Medical and Biological Engineering

From Ideas to Successful Medical Products

Content

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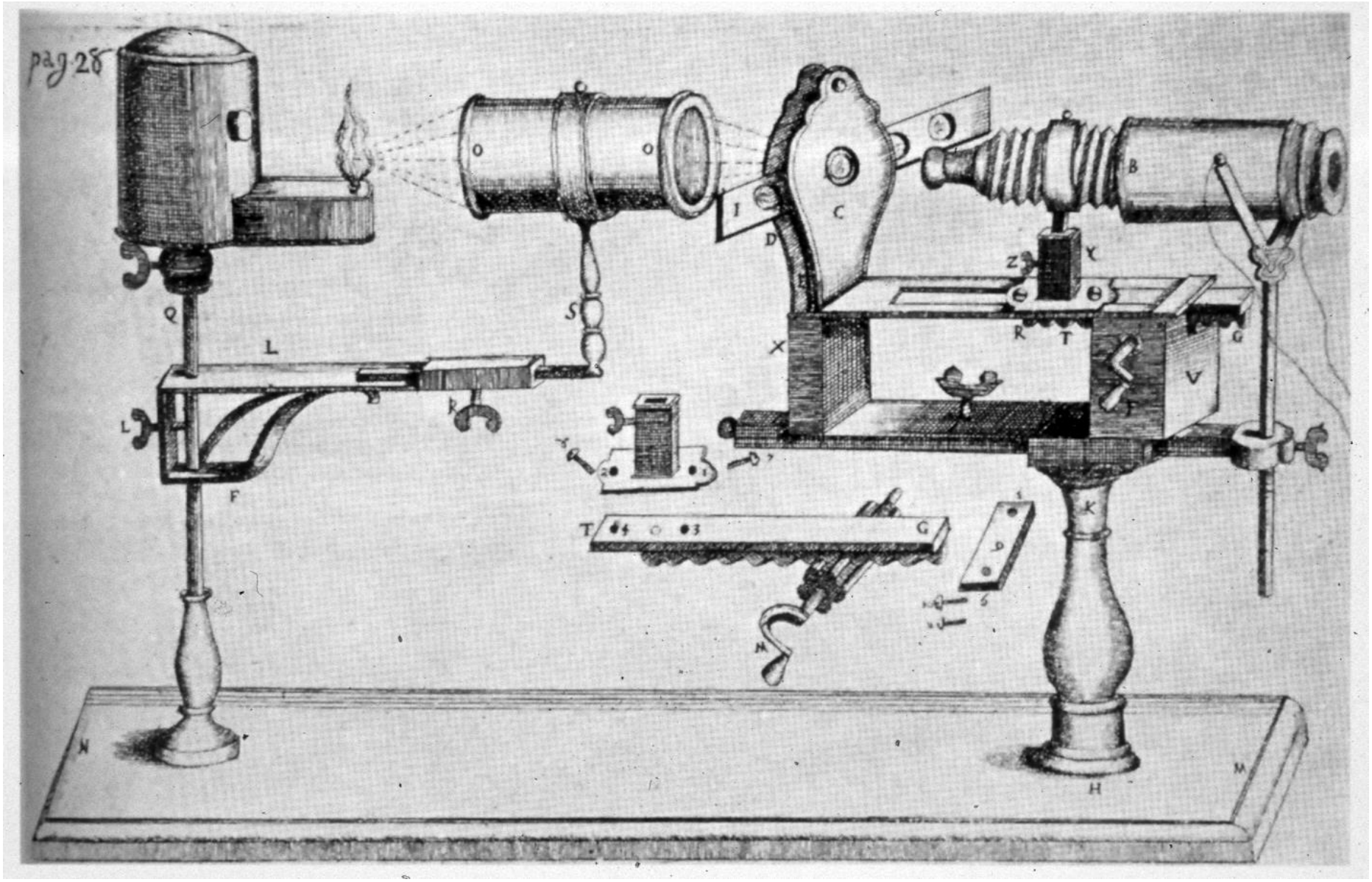
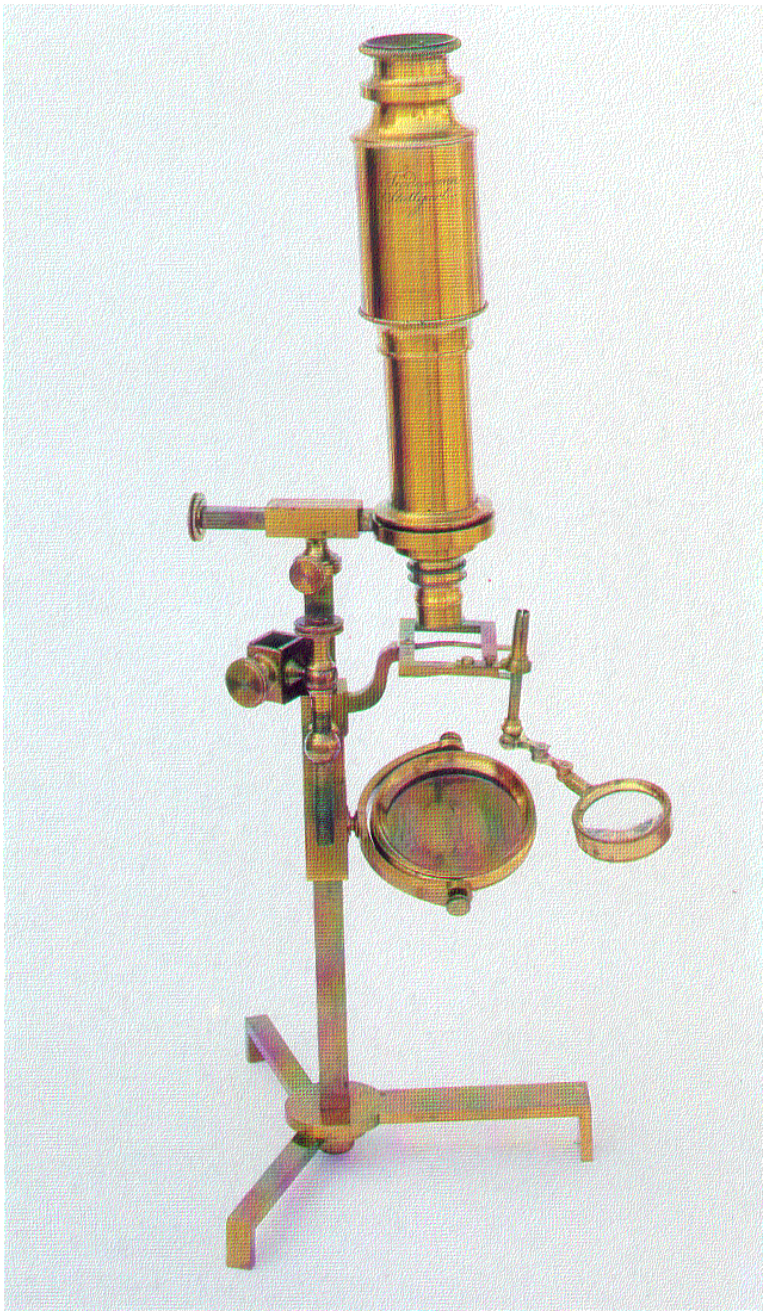
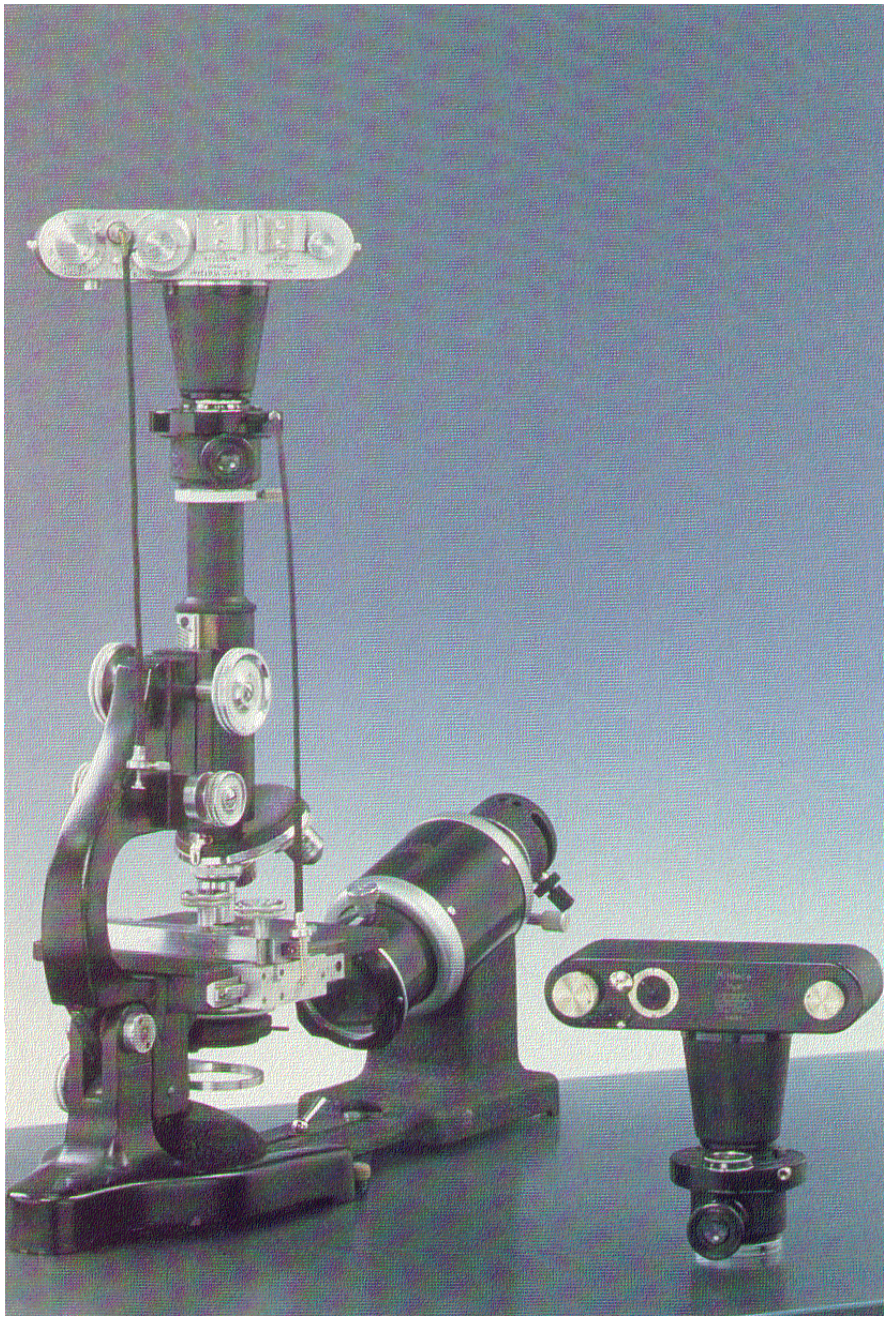


Microsope with horizontal beam path and burning candle as „light source“ (1691)



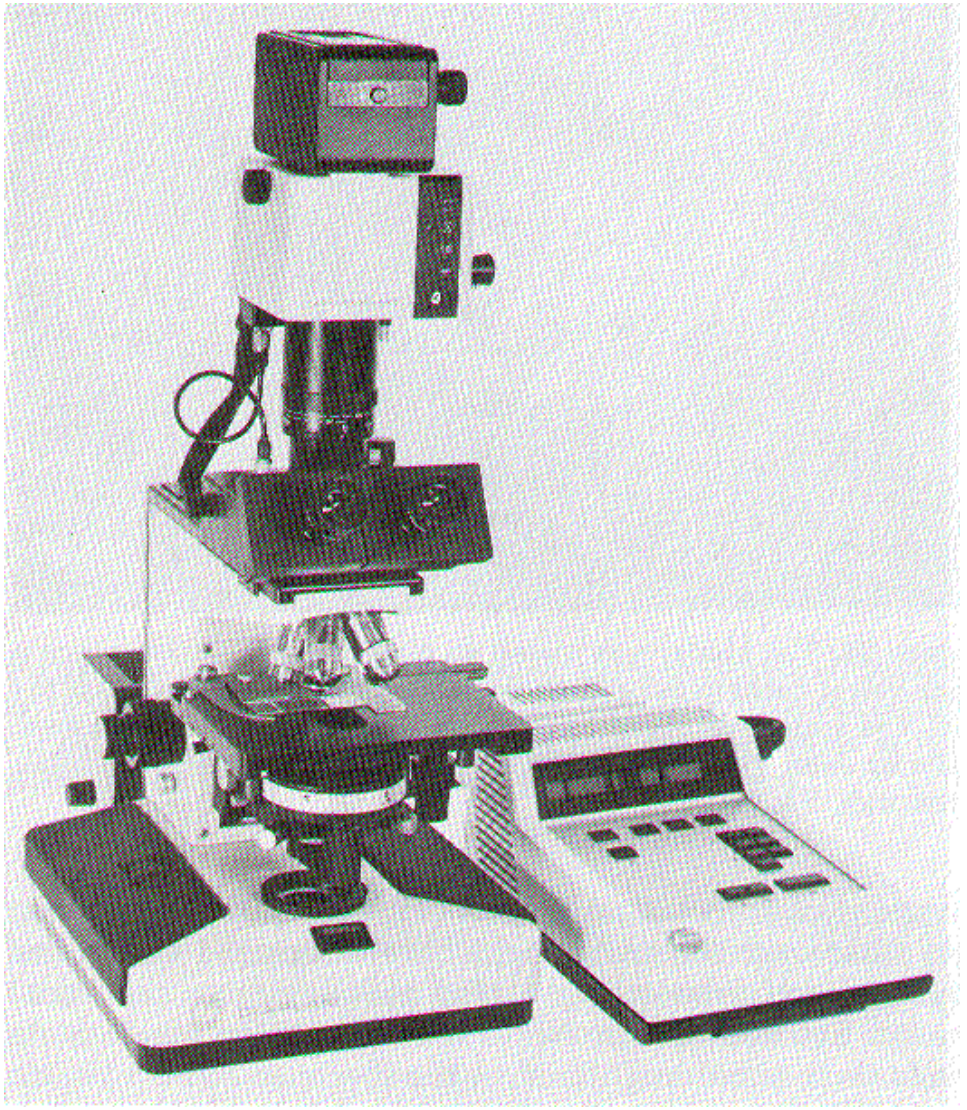
Microscopes for pathology, left (about 1700), right 300x magnification (about 1800)

Microscope with vertical light pathway and standard arrangement (1882):



Microscope with camera, invented 1928 (Leitz, 1940)

Olympus



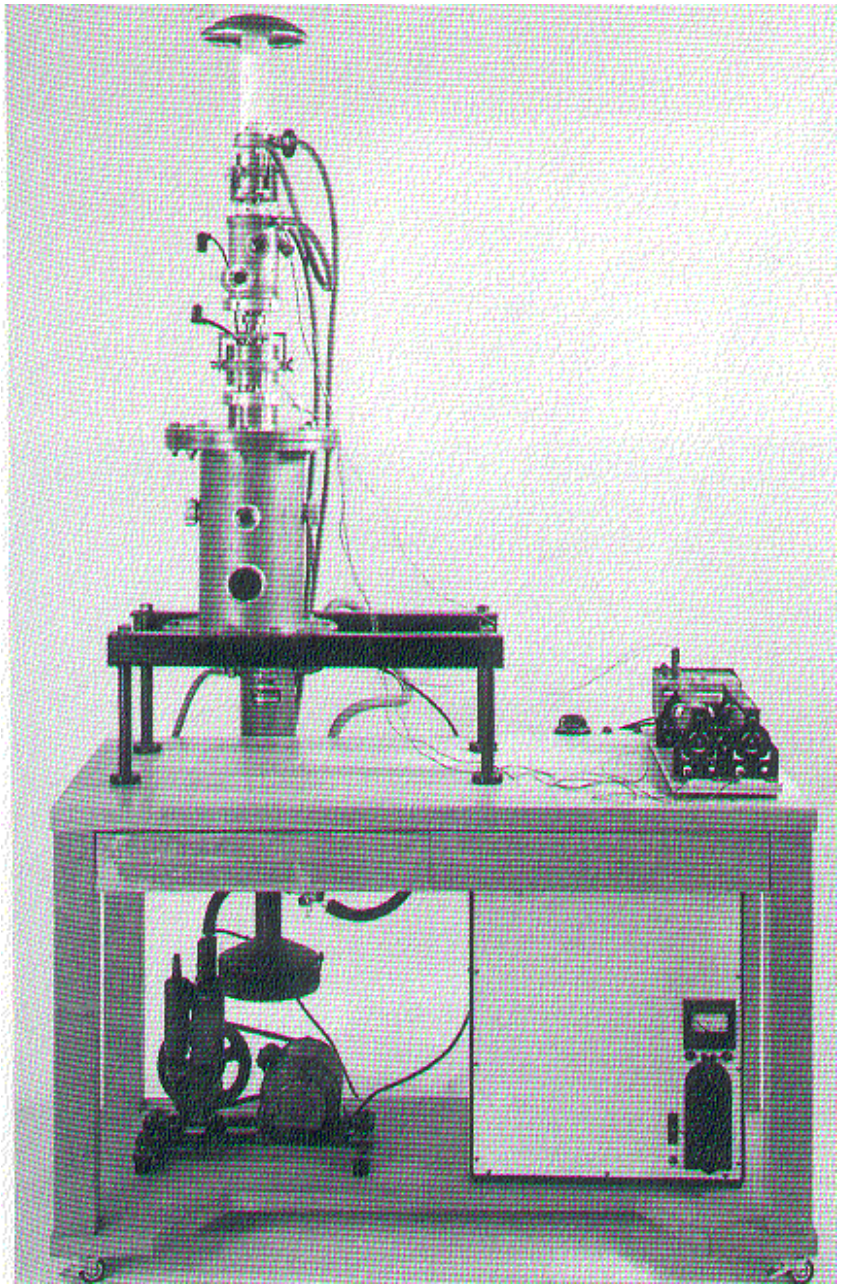
Leitz

Research Microscopes (1988)

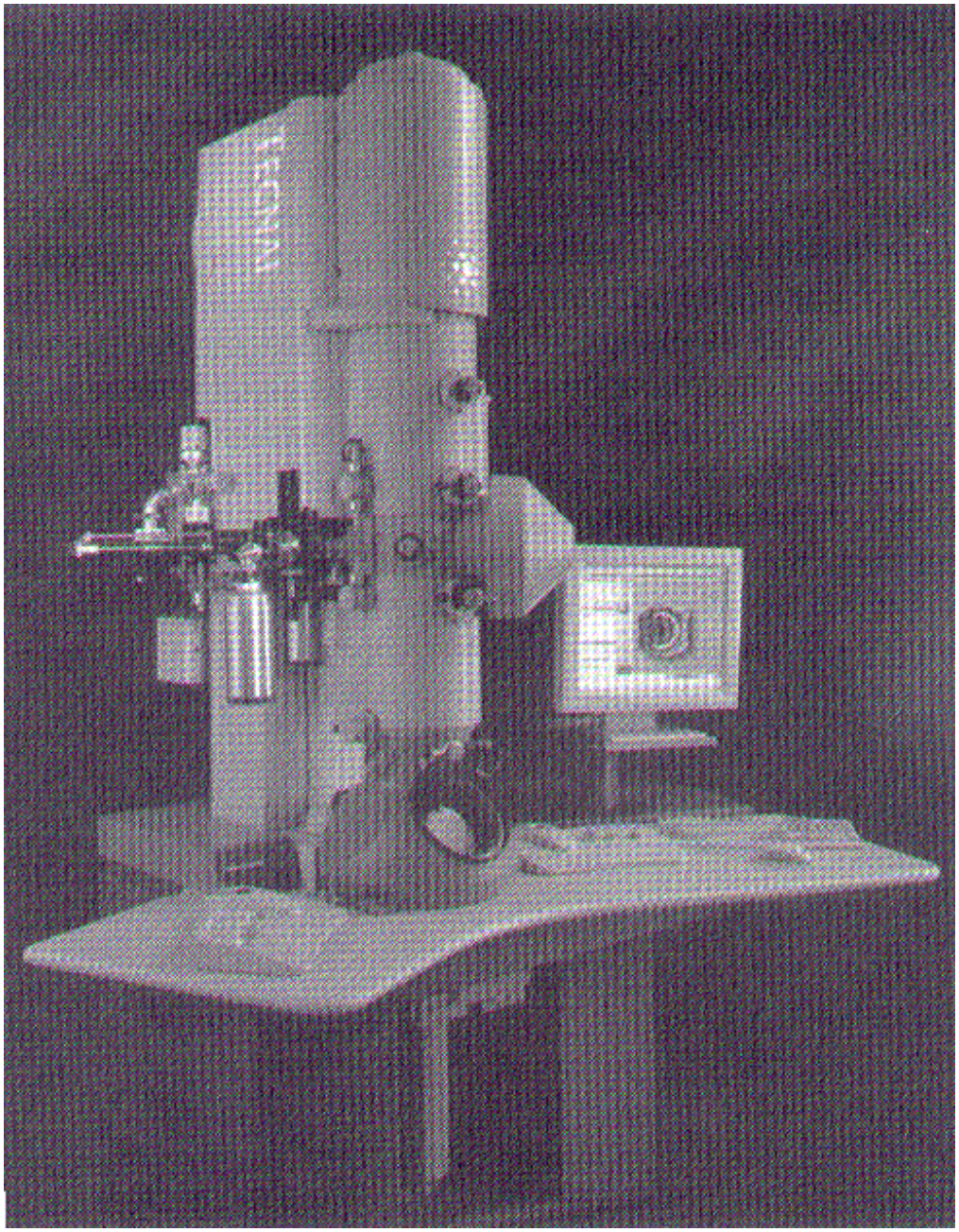
Microscope with computer-assisted image processing and presentation

2 separate viewing hoods for assistance

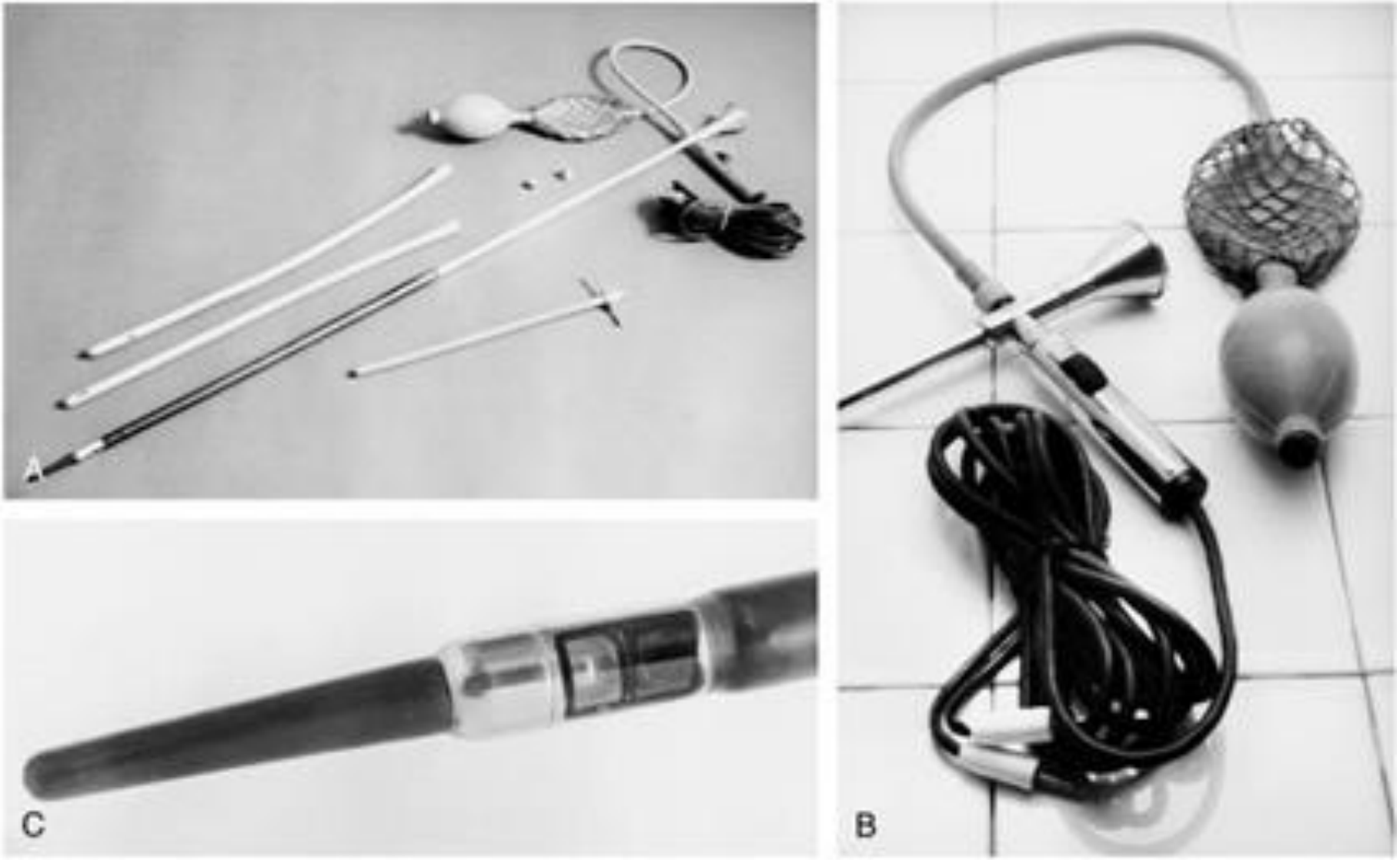
Special microscope for microsurgery and used by two persons



Electron microscope by Ernst Ruska, Nobel Prize winner in physics 1986 (1931)

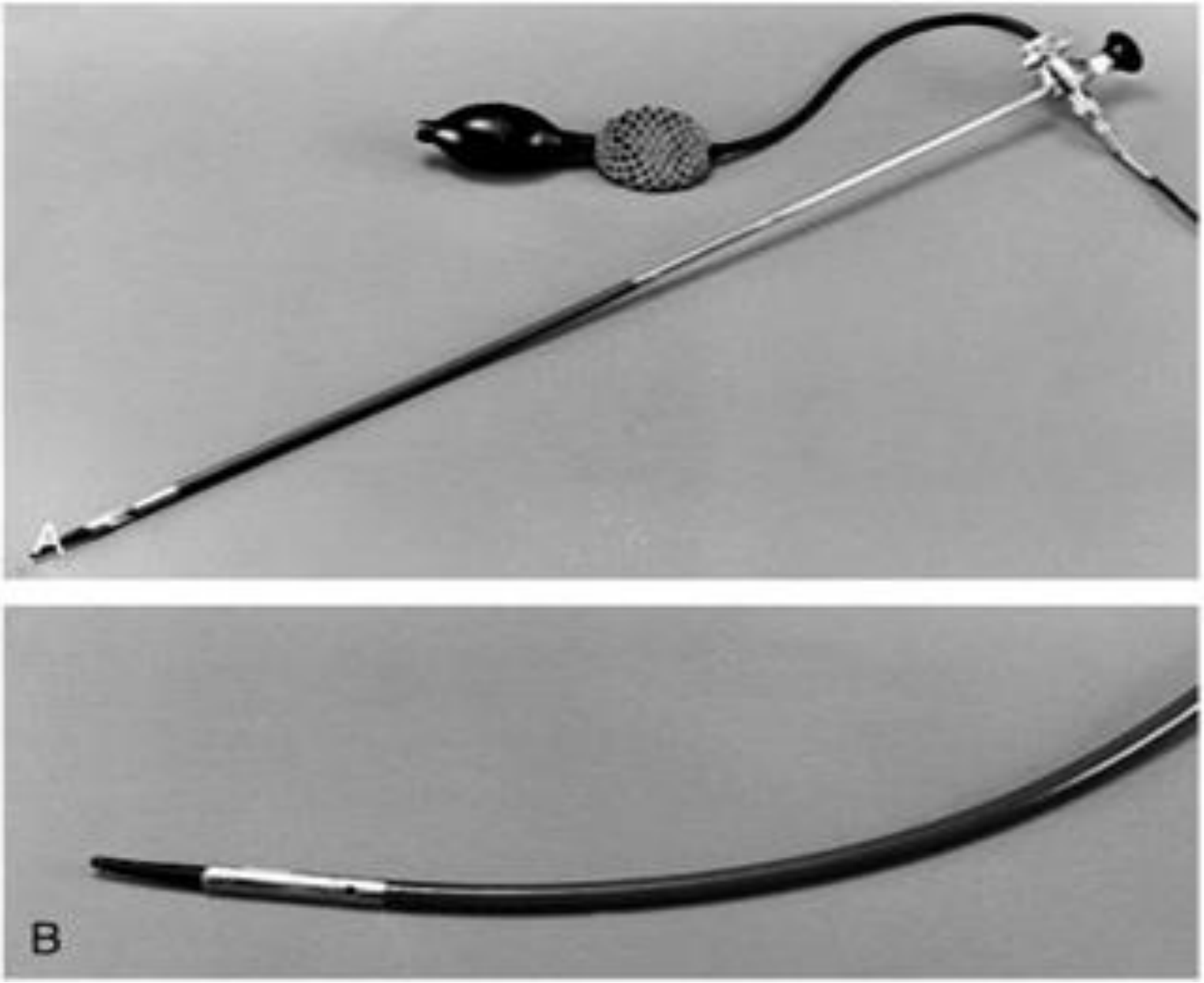


Transmission electronic microscope (FEI, 2006)



Principle and technical details of early rigid endoscopes

First prototype of a flexible endoscope (1957)

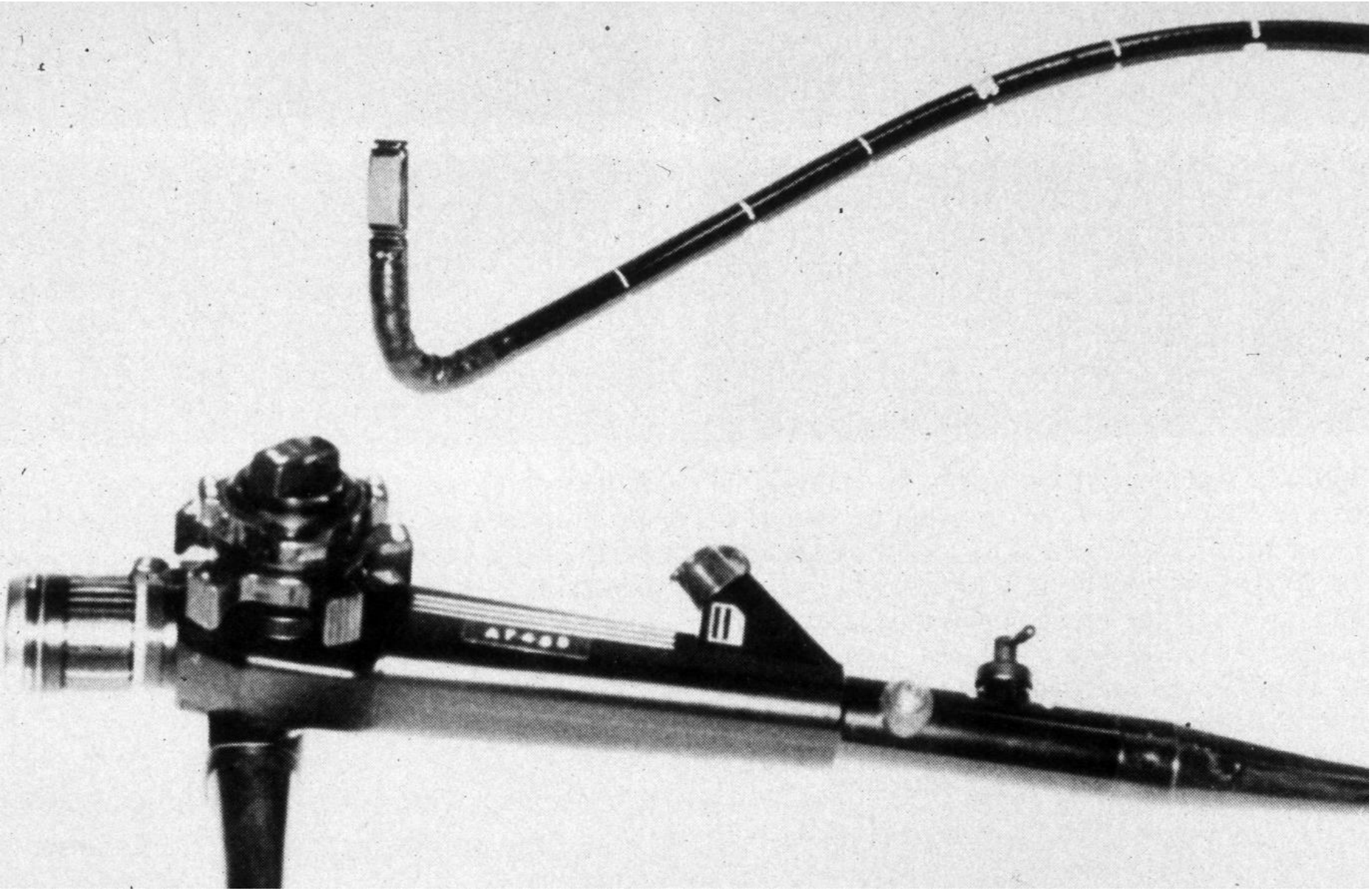


Rigid and flexible gastroscopes (1955 ???)

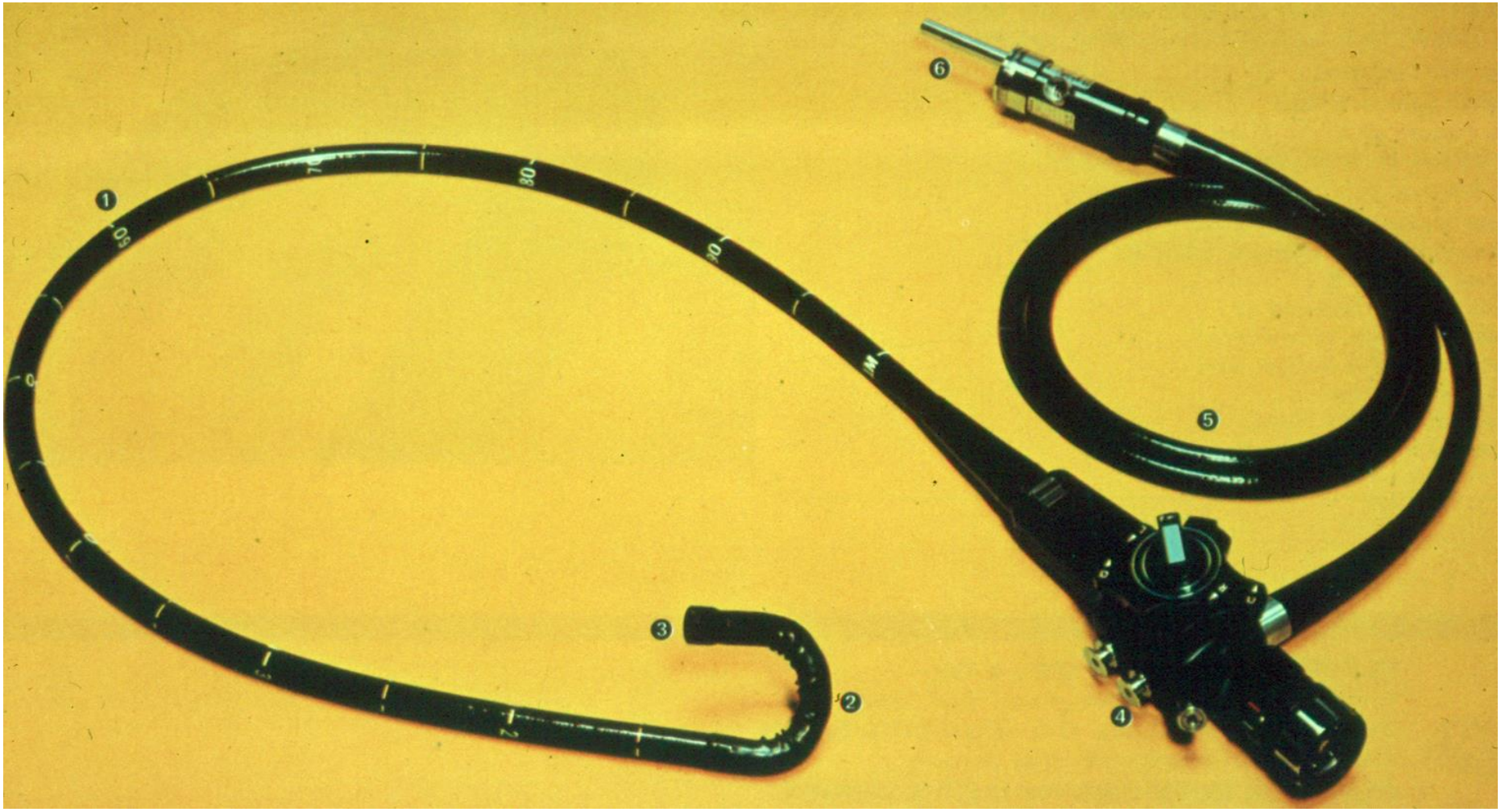
First flexible endoscope with camera (Olympus)

Gastro-endoscopic investigation (1960 ???)

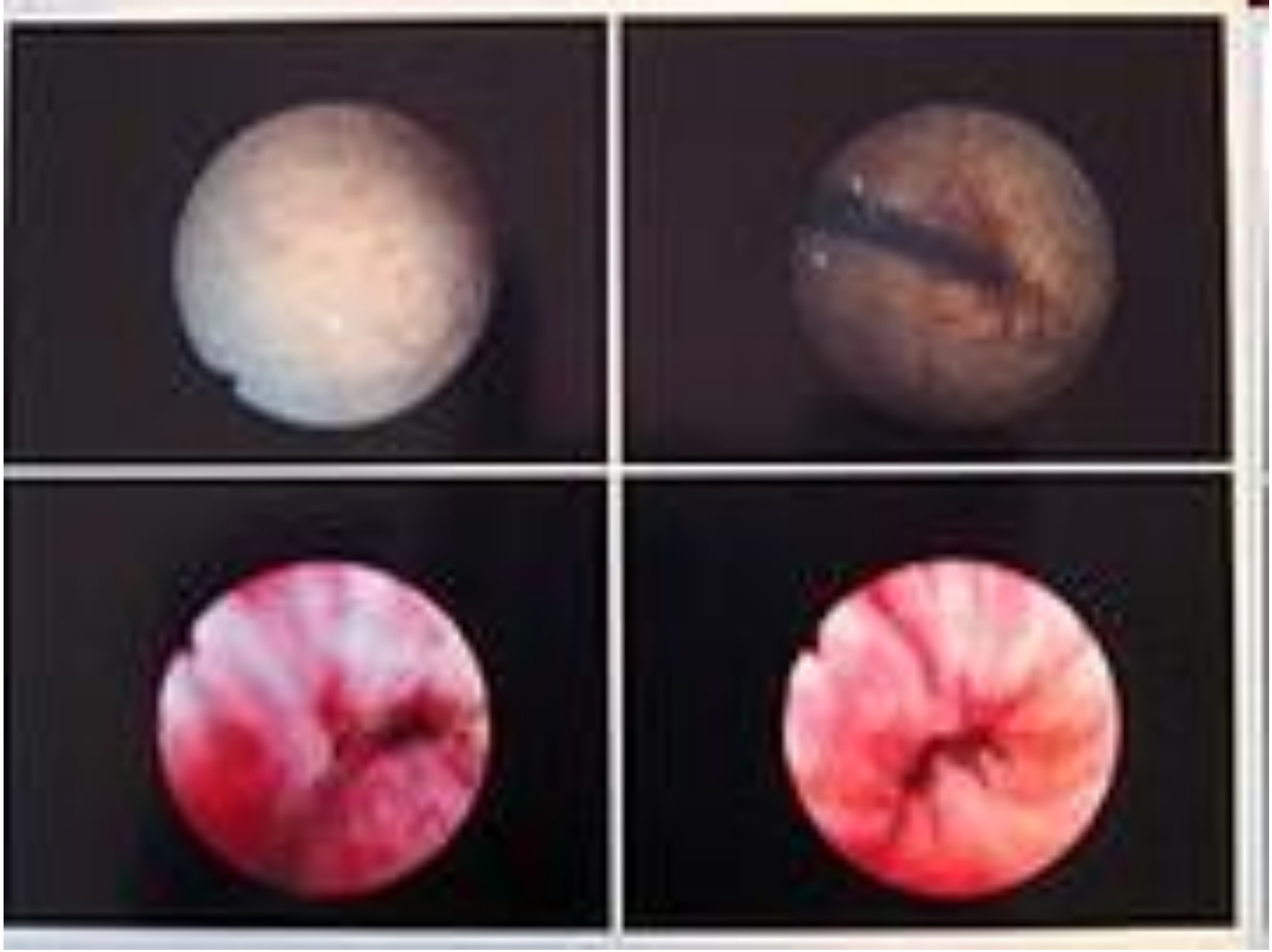
Prototype of the flexible sigmoidoscope (1968)



Actively bendable (flexible) endoscope with imaging and working channel (1980)

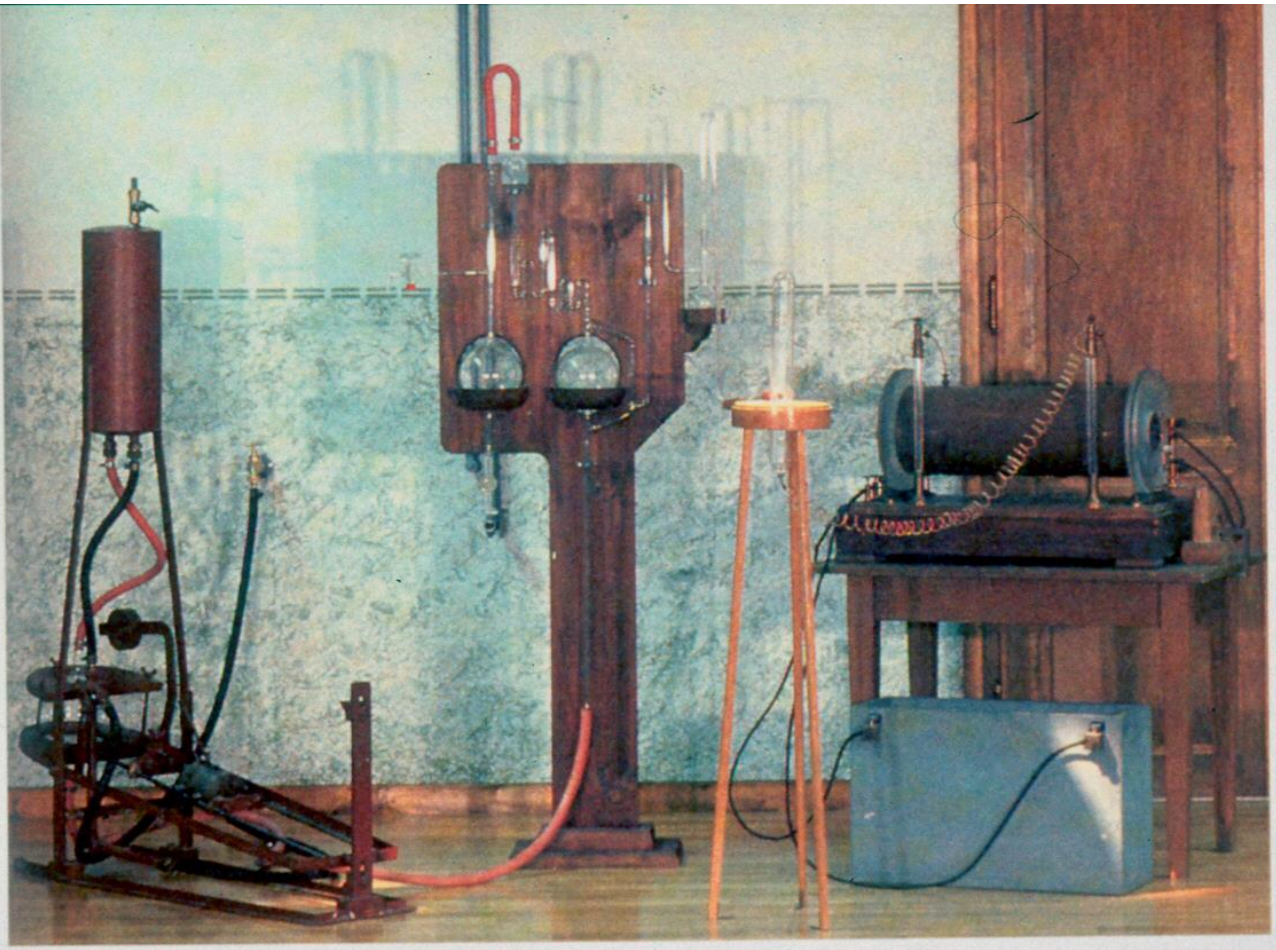


Actively bendable (flexible) endoscope with imaging and working channel (1985 ??



Images acquired with an advanced cystoscope

Endoscopic image of the stomach

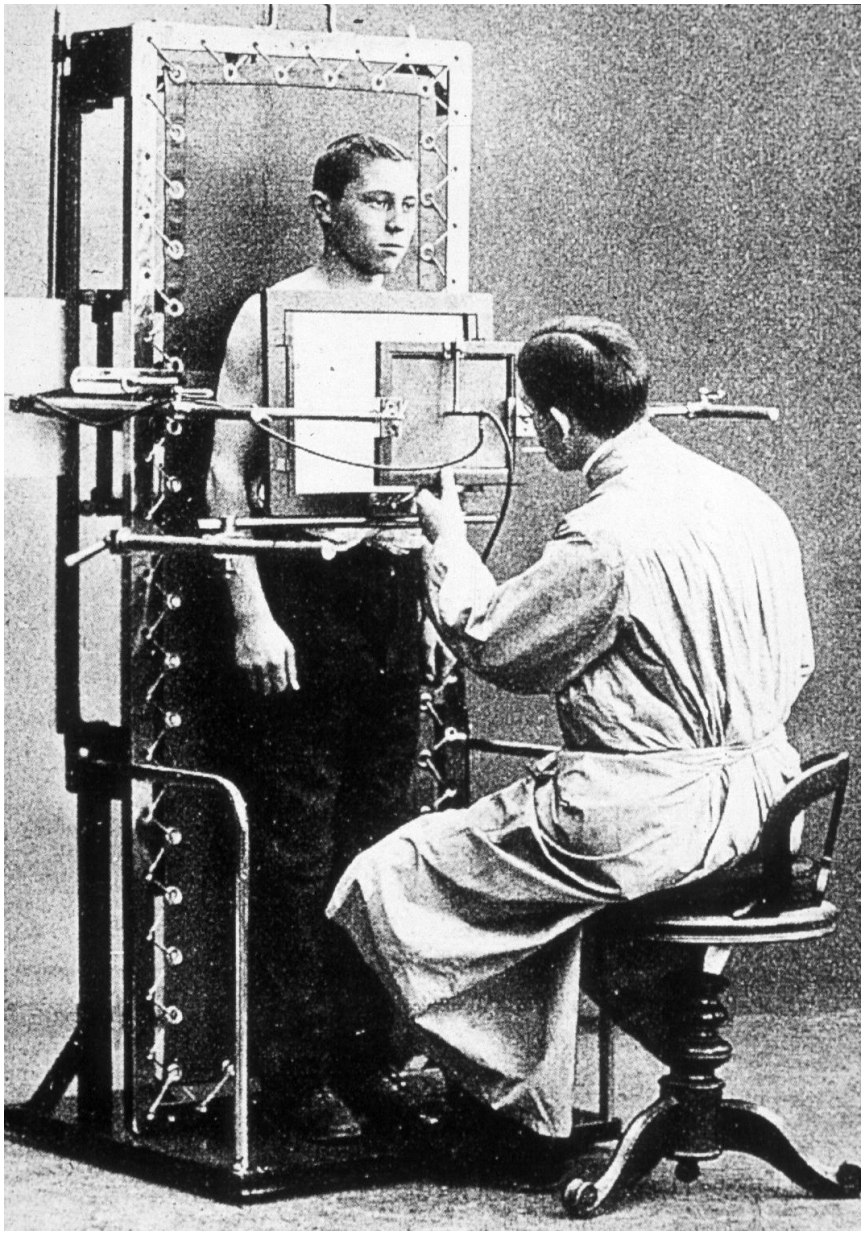


Die von Röntgen bei seinen Experimenten benutzte Versuchsanordnung ist rechts im Bild rekonstruiert worden. Auf dem Tisch erkennt man den Rühmkorffschen Funkeninduktor.

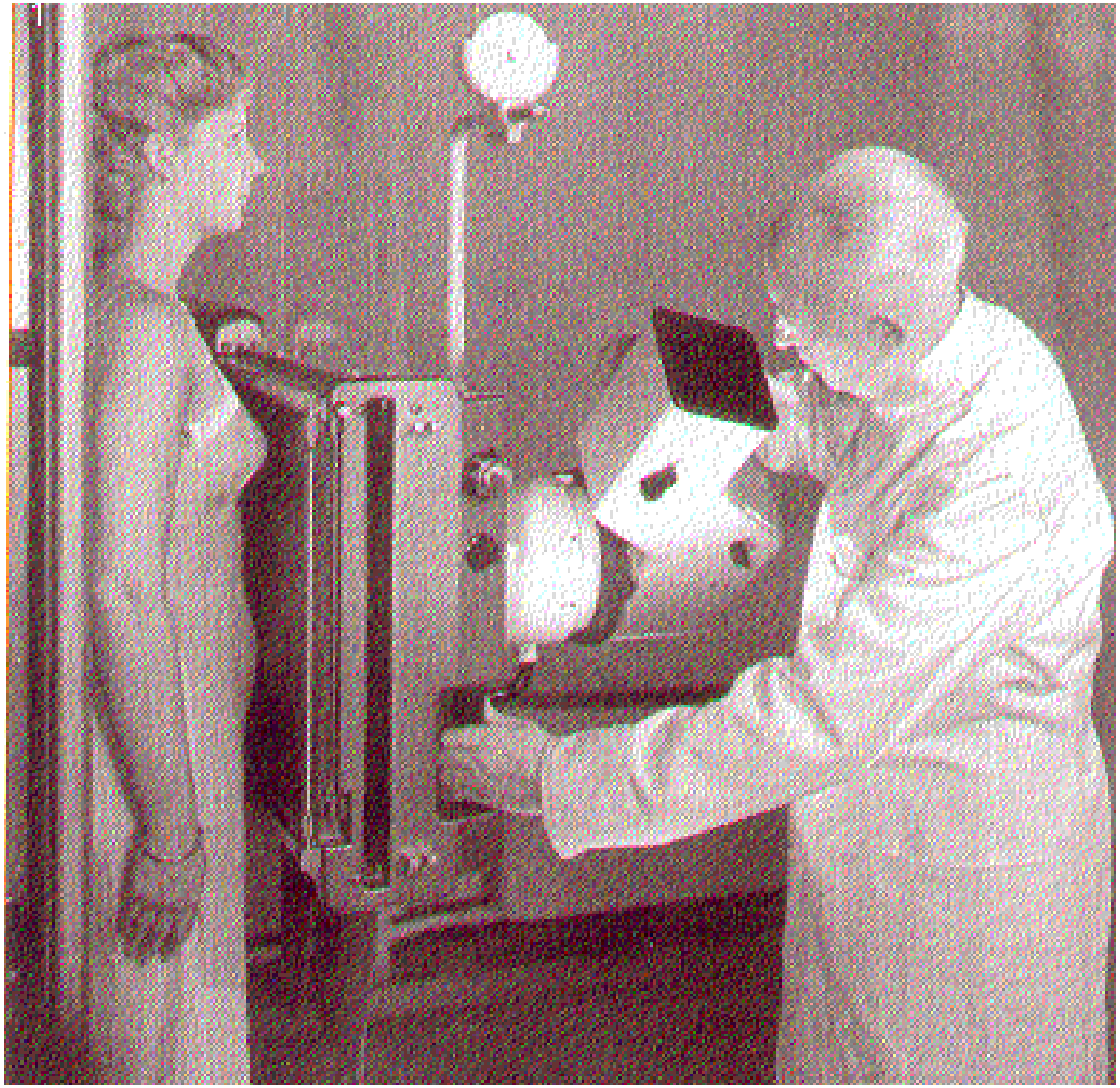
Deutsches Röntgenmuseum, Remscheid

W.C. Roentgen's workplace (reconstruction) for the detection of X-rays (1893)

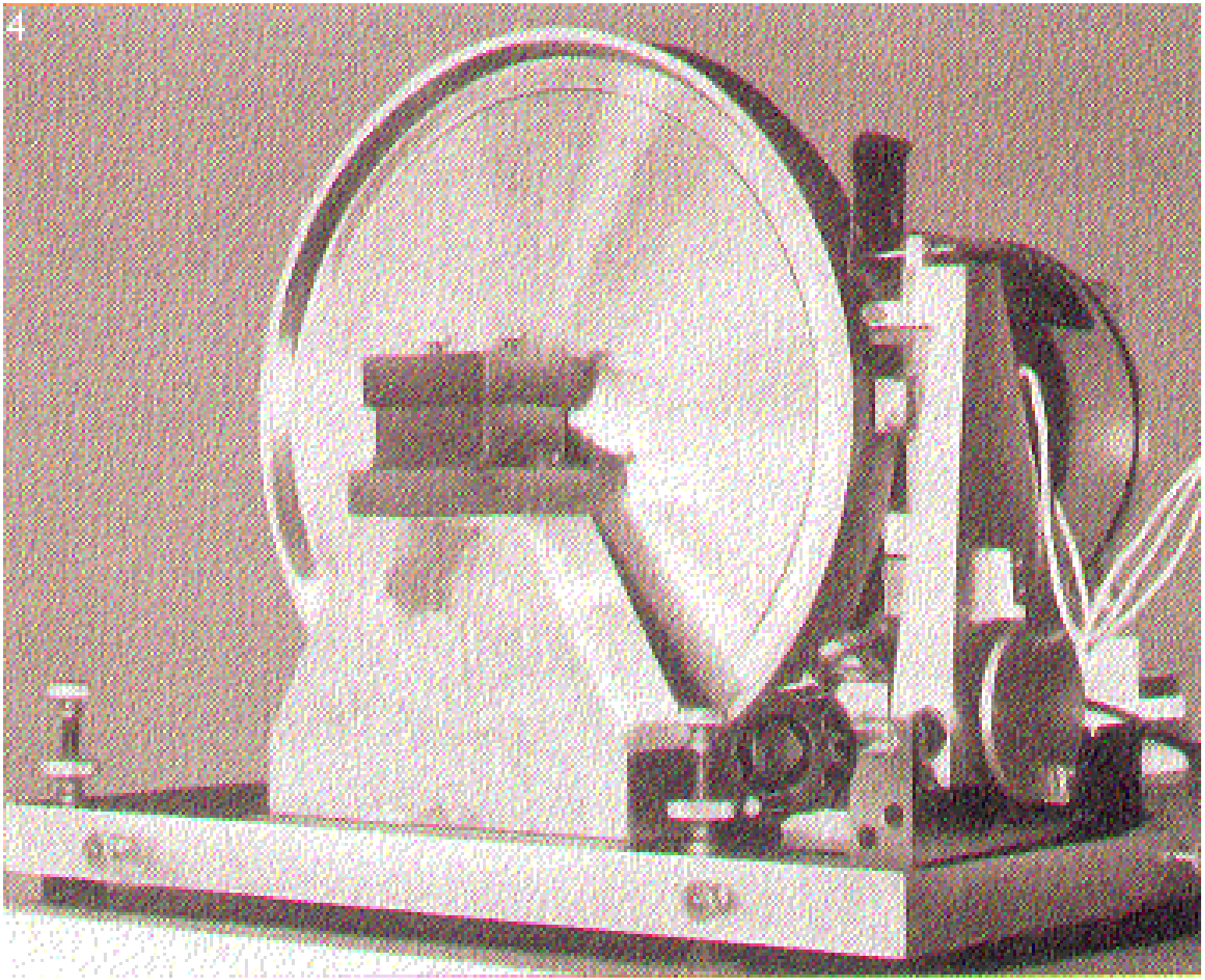
X-ray imaging of the chest and lungs (H. Schmidt, 1910). Due to the long exposure times, the patient had to be fixed in order to avoid movement artefacts.



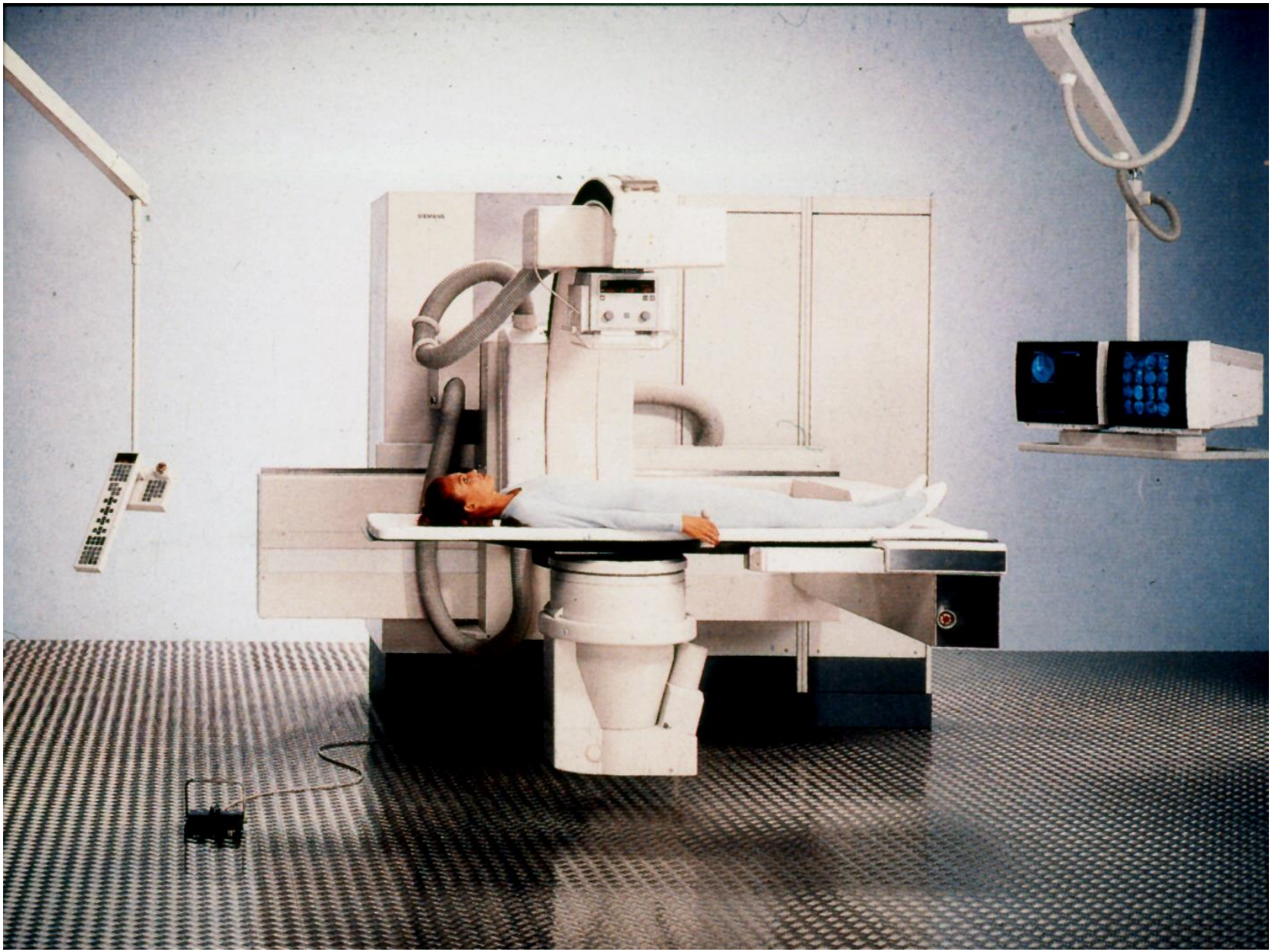
Direct viewing of X-ray images (about 1925)



X-ray image intensifier for direct (binocular) viewing with 5-inch field dimension (1953)

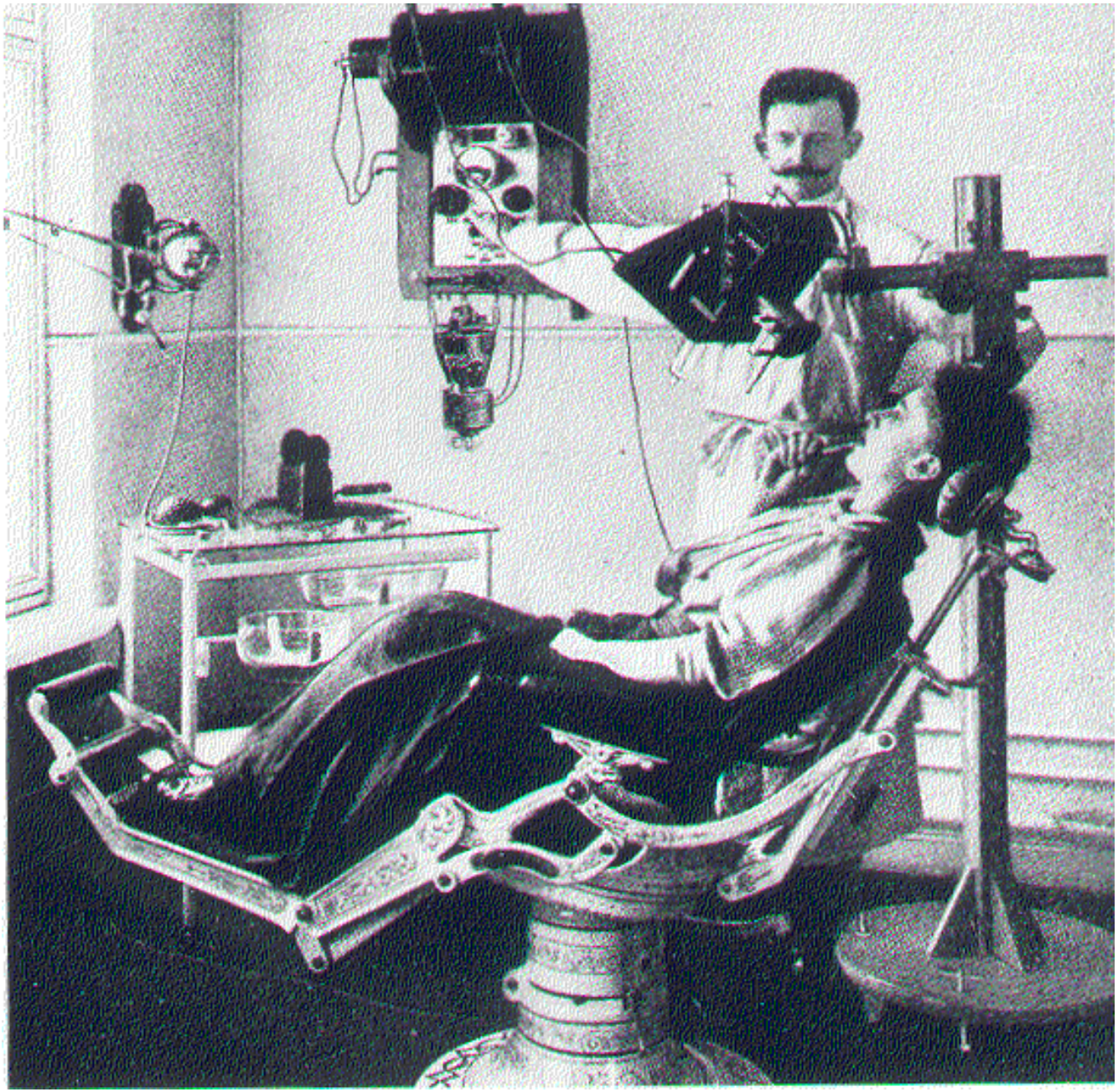


Memory wheel (diameter 40 cm, 50 revolutions per second) for video recording, Philips (1957)

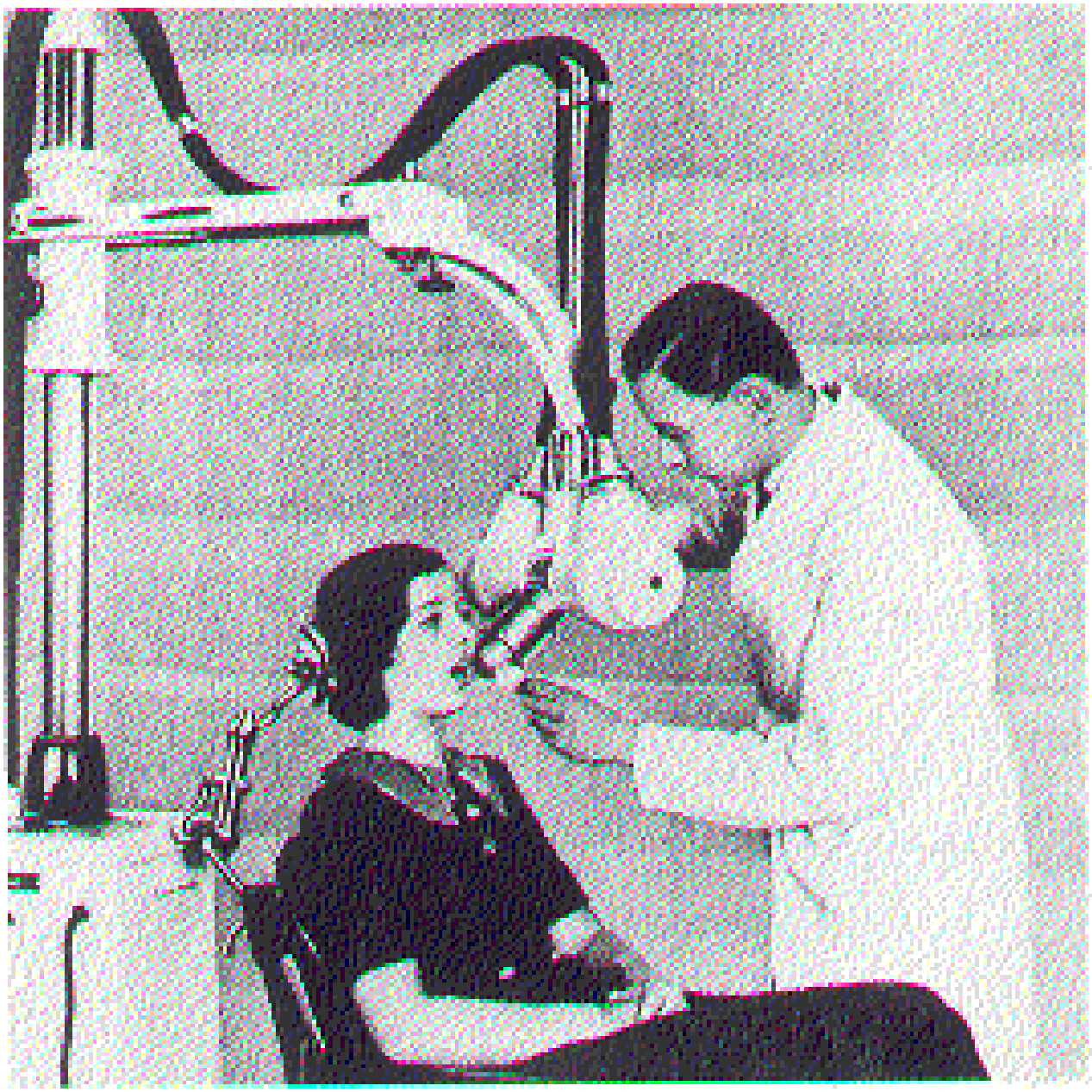


X-ray equipment with electronic monitors (about 1990)

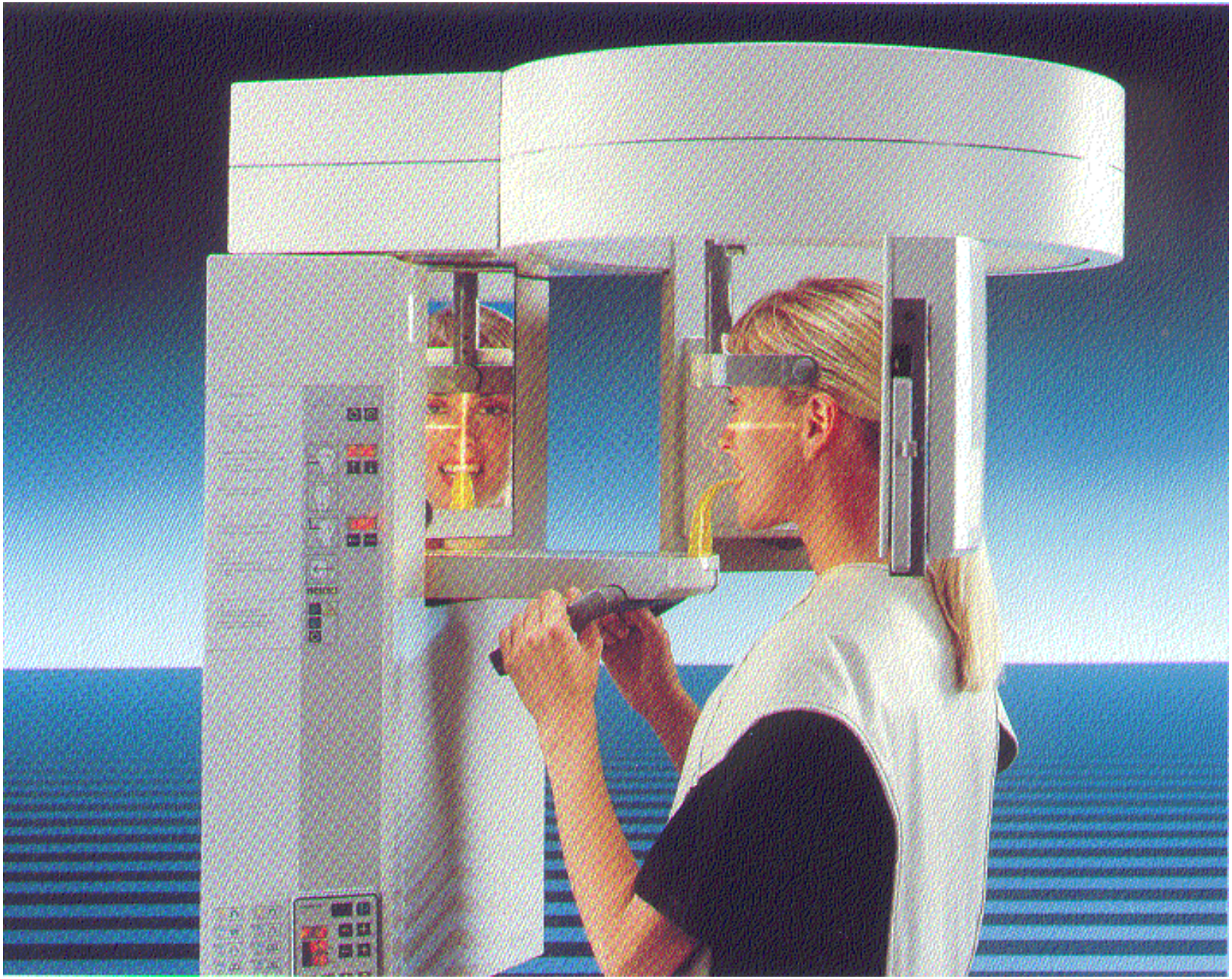
X-ray imaging machine with mobile C-shaped fixation for the operation theater



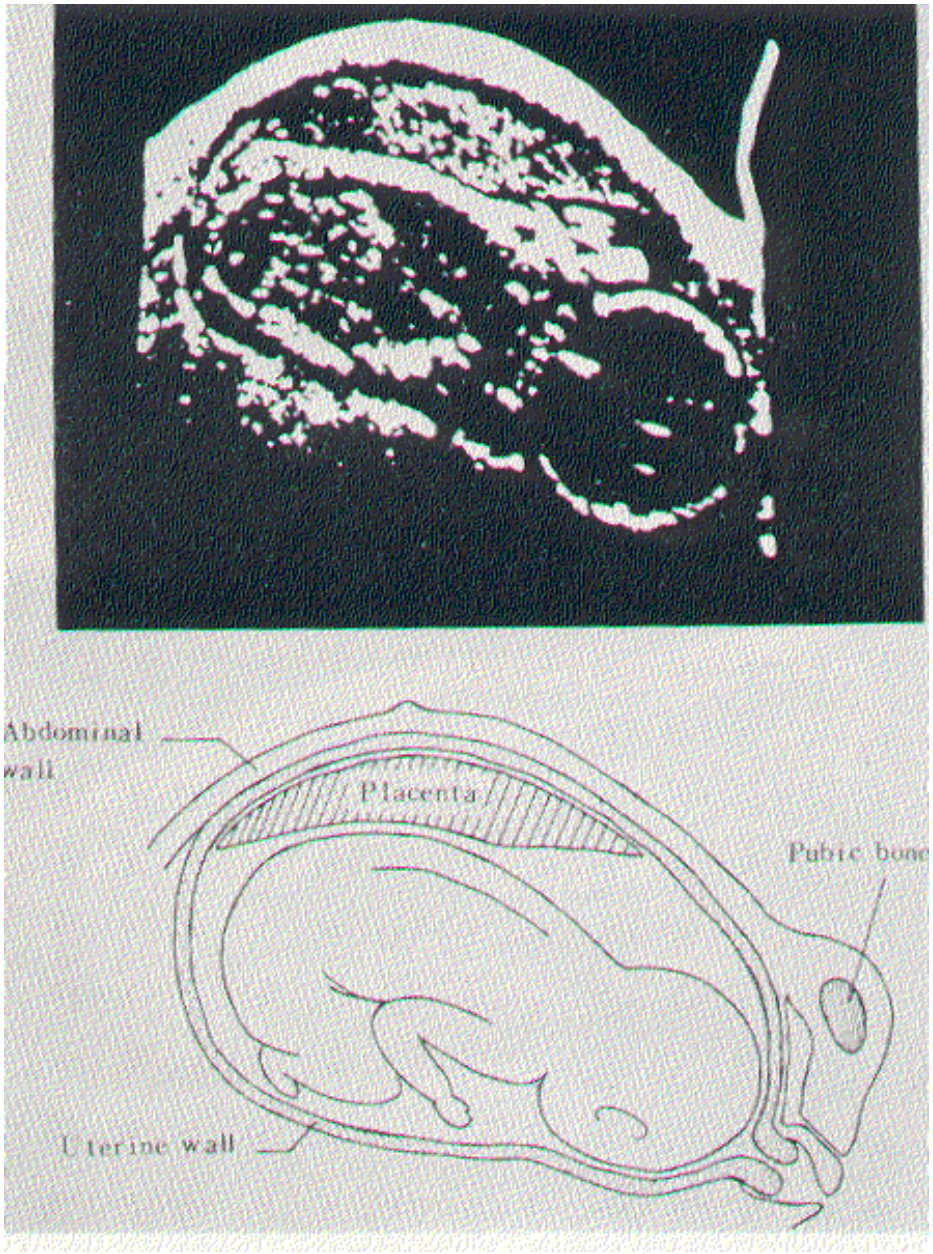
X-ray testing of jaw and teeth with free running cables (Siemens 1911)



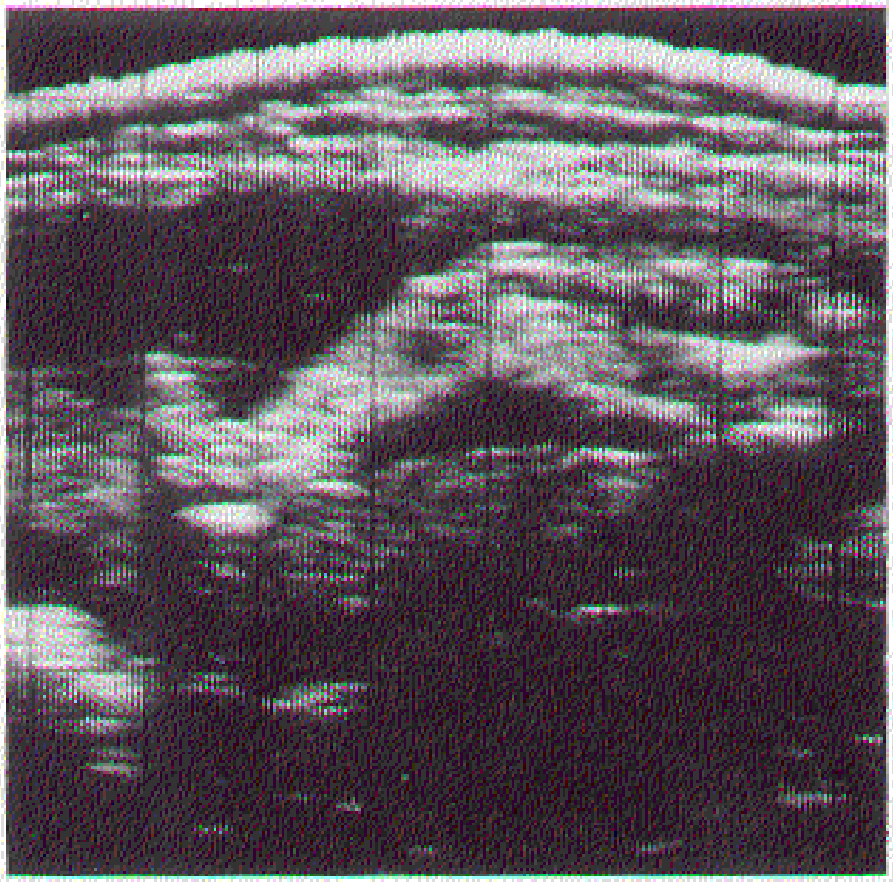
X-ray testing of jaw and teeth (Siemens 1931)



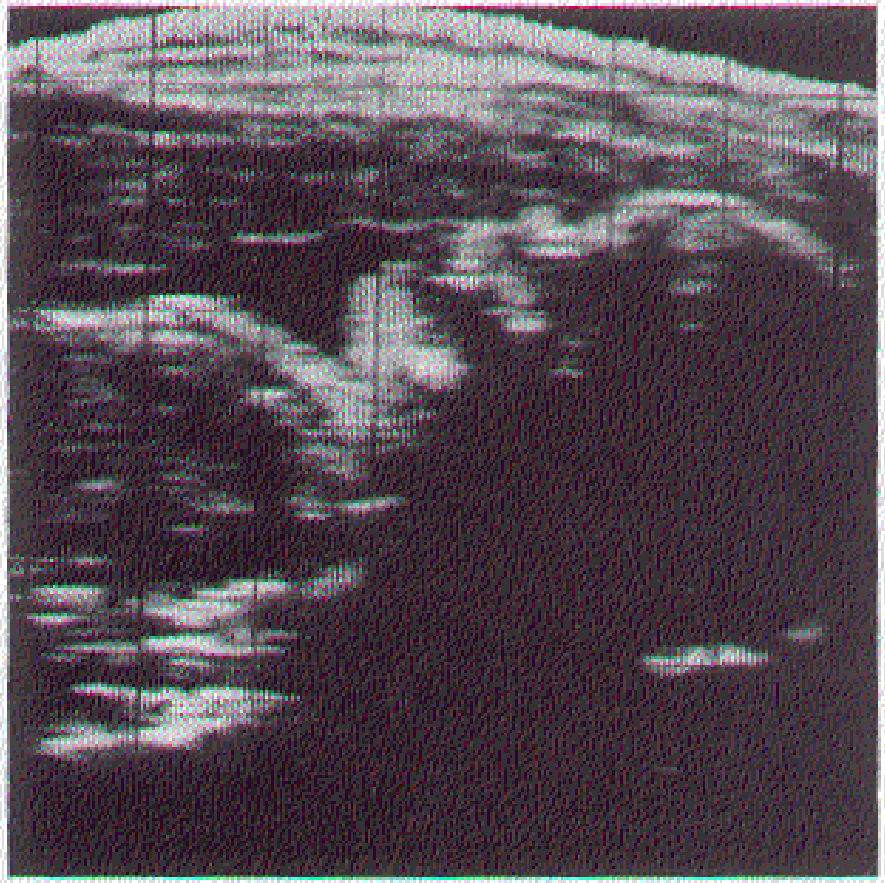
X-ray testing of jaw and teeth (Siemens 1995)



Ultrasound B-mode image of a foetus in the 38th week (1973)

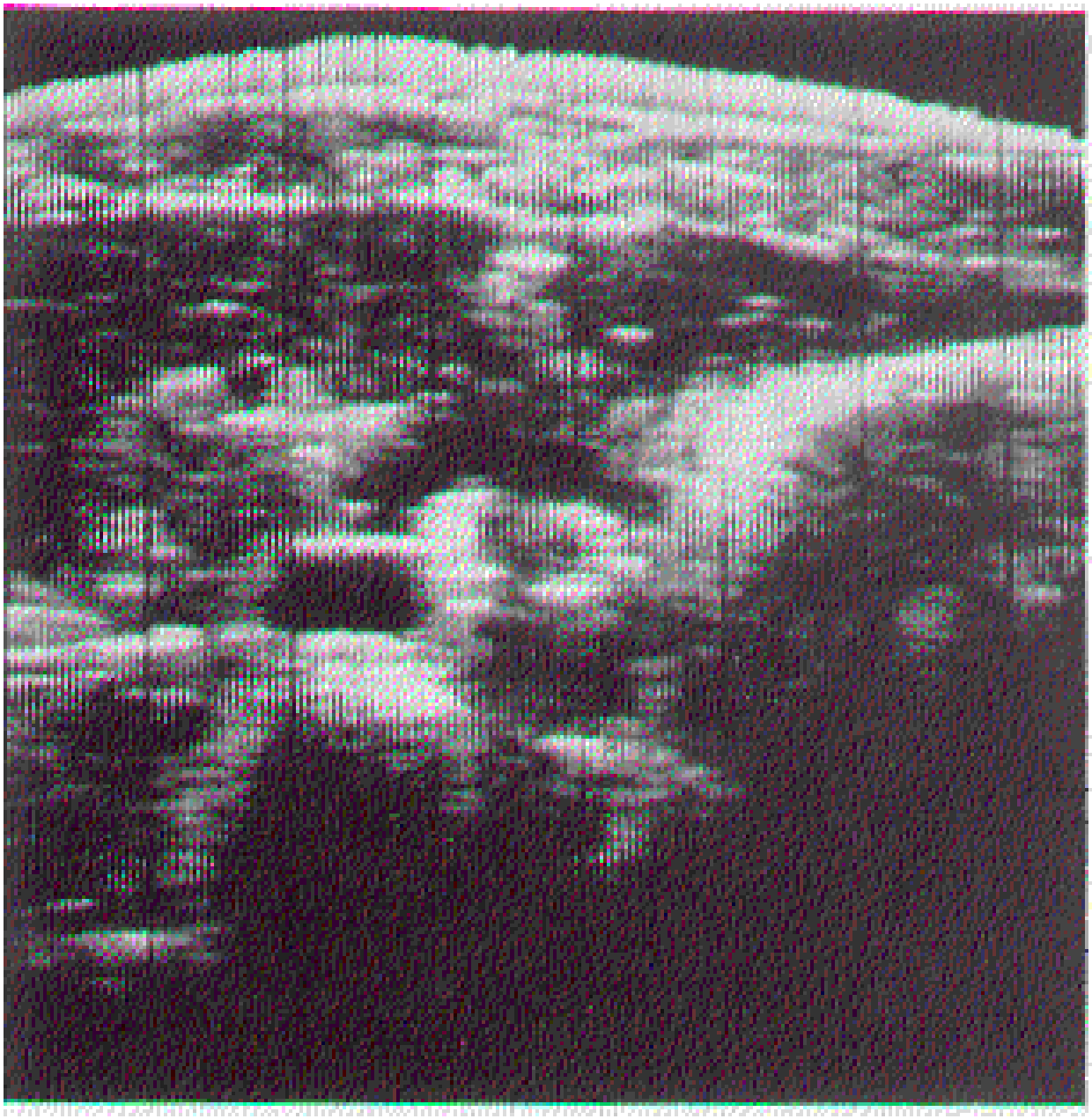


Leg

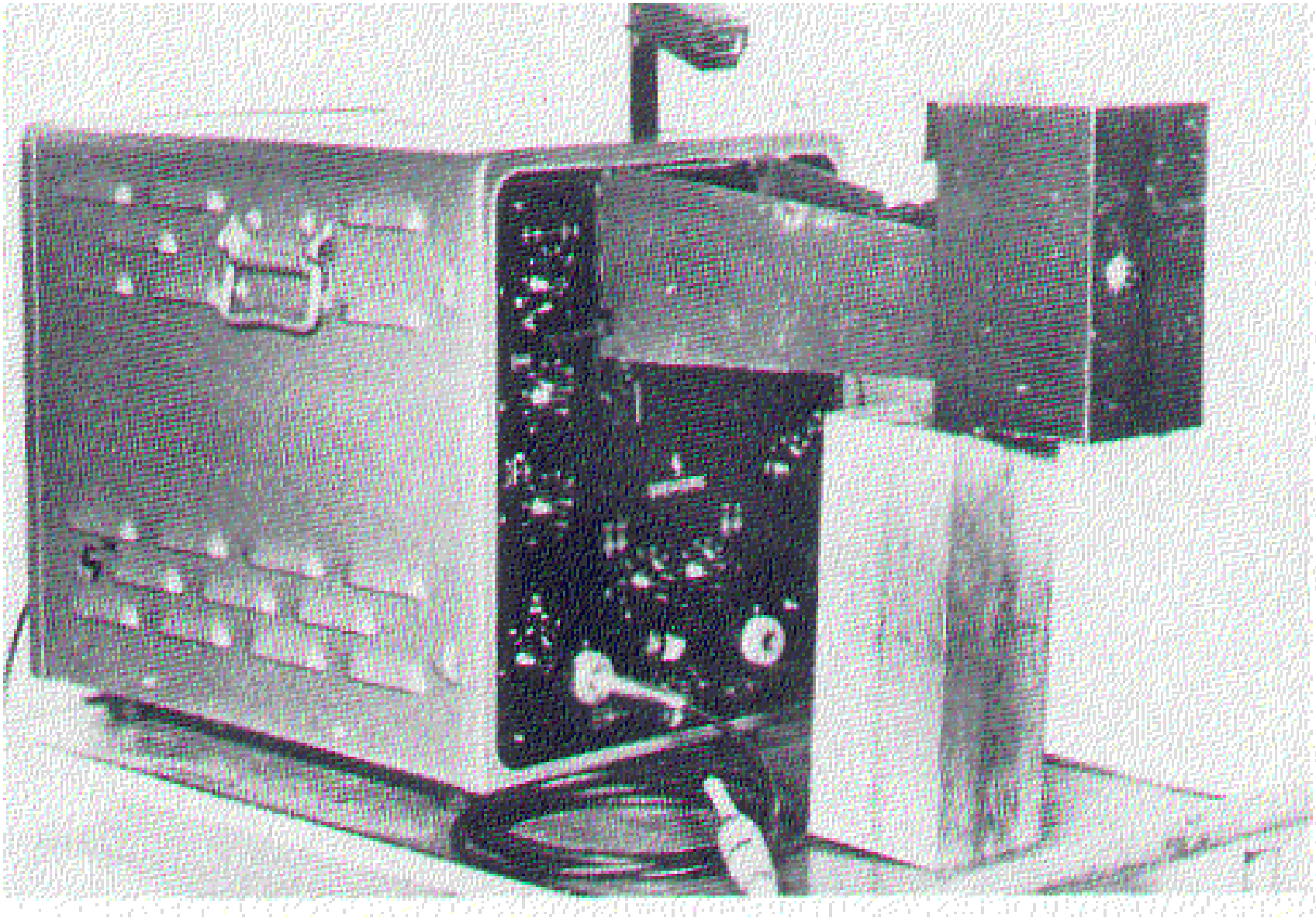


Head and thorax

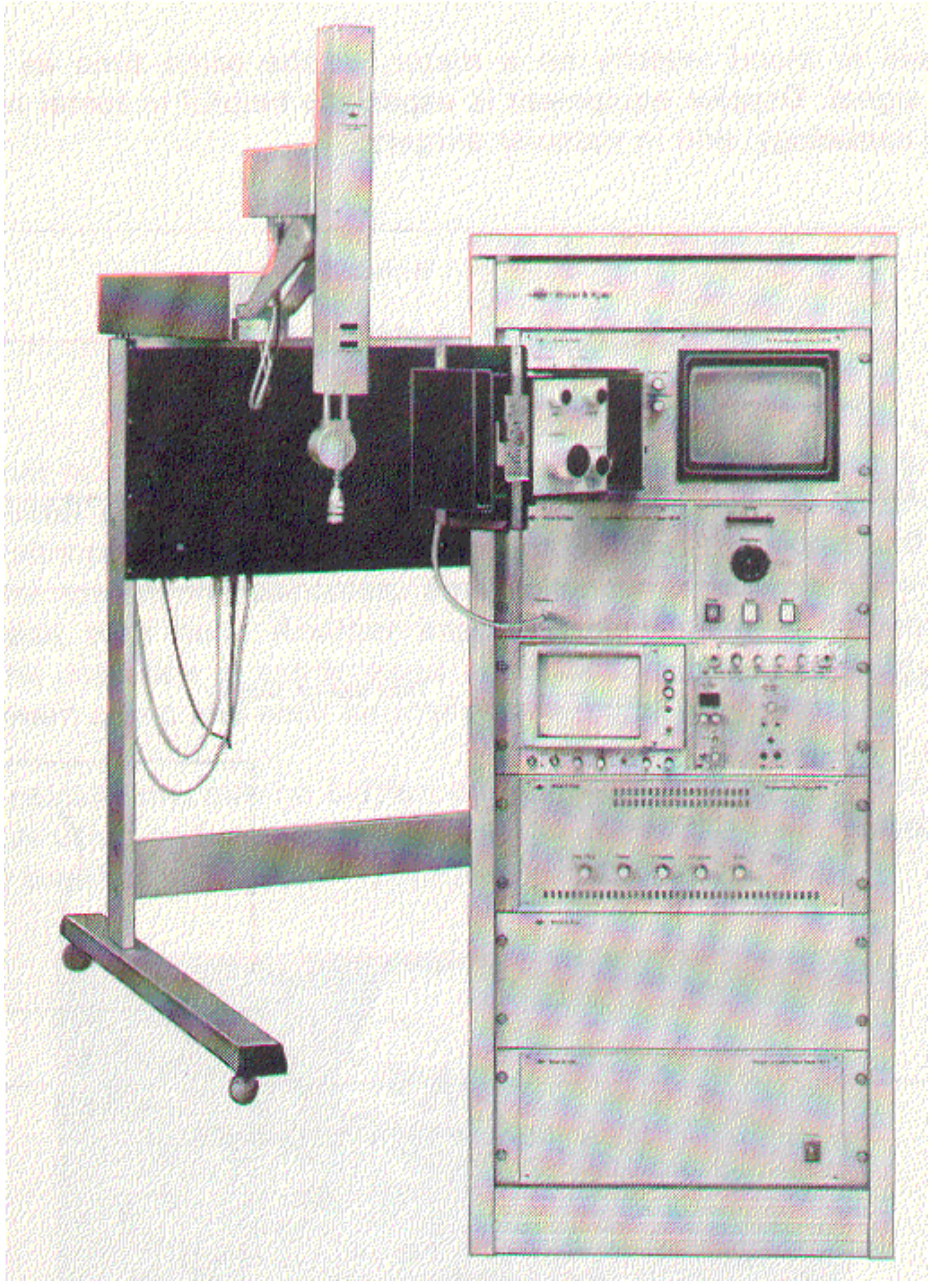
Ultrasound B-mode image from a fetus (1980)



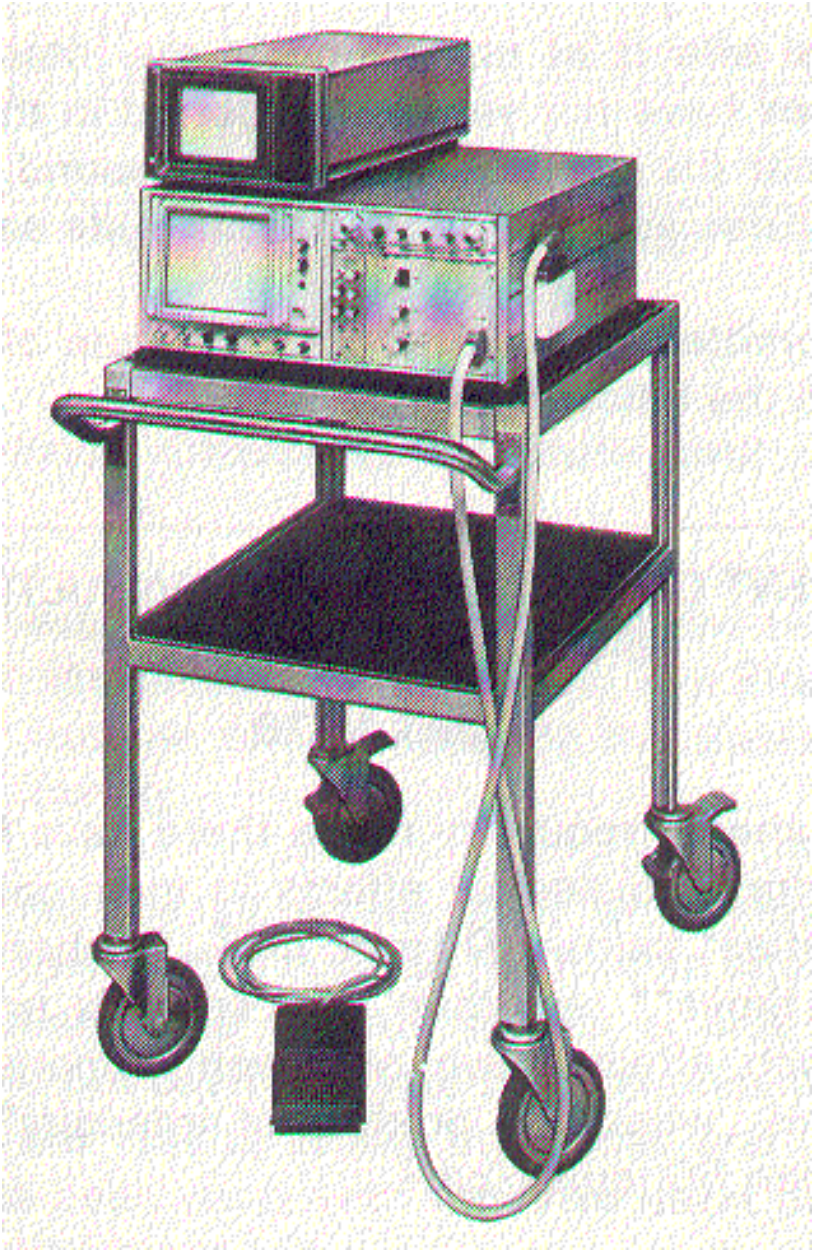
Ultrasound B-mode image showing liver, pancreas, vena cava and aorta (1980)



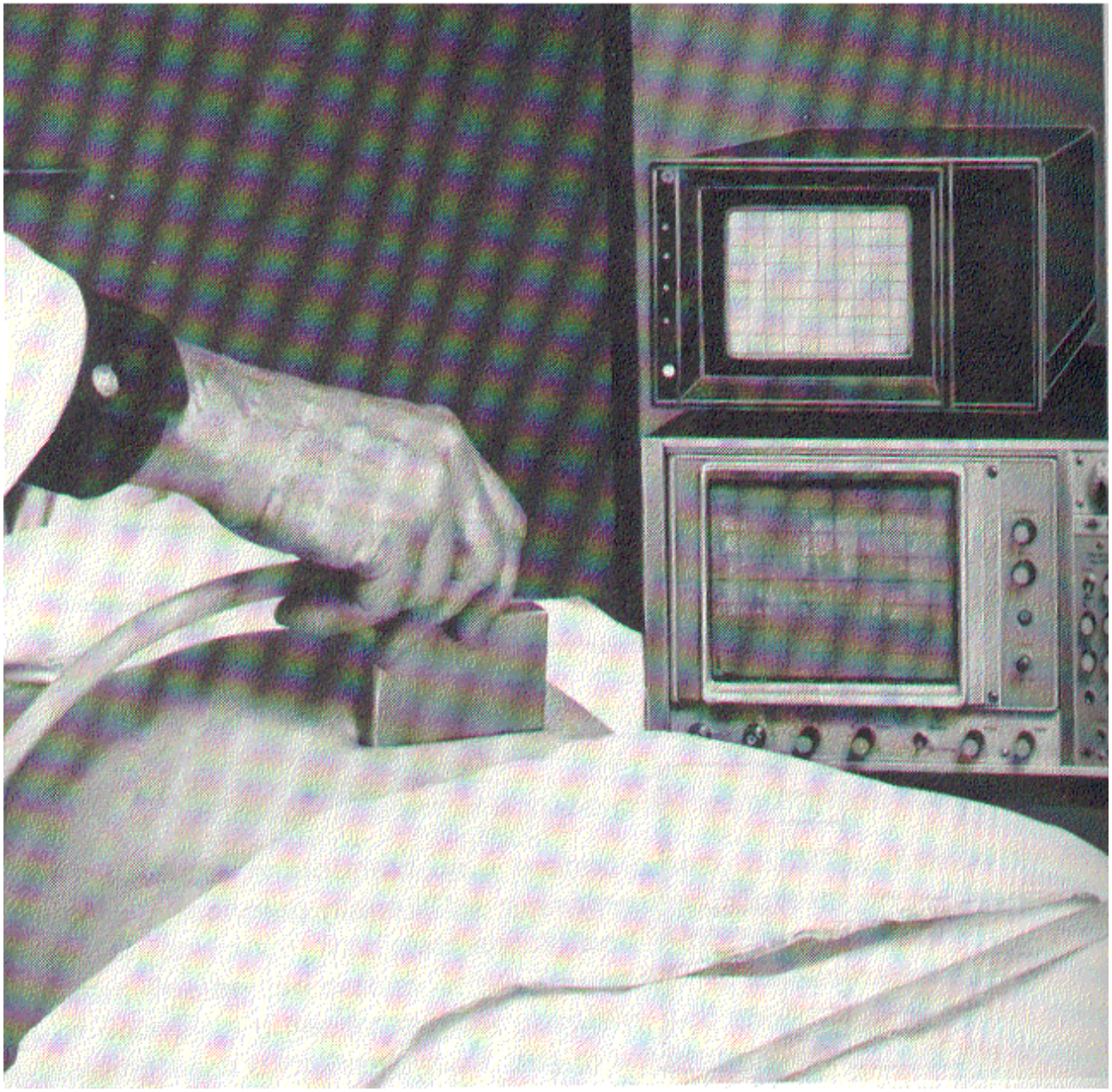
First echocardiograph (Siemens-Reiniger, 1953)



Ultrasonic grey-scale machine (Brüel & Kjaer 1979)

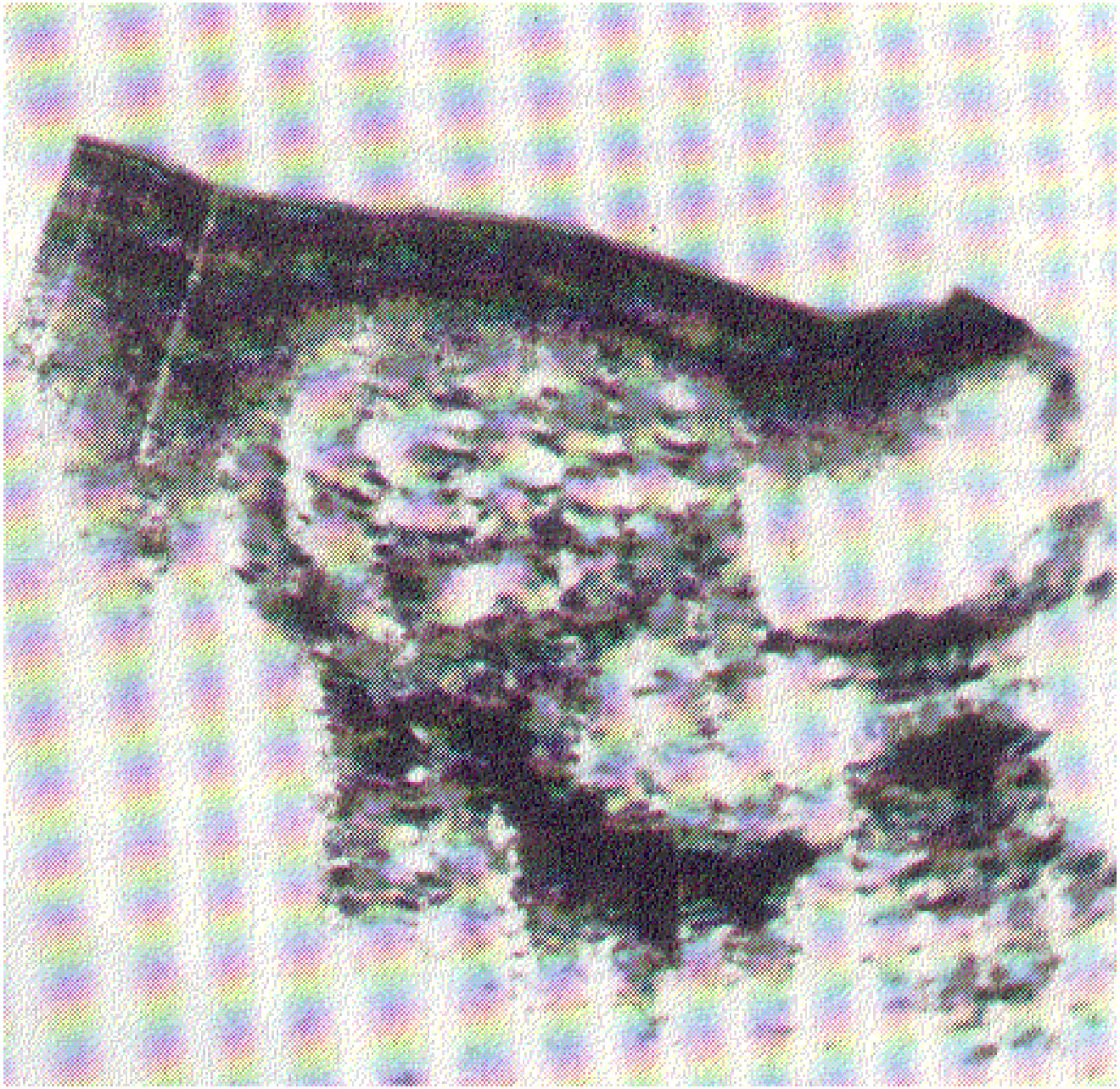


Mobile B-mode realtime ultrasonic equipment (Brüel & Kjaer 1979)

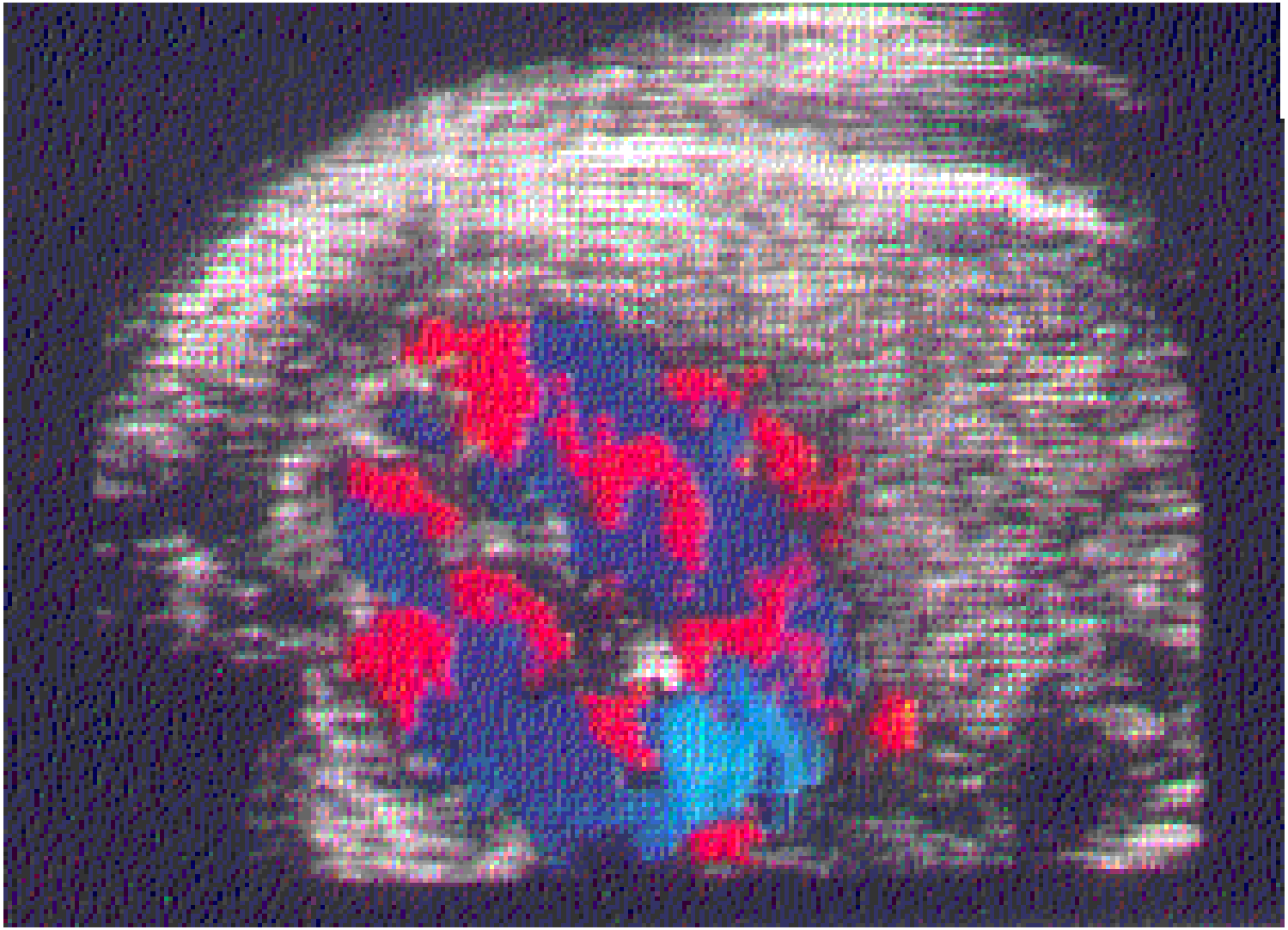


Mobile B-mode realtime ultrasonic equipment:

Multi-element transducer and monitors (Brüel & Kjaer 1979)



Ultrasonic grey-scale imaging, pregnancy 16th week (Brüel & Kjaer 1979)

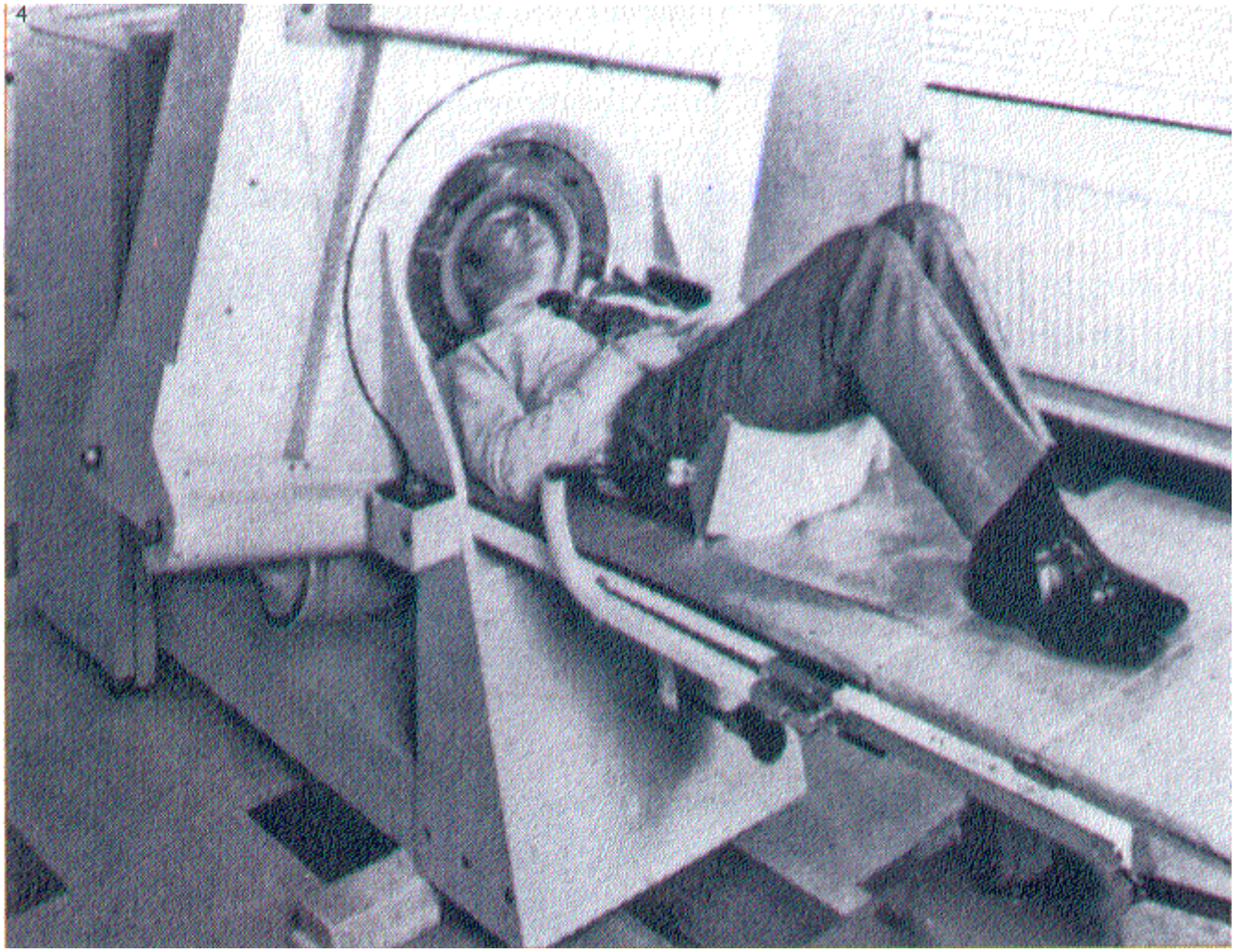


Foetal heart four chamber ultrasonic Doppler-mode image (1990)

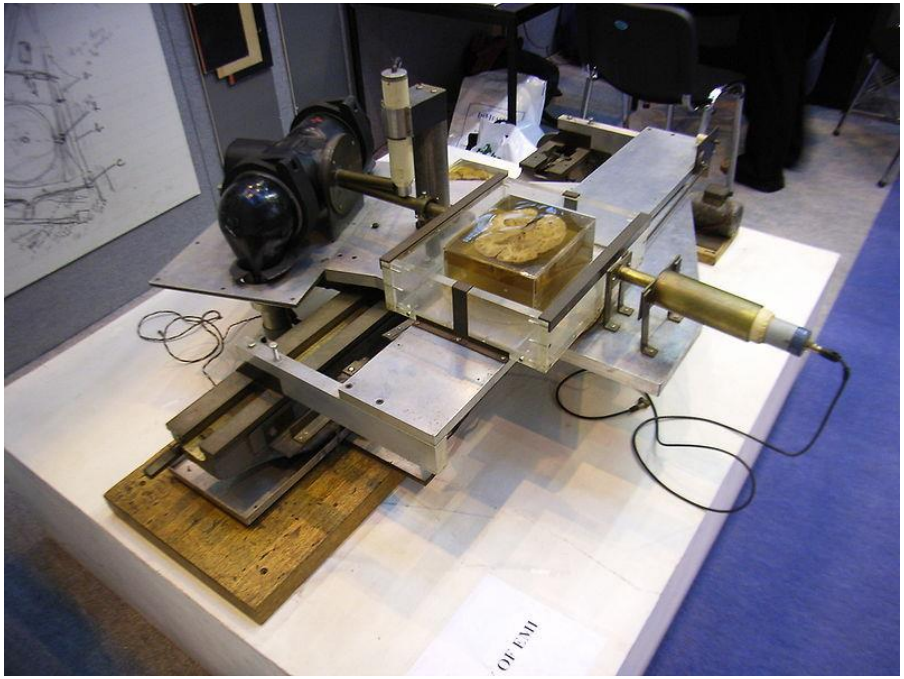
Multipurpose ultrasonic imaging apparatus for colour flow mapping (Aloka 1990)

3D ultrasonic monitor (Philips, 2008)

Colour Doppler flow mapping with sector scanner (Esaote 1990)



G. Hounsfield (Nobel Prize 1979) with the first EMI-CT-prototype (water-bag around the head) and the first brain scan of Hounsfield himself? (1972)

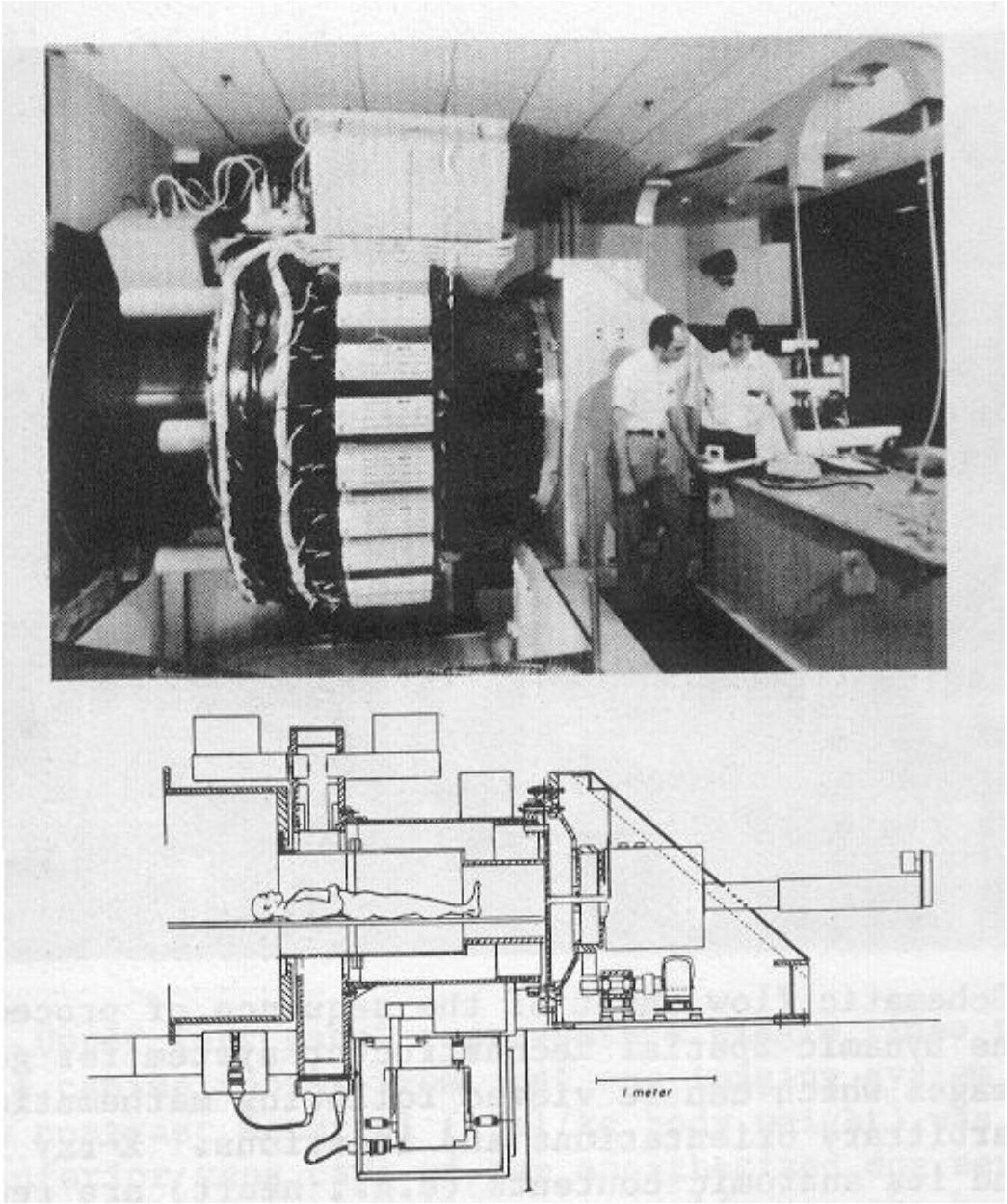


***Upper left*: Reconstructed laboratory equipment of the EMI-Hounsfield-CT-Scanner with an isotope source, sampling time 9 days**

***Upper right*: EMI-Mark 1, first commercial CT-device, single-element configuration, translateral scanning with subsequent rotation, 180 projections in 5 minutes, 3 line pairs/cm, 6400 pixels (1972)**

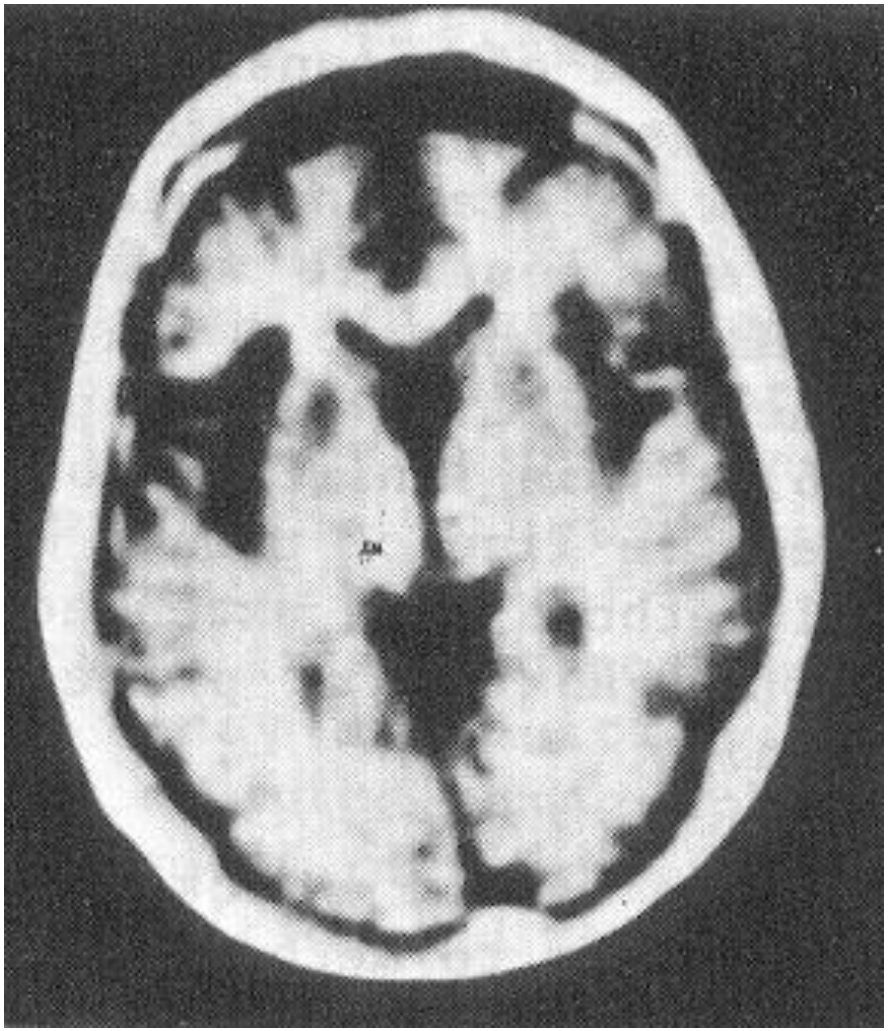
***Lower left*: Advanced CT-machine with multidetector arrangement with 16 lines (2011)**

CT-development 1972 - 2011



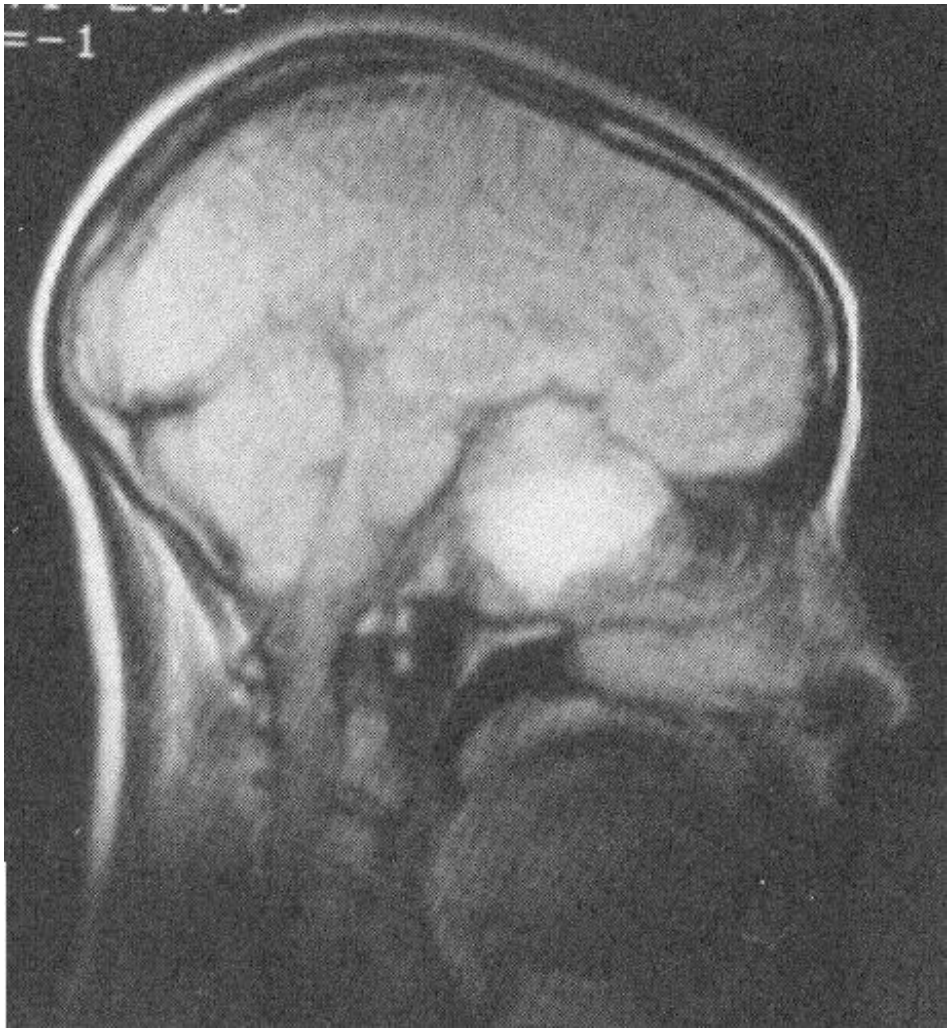
CT-Scanner (1979)

First MR-image from the brain (1980)



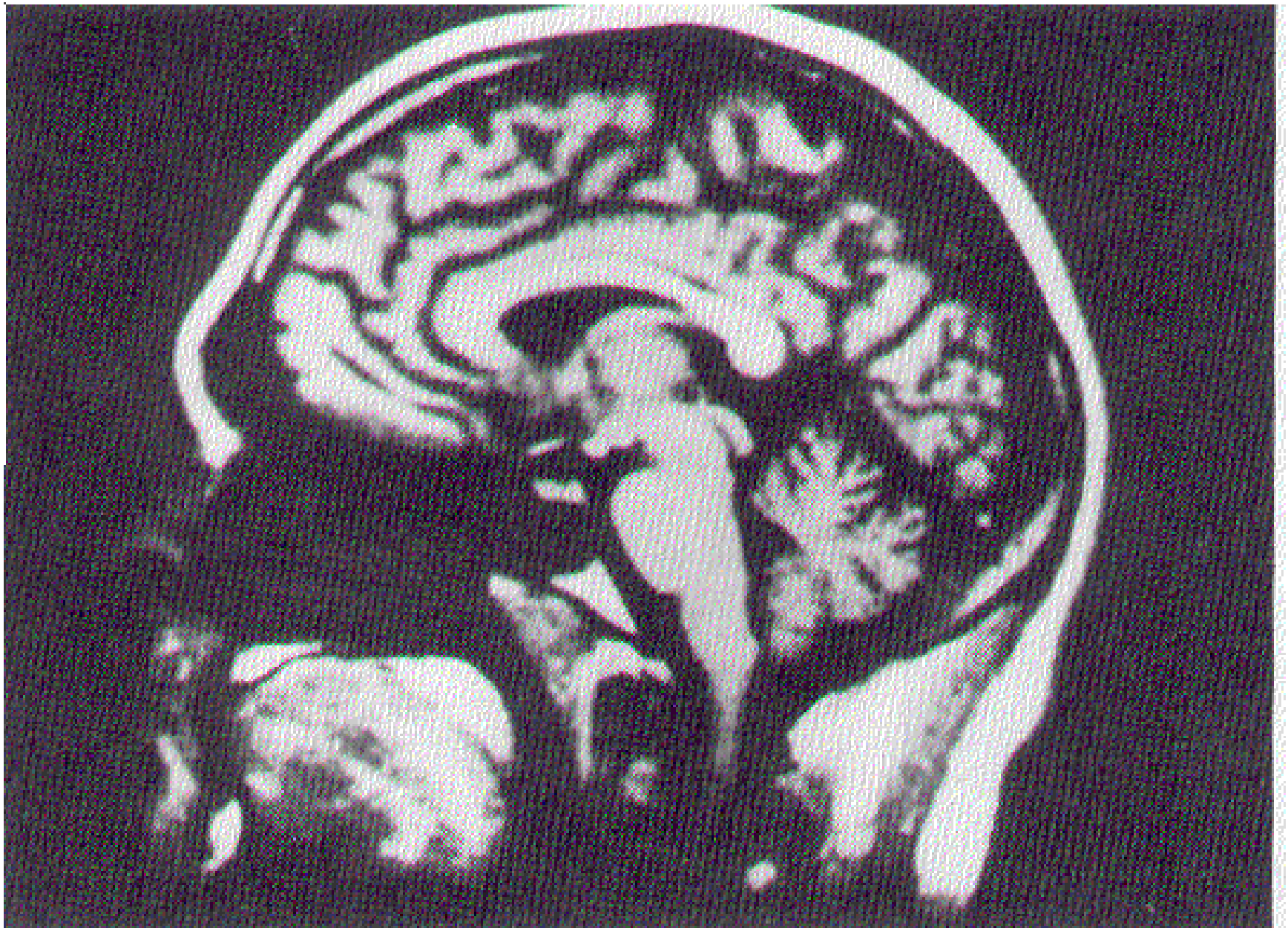
Transvers MR imaging of the brain

(1983)

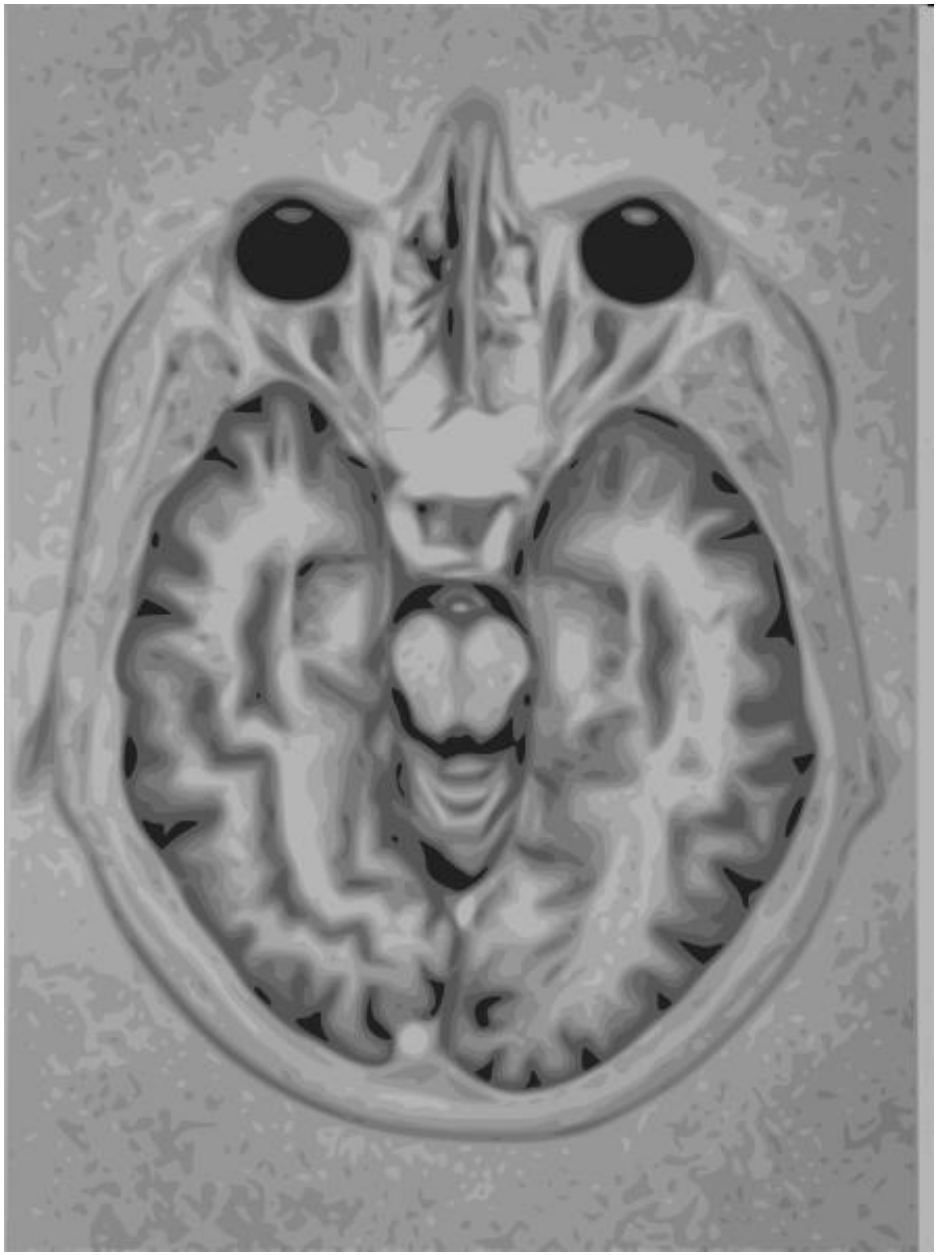


Sagittal MR imaging of the head

(1987)

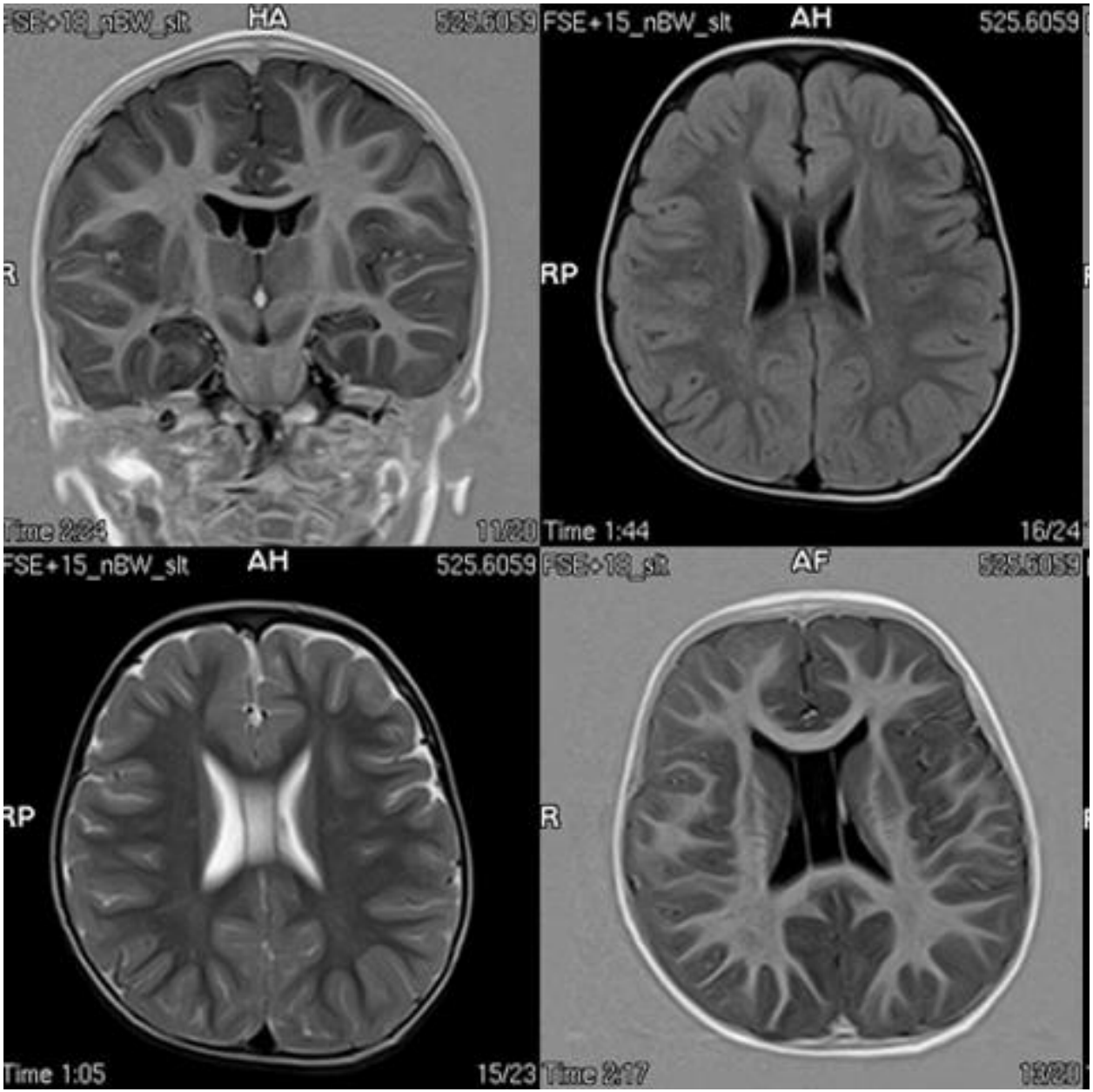


Sagittal MRI from the head with soft tissue imaging (GE, 1988)



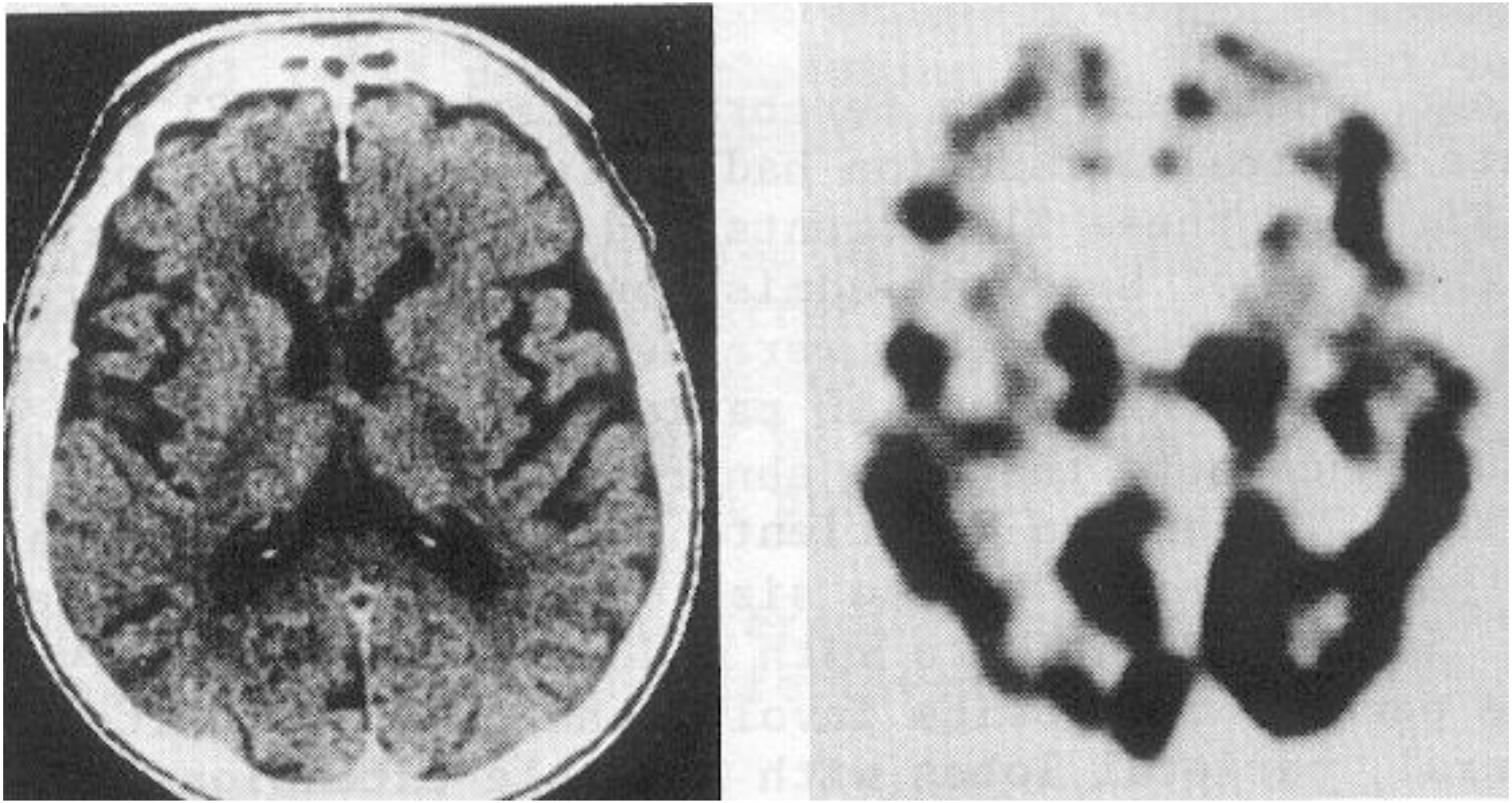
MRI brain scan with 579 x 778 pixels (2008)

MRI 3D-imaging with 1.1 mm partition (Siemens, 2009)



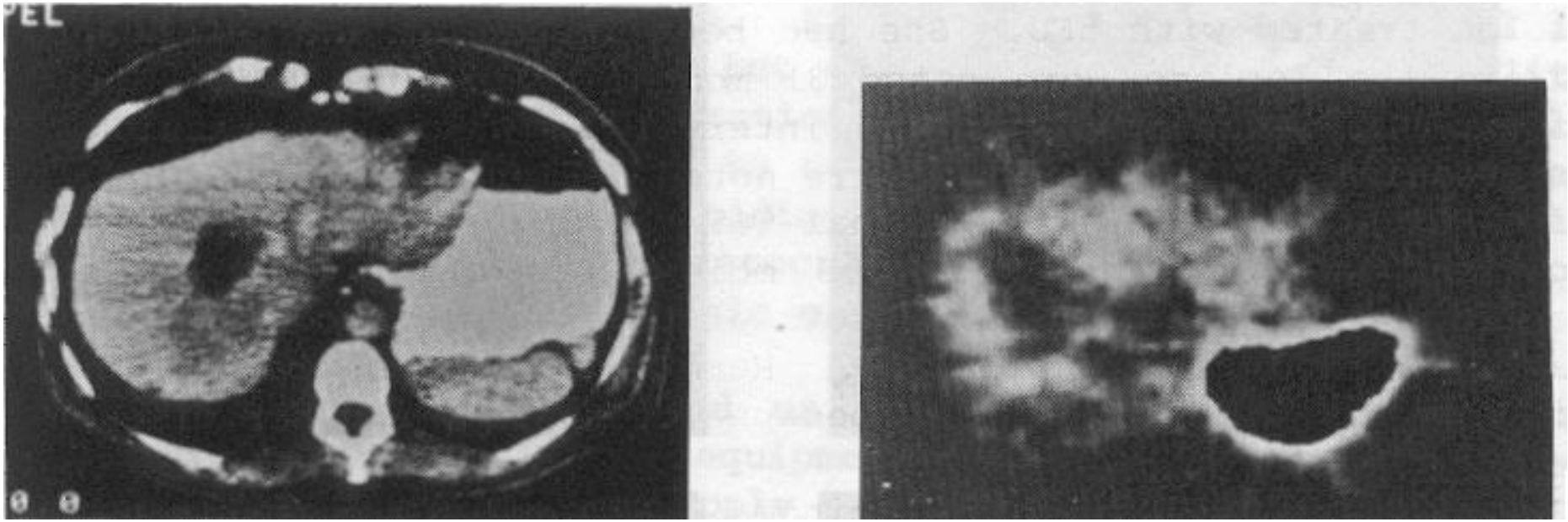
MRI of the brain using different modalities (Toshiba, 2009)

Whole body Gamma scan: dark spots (e.g. in the ribs) show the metastases (1988)

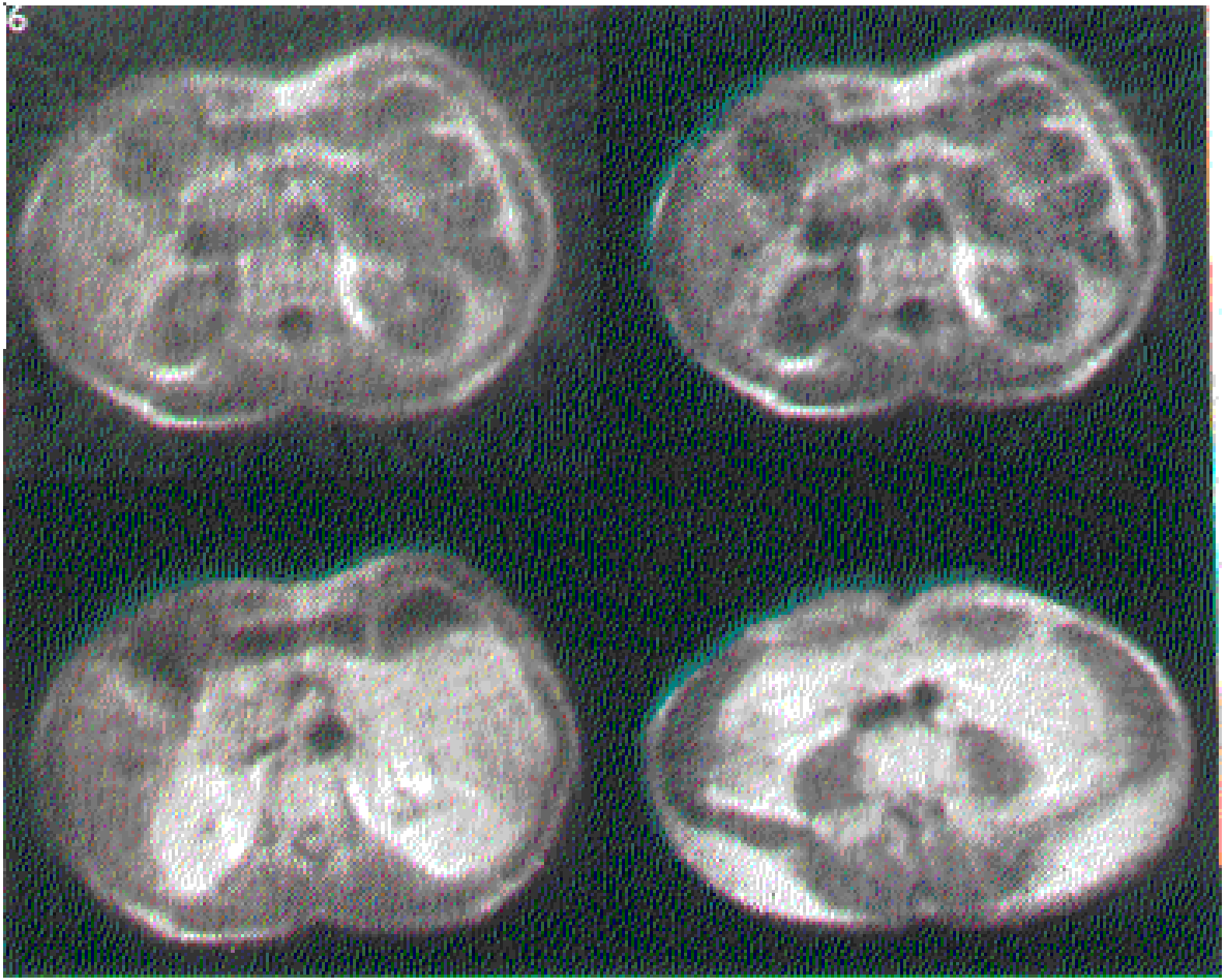


CT imaging (left-hand) and SPECT imaging (right hand) of the brain (1983)

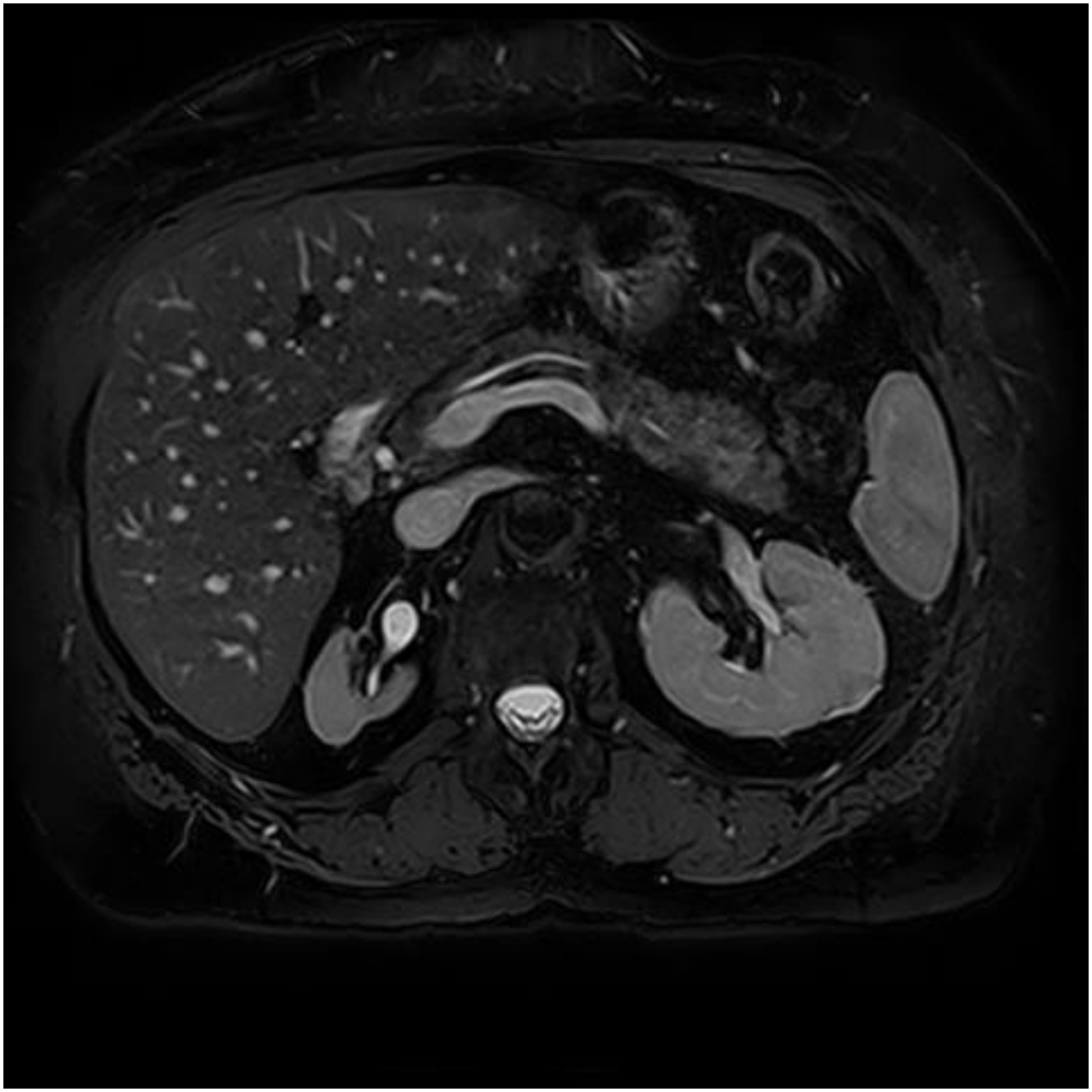
SPECT imaging = single photon computed tomography using N-isopropyl I-123 p-iodoamphetamine as „biomarker“)



Transvers scans using CT (left-hand) and SPECT (right hand) in a patient with metastatic carcinoma of the colon (1983)



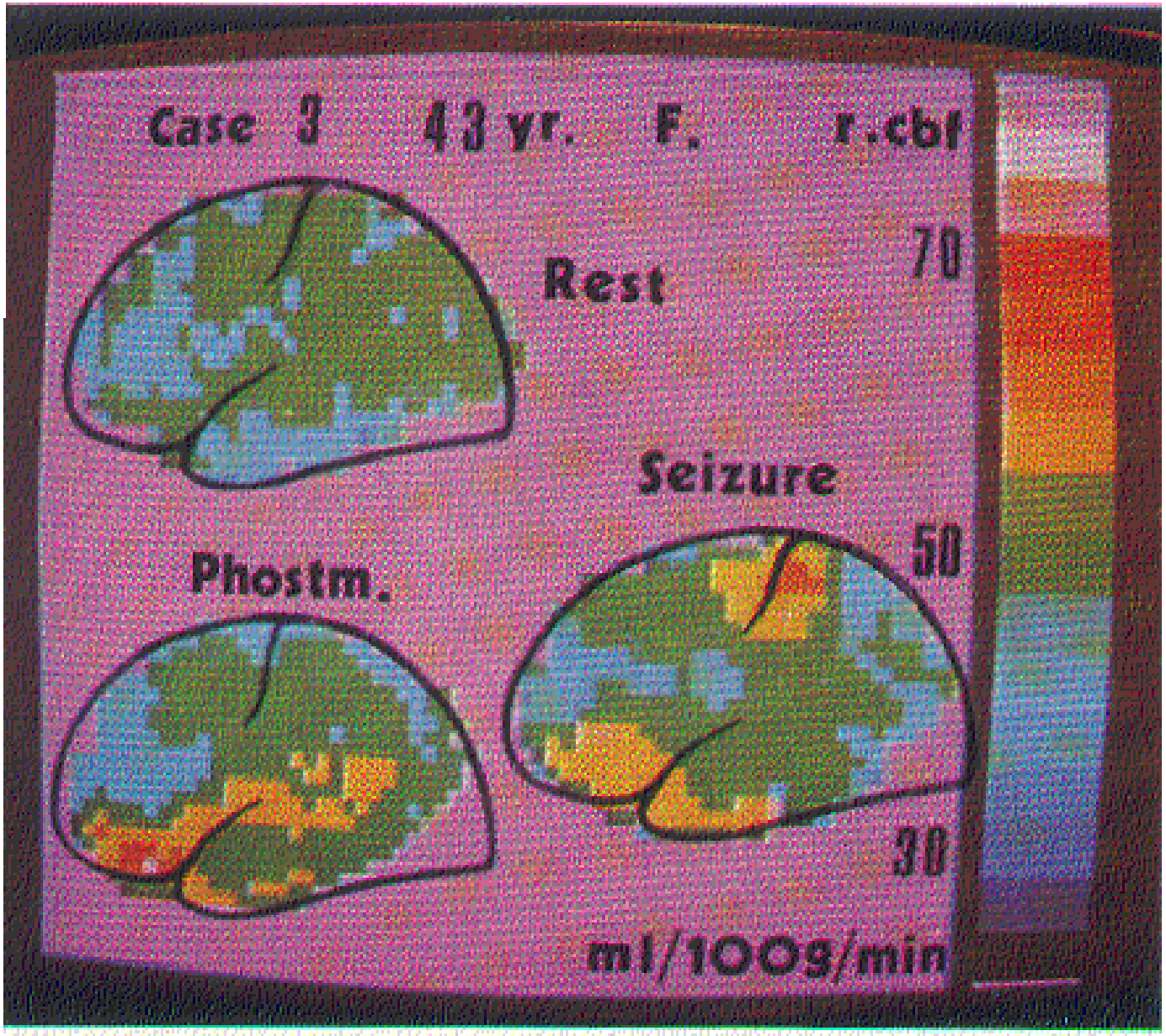
Early abdominal MR-images, illustrating reconstruction artefacts



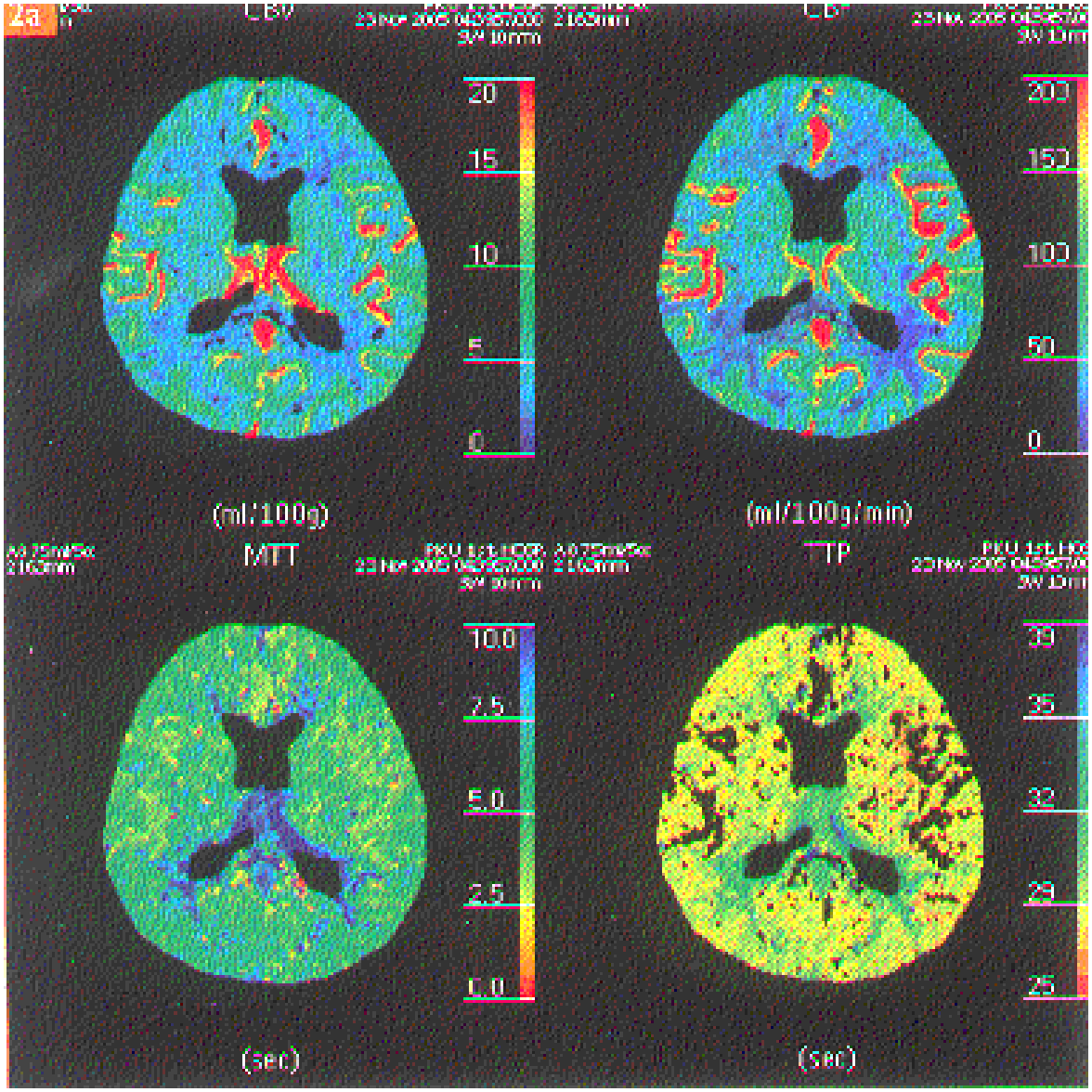
Transvers MR-imaging of the abdomen with fat suppressed (Toshiba, 2009)

Siemens Sensation 16: A combined PET/CT scanner with 16 slice configuration

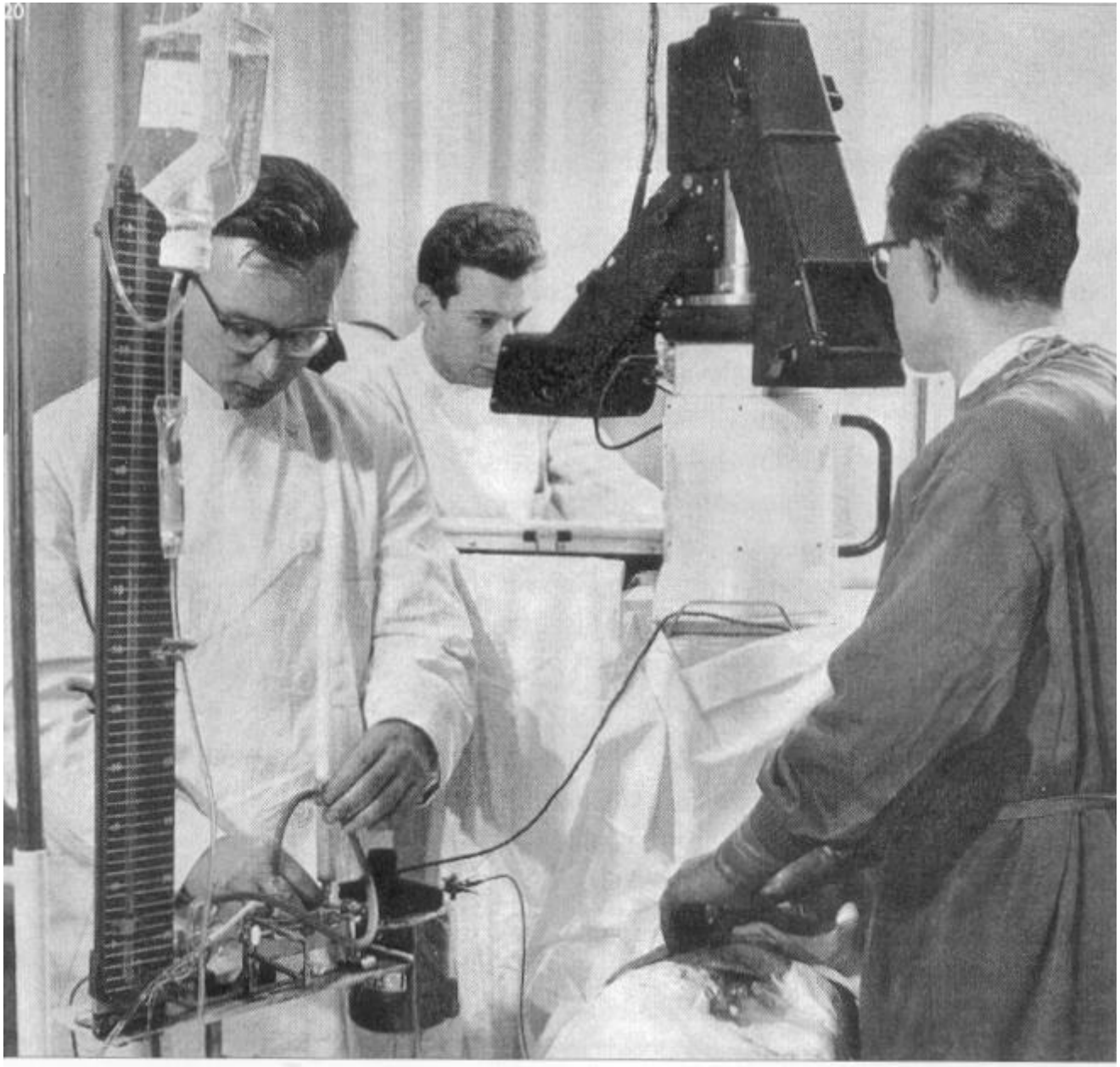
(the most advanced version has already 64 slices)



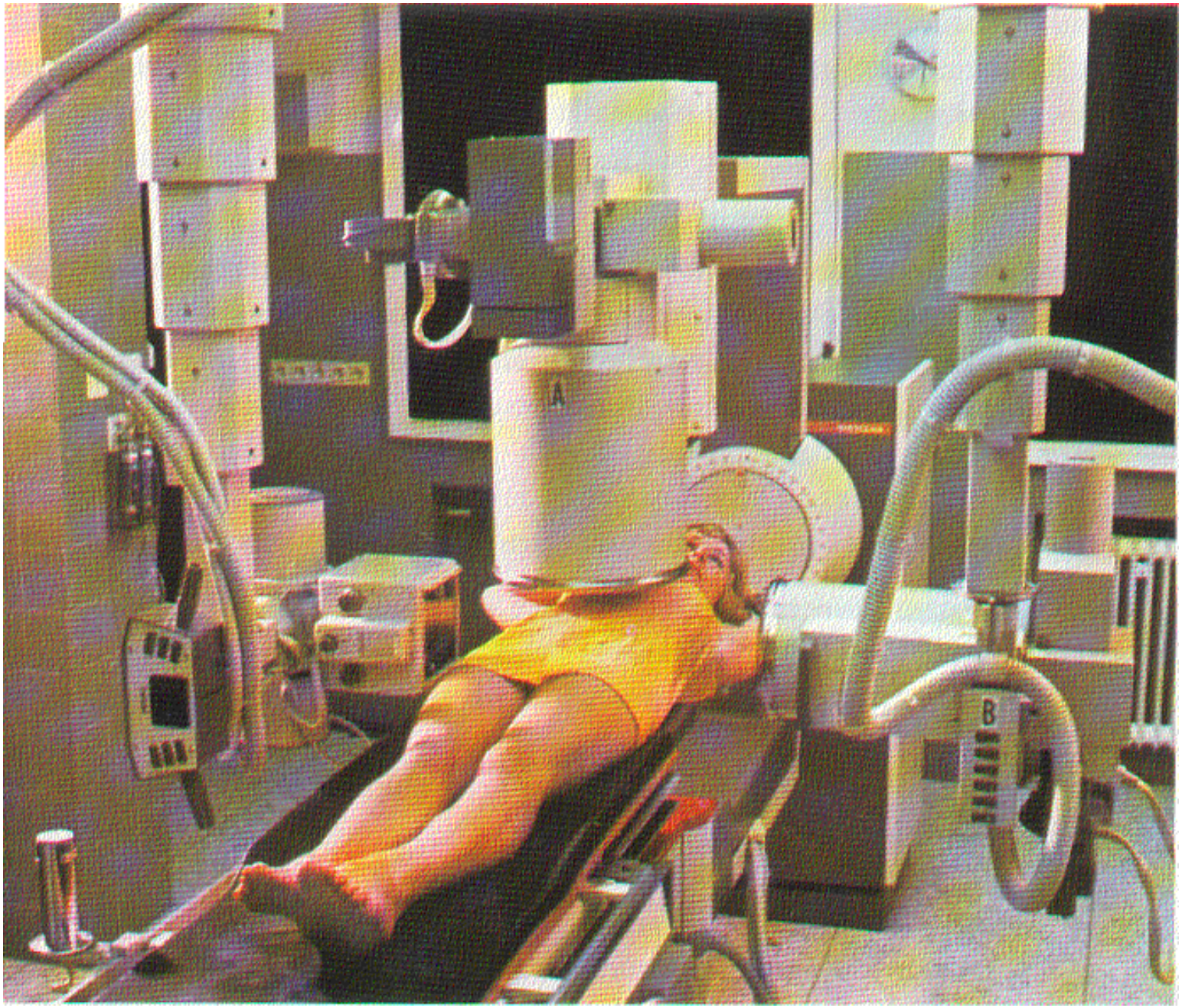
Regional cerebral blood flow (rCBF) determined from 133-Xenon washout curves Acquired with a 254 channel multidetector scintillation camera, N.A. Lassen (1976)



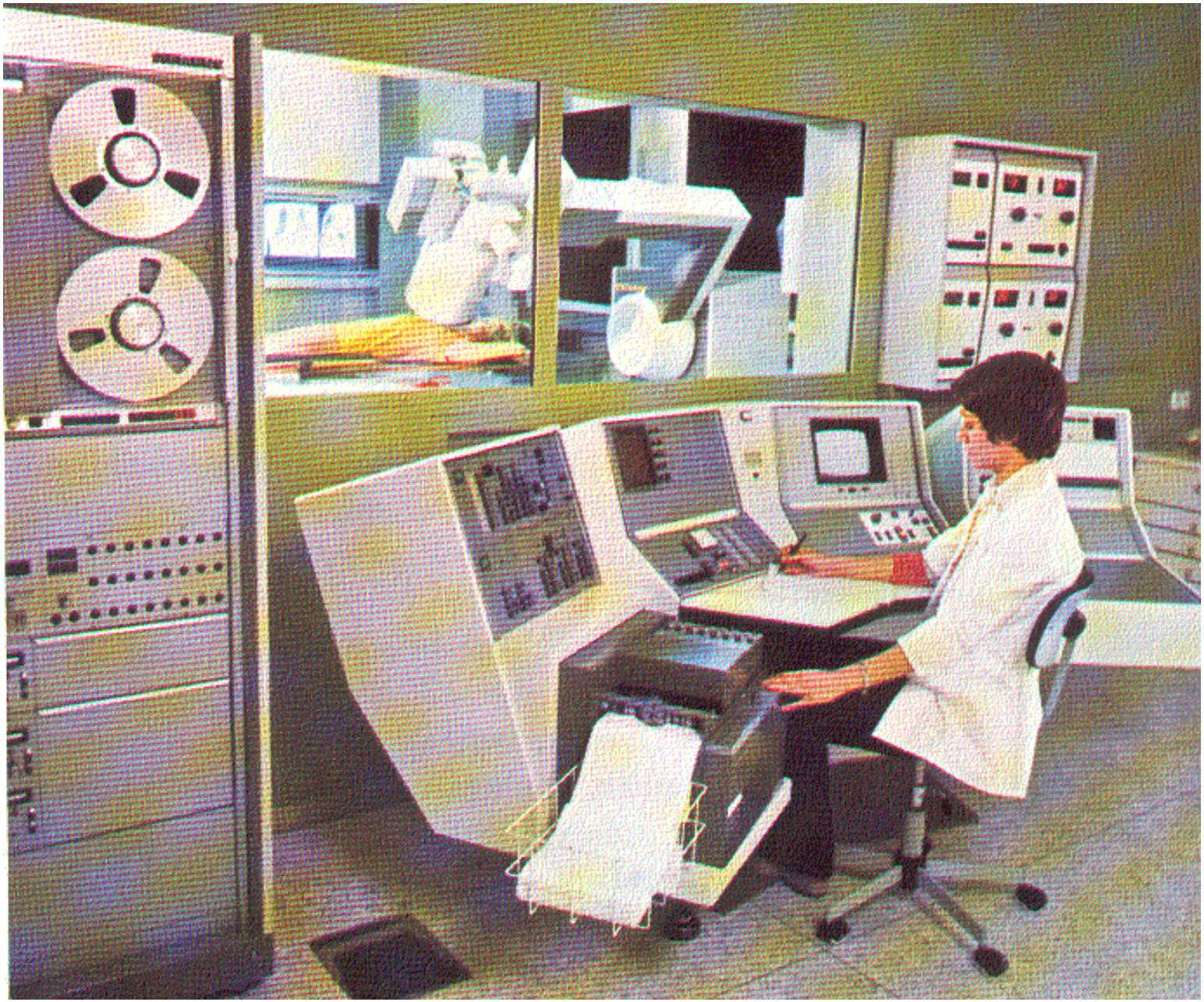
Perfusion maps of normal brain: CBV = (intravascular) Cerebral Blood Flow, CBF = (tissue) Cerebral Blood Flow, MTT = Mean Transit Time, TTP = Time To Peak acquired with contrast-enhanced CT imaging (2008)



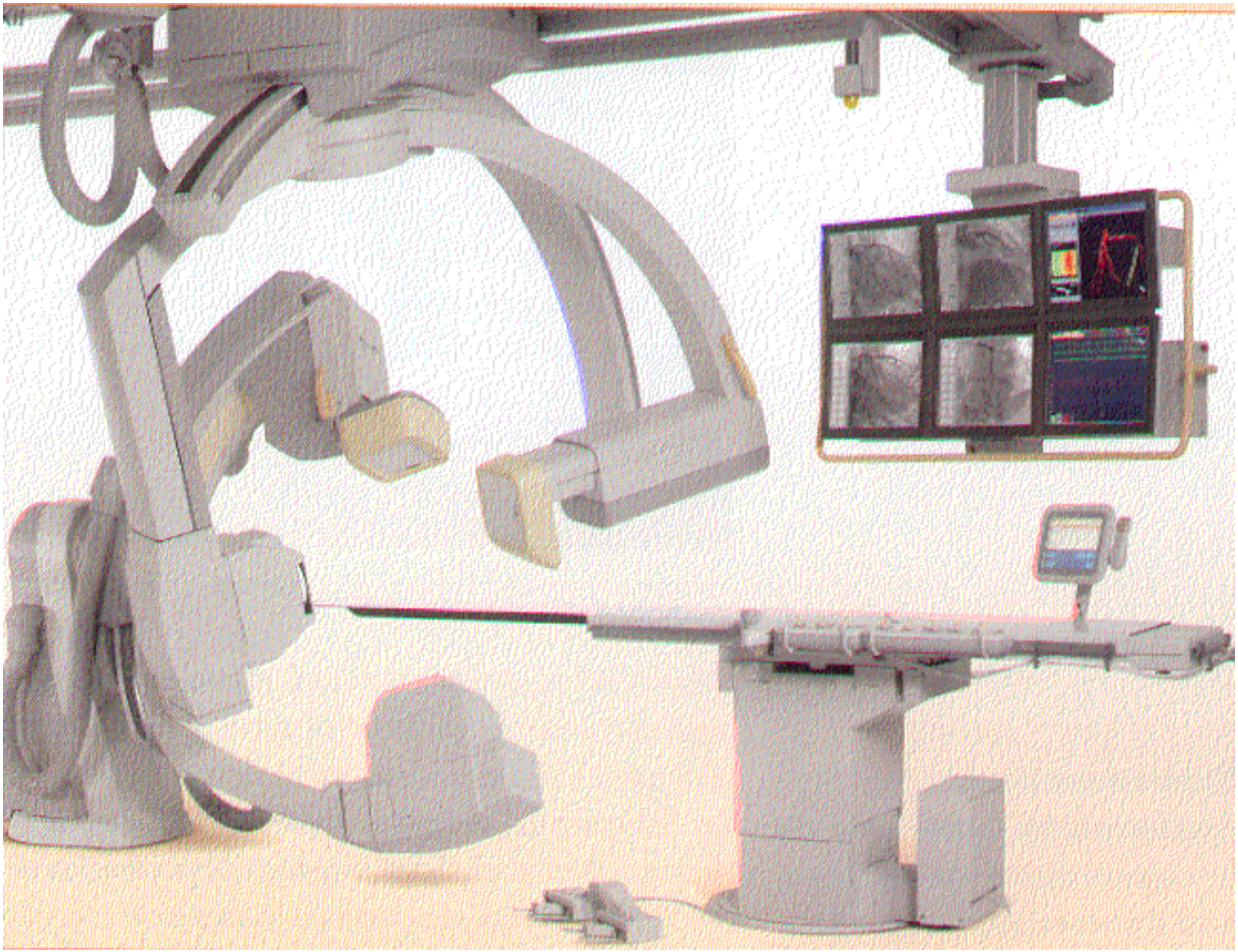
Heart catherization workplace with two-way image intensifier, Philips (1956)



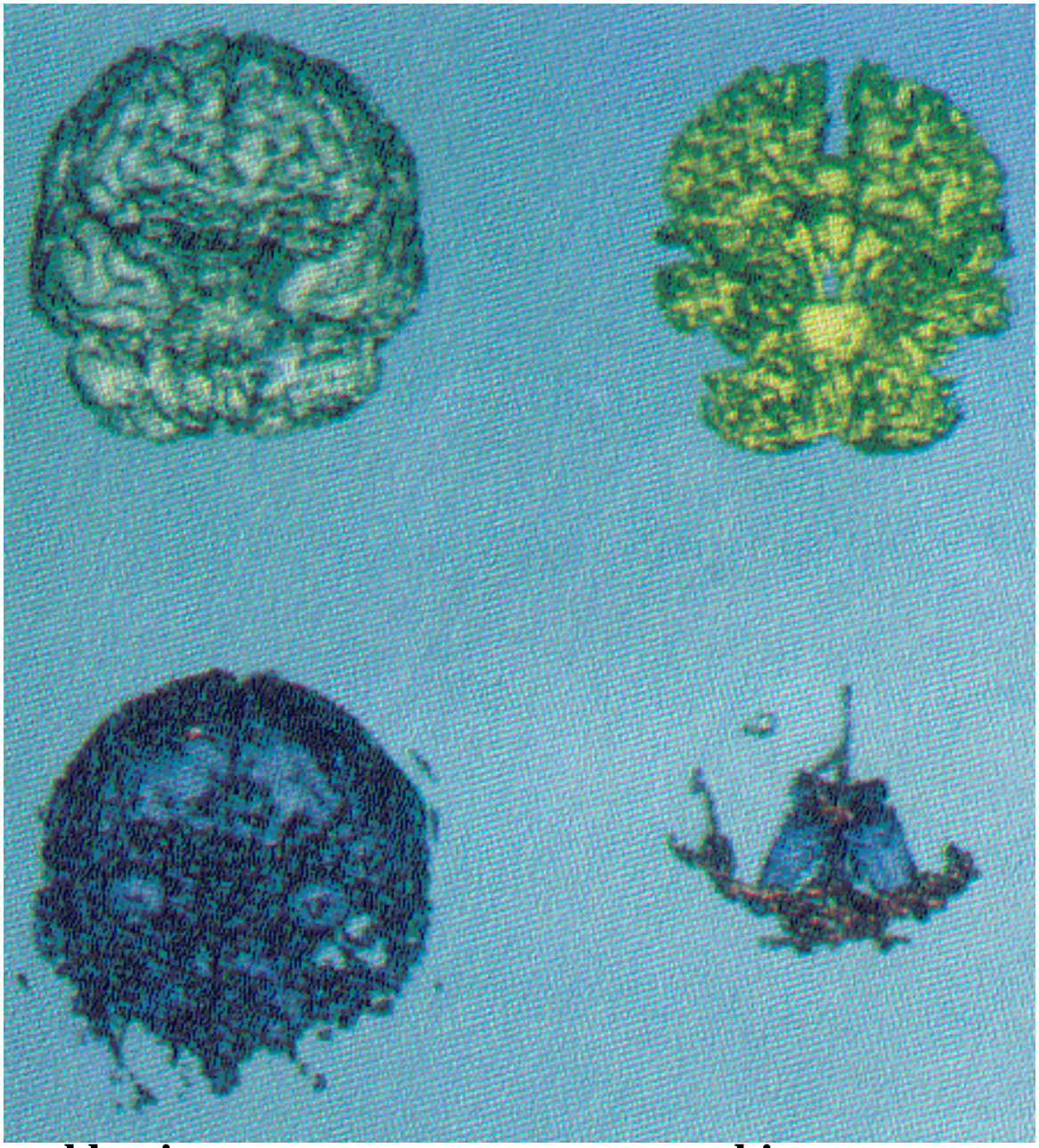
Imaging equipment for cardiac catherization and angiography (1976)



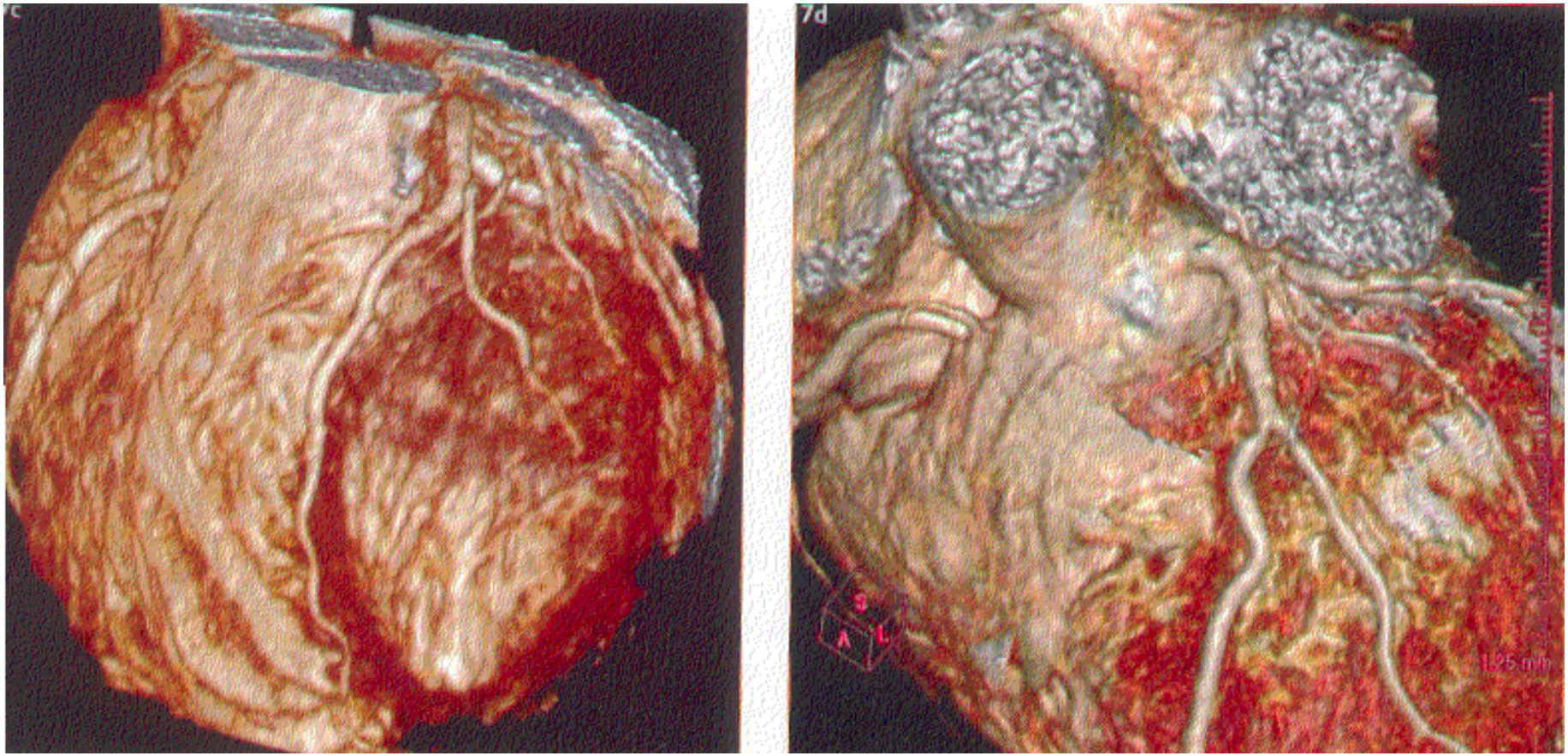
Cardiac catherization workstation for image and data processing (1976)



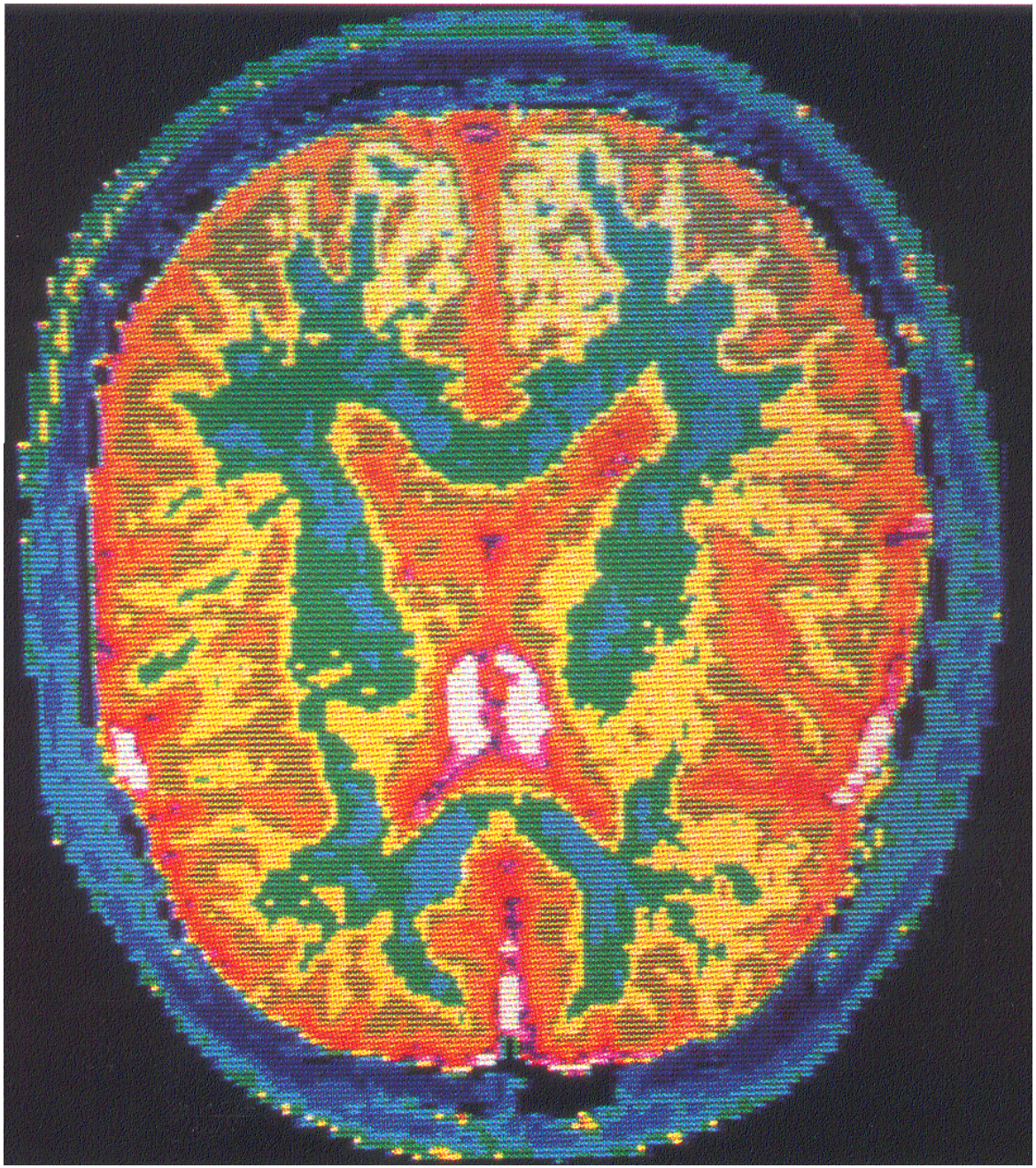
Heart catherization equipment in biplane configuration with flat screen monitors, Philips (2006)



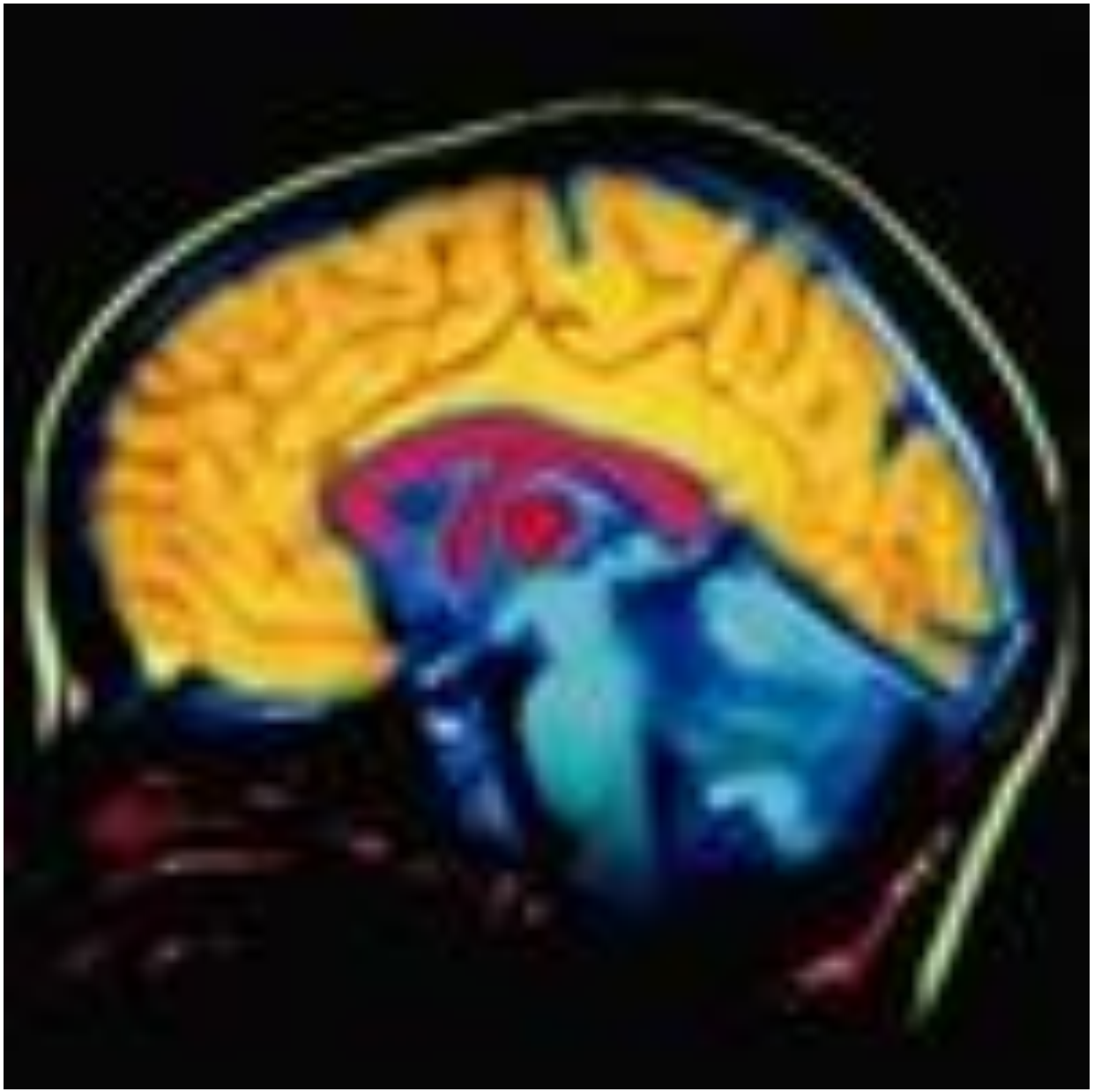
MRI processed brain structures: grey matter, white matter, ventricles and arteries (1990)



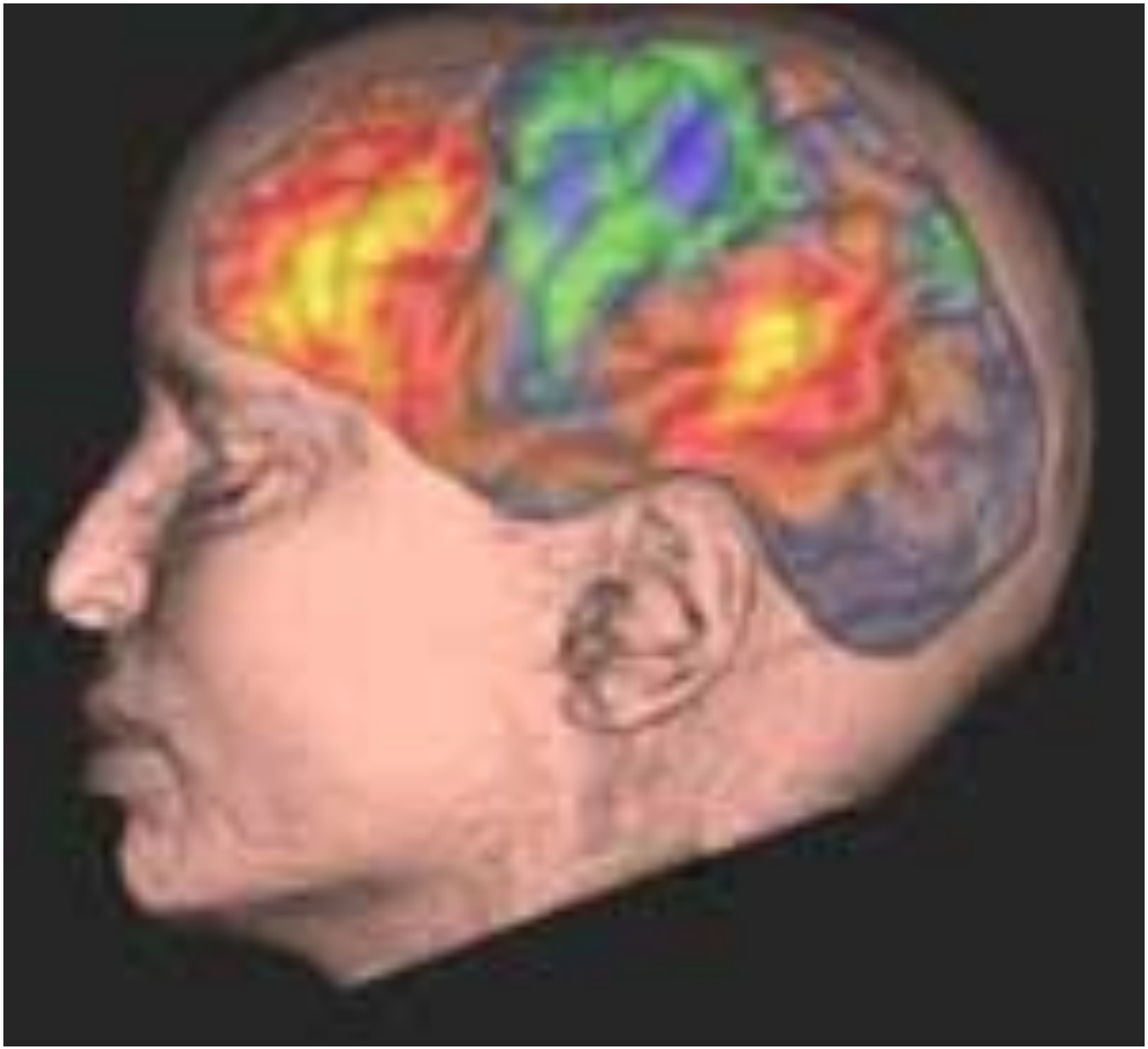
Pseudo-3D heart construction with coronary circulation reconstructed from CT (left-hand) and MR (right hand) multislice images (2006)



MRI false colour representation of brain structures (1990)



Brain imaging using state-of-the-art 3T magnetic resonance



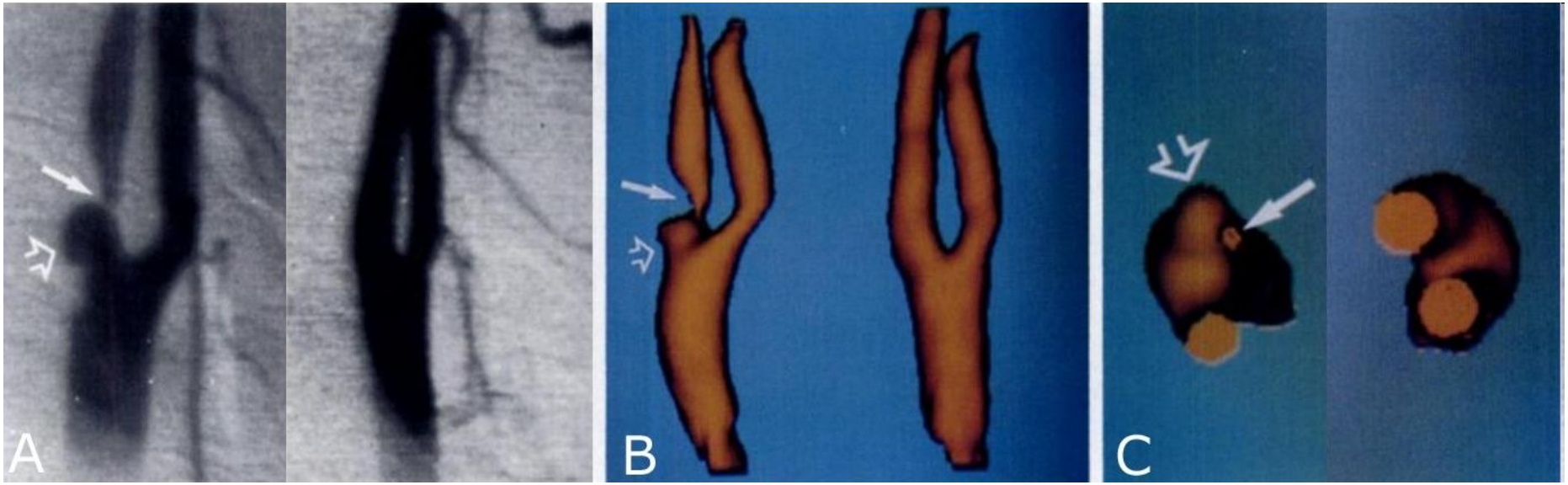
PET and MRI fused image with activity monitoring

Siemens Echocardiography System Acuson SC2000, the first that renders possible 3D whole heart imaging during one cycle

First right coronary angiogram acquired by injection of a contrast agent via a right aortic root catheter by Sones (1958)

Contrast-enhanced CT imaging of the carotid bifurcation (1983)

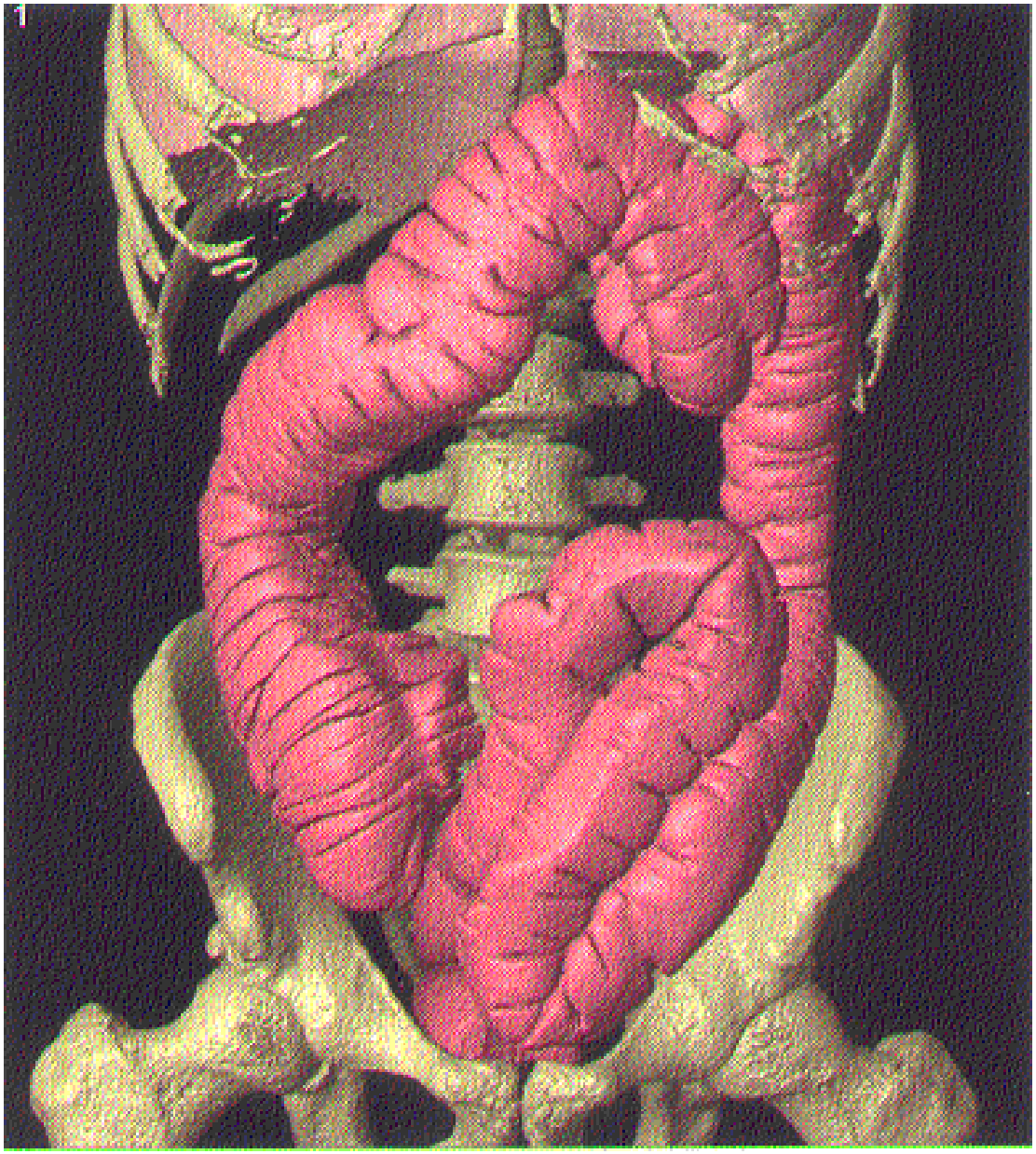
Right-side internal carotid artery is nearly totally occluded at the bifurcation



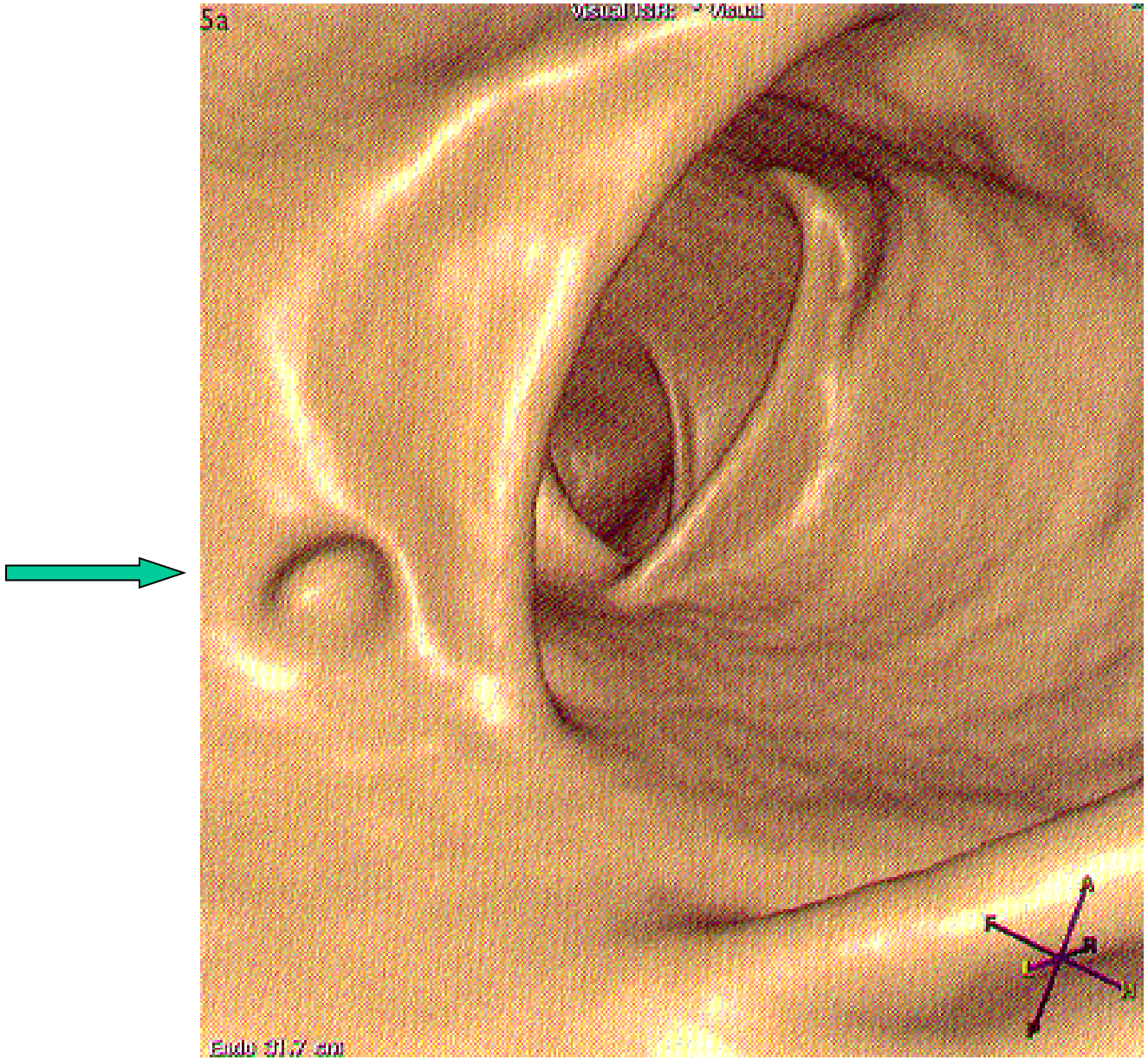
Carotid artery bifurcation, monitored with spiral CT and evaluation supported by image processing (1992)

(high-grade stenosis at the right internal carotid artery)

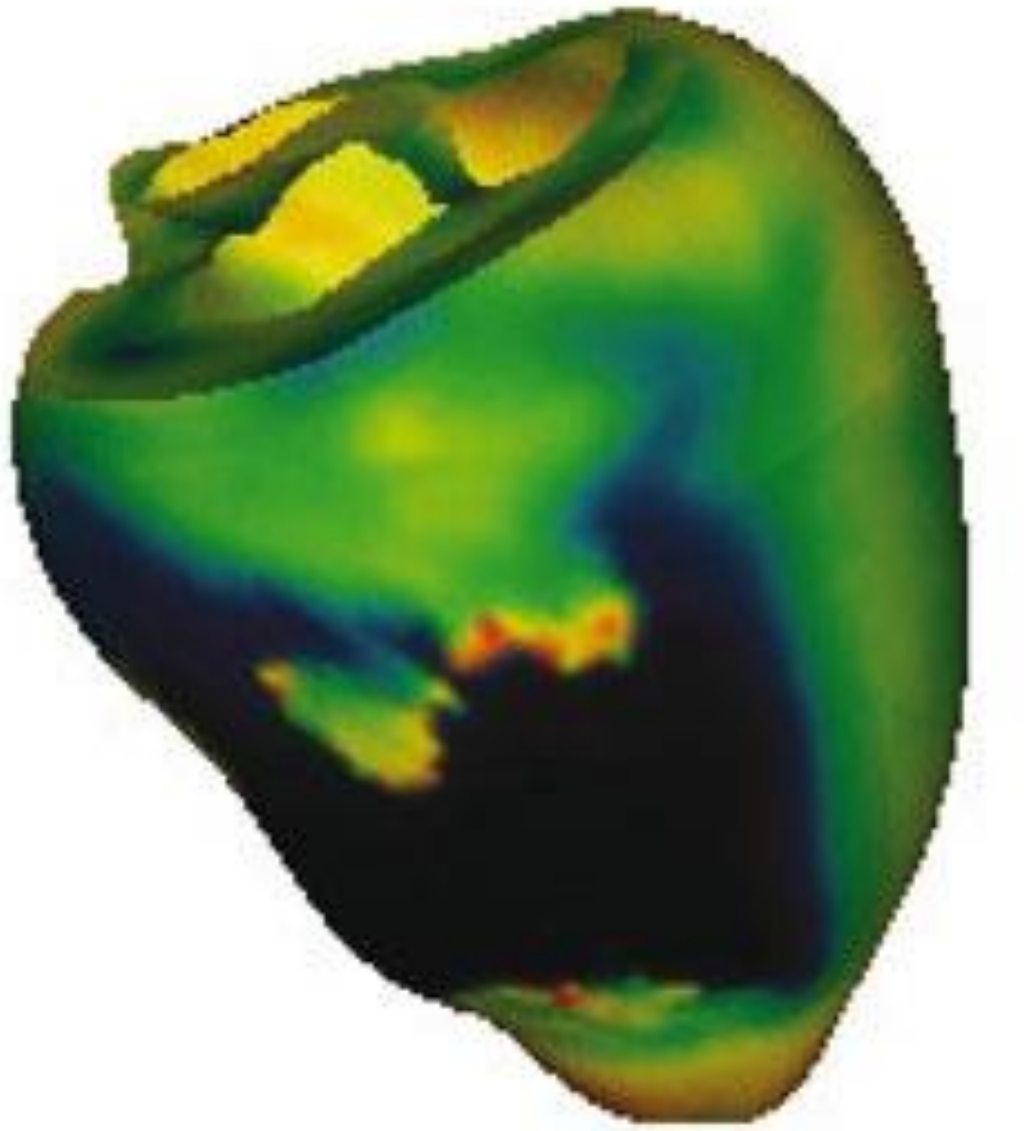
Pseudo-3D-reconstruction of the coronary tree from CT multisclices (2006)



Pseudo-3D-reconstruction of the colon from CT-multisclices (2006)



Polyp in the colon detected by computer-supported CT colonography (2006)



Simulation of the action potential and re-entry on the ventricular section of the heart visualized as geometric-anatomic model