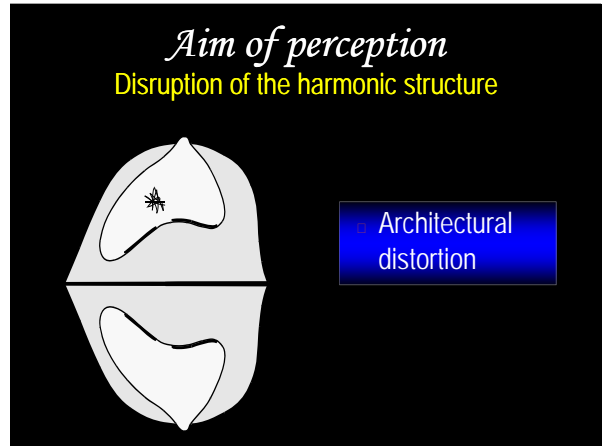
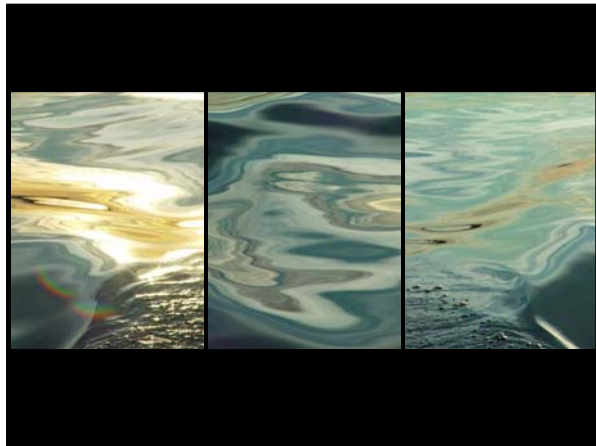
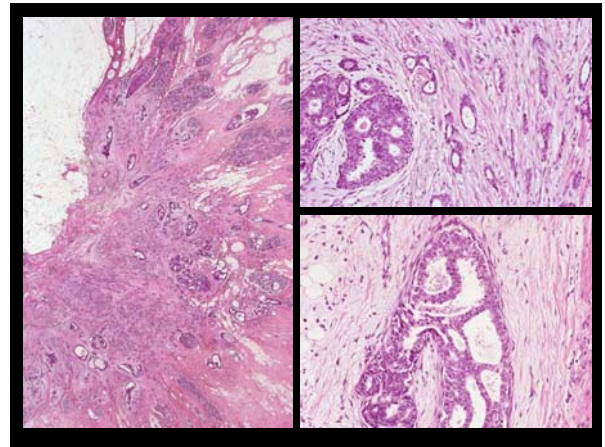
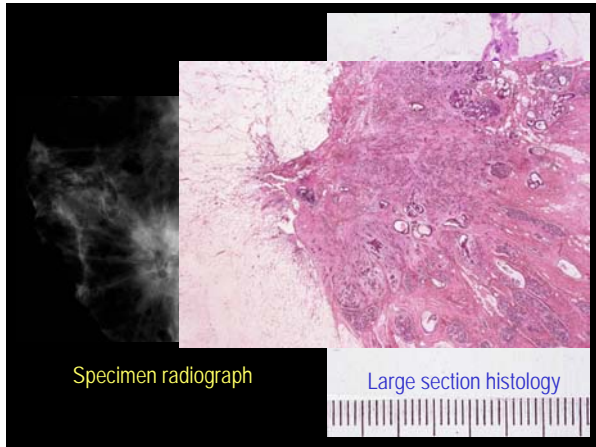
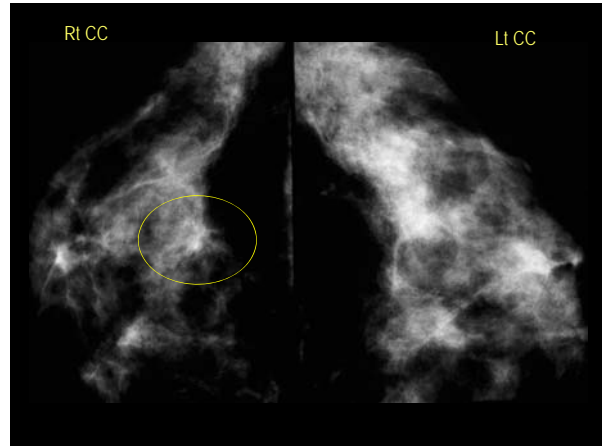
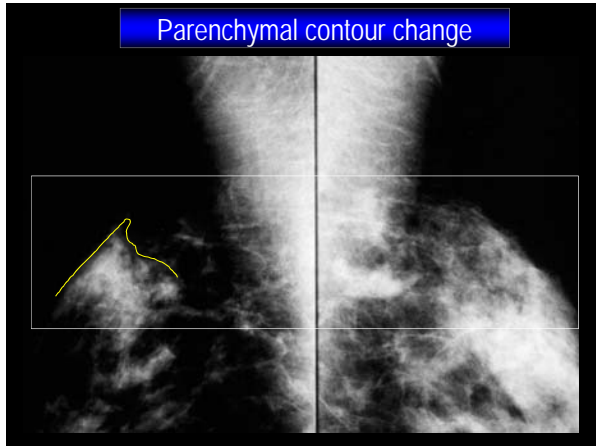
Aim of perception
Disruption of the harmonic structure

Parenchymal contour retraction (tent sign)

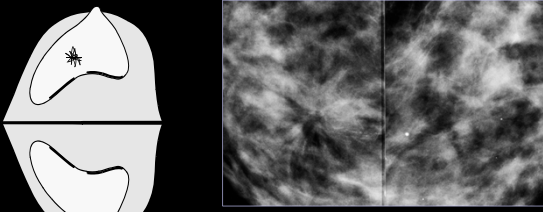
Aim of perception
Disruption of the harmonic structure

Parenchymal contour retraction (tent sign)





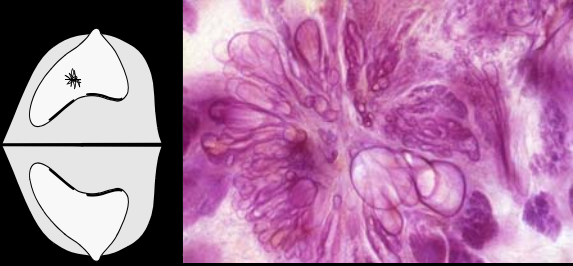
Aim of perception
Disruption of the harmonic structure



Architectural distortion

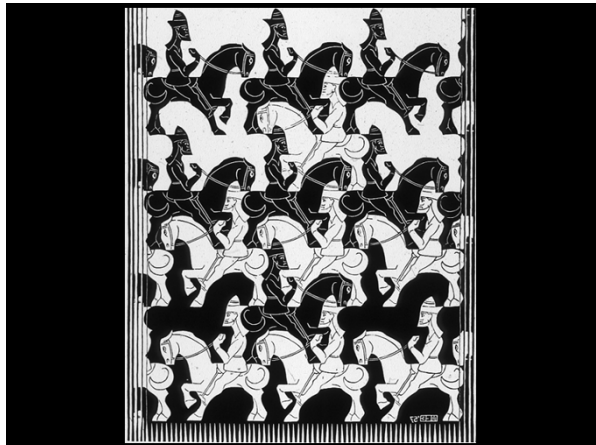
This slide illustrates the concept of architectural distortion in mammography. On the left, a schematic diagram shows a breast cross-section with a central starburst artifact. On the right, a corresponding mammogram image shows a distorted architectural pattern. A blue box at the bottom right contains the text 'Architectural distortion'.

Aim of perception
Disruption of the harmonic structure



Architectural distortion

This slide illustrates the concept of architectural distortion in mammography. On the left, a schematic diagram shows a breast cross-section with a central starburst artifact. On the right, a corresponding mammogram image shows a distorted architectural pattern. A blue box at the bottom right contains the text 'Architectural distortion'.



39 year old asymptomatic woman,
screening examination.

