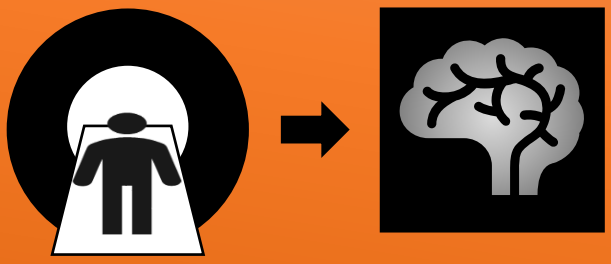
Quantitative Magnetic Resonance Imaging (qMRI)

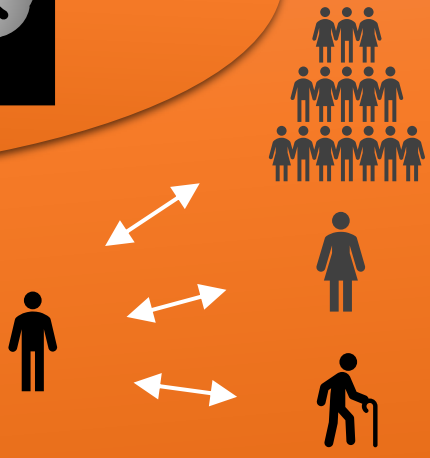
1 Magnetic resonance imaging (MRI) creates **images of the inside of our bodies**.



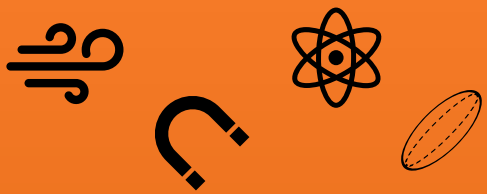
2 In the grayscale images, different tissue compositions appear **brighter** or **darker**.

3 *Standard MRI* measures only relative differences. This lets us **observe abnormal structures**, but we cannot compare brightnesses across patients or time.

4 With *quantitative MRI*, we obtain maps of absolute physical or chemical values. We can compare these values **across patients and time.** Quantitative MRI detects changes of the chemical composition and the microscopic tissue structure. Therefore, we can observe **changes in the aging body, or the development of diseases**, unseen by standard MRI. This comes at the price of longer acquisition times.



5 Quantitative approaches cover **very different physical and chemical aspects**, including perfusion, diffusion, magnetic susceptibiliy, spectroscopy and proton relaxation.



6 Current research explores how to shorten the time it takes to acquire a quantitative MR image. This will allow for a more widespread use of the technique in clinical research and clinical radiology to **improve diagnostics and foster medical discoveries.**

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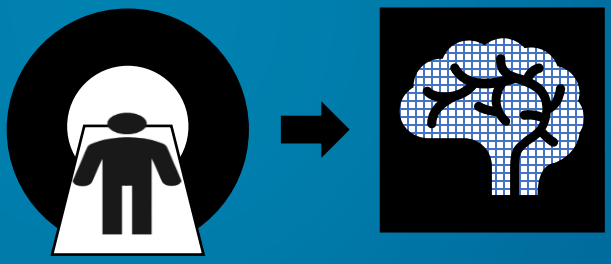
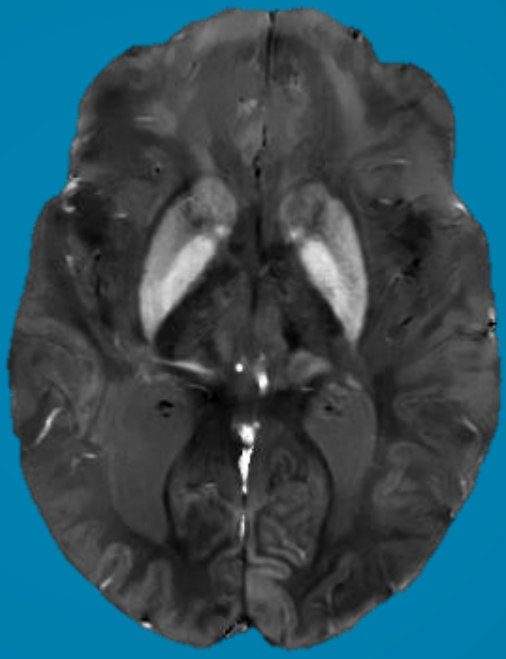
Quantitative Susceptibility Mapping (QSM) – *More Than Just a Phase*

1 **Quantitative Susceptibility Mapping** (QSM) is a special type of quantitative magnetic resonance imaging (qMRI).



2 **Magnetic susceptibility** describes how materials react when brought into a magnetic field, such as the strong magnetic field of an MR scanner. **Materials can weaken or strengthen the magnetic field inside and around them.**

3 From the strengthening or weakening of the magnetic field **we can calculate maps of the magnetic susceptibility**. This calculation is quite complicated and subject to ongoing research.



This image shows a susceptibility map.

4 From a tissue's magnetic susceptibility we can draw conclusions about its chemical composition. **This allows us to detect increased or reduced concentrations of important substances**, like iron or calcium. This information helps us to research diseases of the brain, such as Alzheimer disease or multiple sclerosis.

5 Current research improves and extends QSM by accounting for the effects from the tissue's texture and alignment.

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