A Brief History of Ultrasound

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History of Ultrasound
The Animal World

Audible Range varies amongst Species
Humans: 20 – 20000 Hz
Cats: 100 to 60,000 Hz
Dolphins: up to 150,000 Hz
Dogs: up to 40,000 Hz
Bats: 1,000 to 100,000 Hz
Elephants: 0.1 - 25 Hz (Infrasound)
History of Ultrasound
The Sixth Sense

- Lazzaro Spallanzani (1729-1799) Italian priest and physiologist
- 1st to provide experimental evidence that non-audible sound exists around us
- Spallazani demonstrated that blind folded bats could navigate around obstacles in the dark but bumped against them when their mouths were covered (1794)
- Hypothesised that bats navigated using sound waves rather than light
- Remained a scientific mystery termed - “Spallanzani’s Bat Problem”
History of Ultrasound

Echolocation

- **Charles Jurine**, Switzerland
  Experiment: Plugged ears of bats with wax and found the bats bumped helplessly into obstacles.

- **Spallazani and Jurine** concluded – “bats require their sense of hearing in order to find their way”

- **Donald R Griffin** and **Robert Gallambo** – Harvard, USA
  “Recorded directional noises emitted by bats in navigating flight” using a Sonic Detector in 1938

- Conied the term - Echolocation
1880 - The real Breakthrough in ultrasound technology

Discovery of the “Piezo-electric Effect” in certain crystals

Pierre and Jacques Currie – Paris, France

Led to the development of the ultrasound transducer

Transducer - The backbone of any Ultrasound device

http://www.ob-ultrasound.net/history1.html
History of Ultrasound
The Doppler Effect

- Johann Christian Doppler (1803-1853) Austria
- “Hypothesised that the pitch of a sound would change if the source of the sound was moving”
- Color doppler ultrasound an important tool in ultrasonography today
History of Ultrasound
Submarines and Battleships

- Sinking of the Titanic 1912 was the impetus for the development of echolocating devices for nautical purposes
- SONAR (sound navigation and ranging)
History of Ultrasound
Sonar

- Reginald Aubrey Fessenden (1866-1932) from Quebec, Canada
- Designed and built the first working SONAR system in the USA
- It was an electromagnetic moving-coil oscillator
- Capable of detecting an Iceberg 2 miles away
- Also the first person to prove that voices and music could be heard over the air without wires

http://www.ob-ultrasound.net/history1.html
History of Ultrasound
World War I & II

- Paul Langévin - Paris, France
- 1915 - Invented the underwater Sonar for submarine detection (World War I)
- Name of the device – “Hydrophone”
- 23rd April 1916 – first recorded detection and sinking of a German U-boat (UC-3) using a hydrophone
- Ultrasound technology was refined and used to protect the North Atlantic convoys during World War II

http://www.ob-ultrasound.net/history1.html
- Sergei Y Sokolov - 1928 suggested the concept of ultrasonic metal flaw detection
- “Reflectoscope” or “Flaw detectors”
- Metal Flaw detector - used to detect flaws in metal (ships and aircrafts)
- Radar (Radio Detection and Ranging) – electromagnetic waves, 1935
- Robert-Watson Watts – UK, Father of Radar

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Use of ultrasound for physical therapy dates back to the 1940’s

Thermal energy generated from ultrasound is used in ultrasonic therapy

Once thought – “Ultrasound is a "cure-all" remedy”

Used to treat conditions such as arthritic pains, gastric ulcers, eczema, asthma, thyrotoxicosis, haemorrhoids, urinary incontinence, elephantiasis and even angina pectoris!

http://www.ob-ultrasound.net/history1.html
Karl Dussik (1908 – 1968) a neurologist from the University of Vienna
In 1942 – first to use ultrasound as a diagnostic tool
To locate Brain Tumors and the Cerebral Ventracles
Term – “Hyperphonography”

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History of Ultrasound
Musculoskeletal Ultrasonography

- First report of Musculoskeletal Ultrasonography 1958
- Led to widespread use in Rheumatology for musculoskeletal examination
History of Ultrasound Obstetrics

- Professor Ian Donald, Glasgow, University Department of Midwifery
- Exposed to Ultrasound and Radar technology in the RAF (Royal Air Force)
- 21 July 1955 – first put into practice using two metal flaw detectors to scan specimens of fibroids and ovarian cysts
- Quoted – “finding flaws in women”
- Rest is History

[http://www.ob-ultrasound.net/history1.html](http://www.ob-ultrasound.net/history1.html)
History of Ultrasound
Flaw Detectors to Hand Carried Devices

Metal Flaw Detectors

Metal flaw detector in use ** (Kretztechnik, Austra)

The Pan Scanner

The pan-scanner in 1957

Early B-Mode machine

The water-bag B-mode scanning system, the SSD-1, from Aloka in 1960

Deneir’s ultrasound apparatus 1946

Early Aloka machine

Machine from China

http://www.ob-ultrasound.net/history1.html
History of Ultrasound
Cart Based Machines of Today

Phillips HD11XE  
GE Vivid Five
History of Ultrasound
Hand Carried Devices of Today

- Sonosite - Micromaxx
- Sonosite - Titan
- Sonosite - I Look
- Sonosite - 180
History of Ultrasound
Medical 3D - Ultrasound

What is 3D ultrasound?
3 dimensional -or "3D"- ultrasound machines allow multiple 2D images to be acquired and rendered as a 3D image of the fetus.

These machines can provide fascinating images of the fetal face and body.
History of Ultrasound

4D - Ultrasound

What is 4D ultrasound?

The 4D ultrasound adds a fourth dimension to the ultrasound: time. 4D takes 3-dimensional ultrasound images and adds the element of time to the process. The result: Live action images.
La Grange P in 1978 described the use of Doppler ultrasound for supraclavicular brachial plexus block.


*Br J Anaesth 1978; 50: 965-7*
History of Ultrasound Applications in Anaesthesia

- Vascular Access
- Echocardiography: Transthoracic / Trans oesophageal
- Peripheral Nerve Blocks
- Spinal Sonography
- Airway: Documentation of airway anatomy, position of endotracheal tube, airway assessment in patients with large thyroid mass
- Chest: Detect isolated loculated fluid for drainage, Hemothorax, Identify Rib and sternal fracture, pericardial effusion
- Pain clinic: identify neuroma, tumour infiltration, myofascial trigger point injection
- Indications are expanding day by day
Acknowledgement

A Philatelic History of Radiology
http://www.xray.hmc.psu.edu/rci/ss4/ss4_12.html

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A short History of the development of Ultrasound in Obstetrics and Gynecology. Dr. Joseph Woo (A Must Read Article)
http://www.ob-ultrasound.net/history1.html

http://www.ob-ultrasound.net/

D Kane et al. A brief history of musculoskeletal ultrasound: “From bats and ships to babies and hips” Rheumatology 2004; 43:931-933
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