

HOT TRENDS

in medical imaging

GE Healthcare



INTERNATIONAL
SOCIETY
FOR STRATEGIC
STUDIES IN
RADIOLOGY

1. Device Technology Innovation “Headroom”

New Technologies Review - Examples

- New developments for Intervention
- High Field MR
- **Hyperpolarized MR**
- Photon counting in CT

MR



Process to detect alignment of magnetic nuclei with or against an applied magnetic field

Polarization

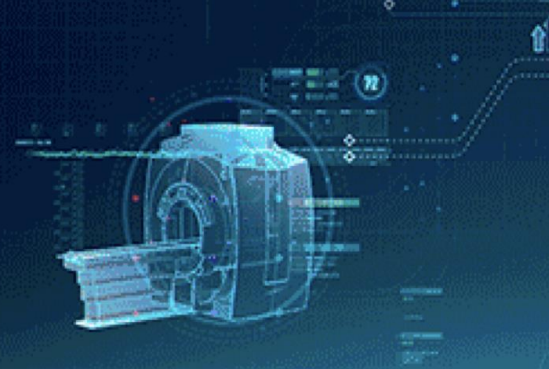


Fraction of nuclei aligned in these two states

Hyperpolarization

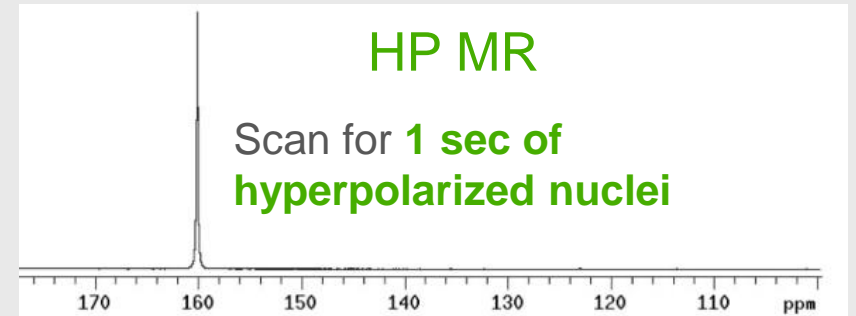
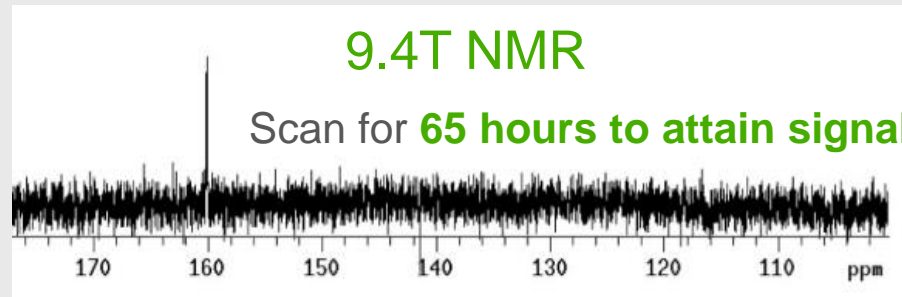


SNR raised > 10,000x



Continued Device Tech Innovation

Example: Urea



Early applications hyperpolarize noble gases (^3He & ^{129}Xe) to improve scans for areas with low nuclei density (e.g., the lungs)... newer applications hyperpolarize biochemicals to probe metabolism (^{13}C & ^{15}N)



Hyperpolarized ^{13}C Carbon in Pyruvate and its metabolites: Can be imaged in real time

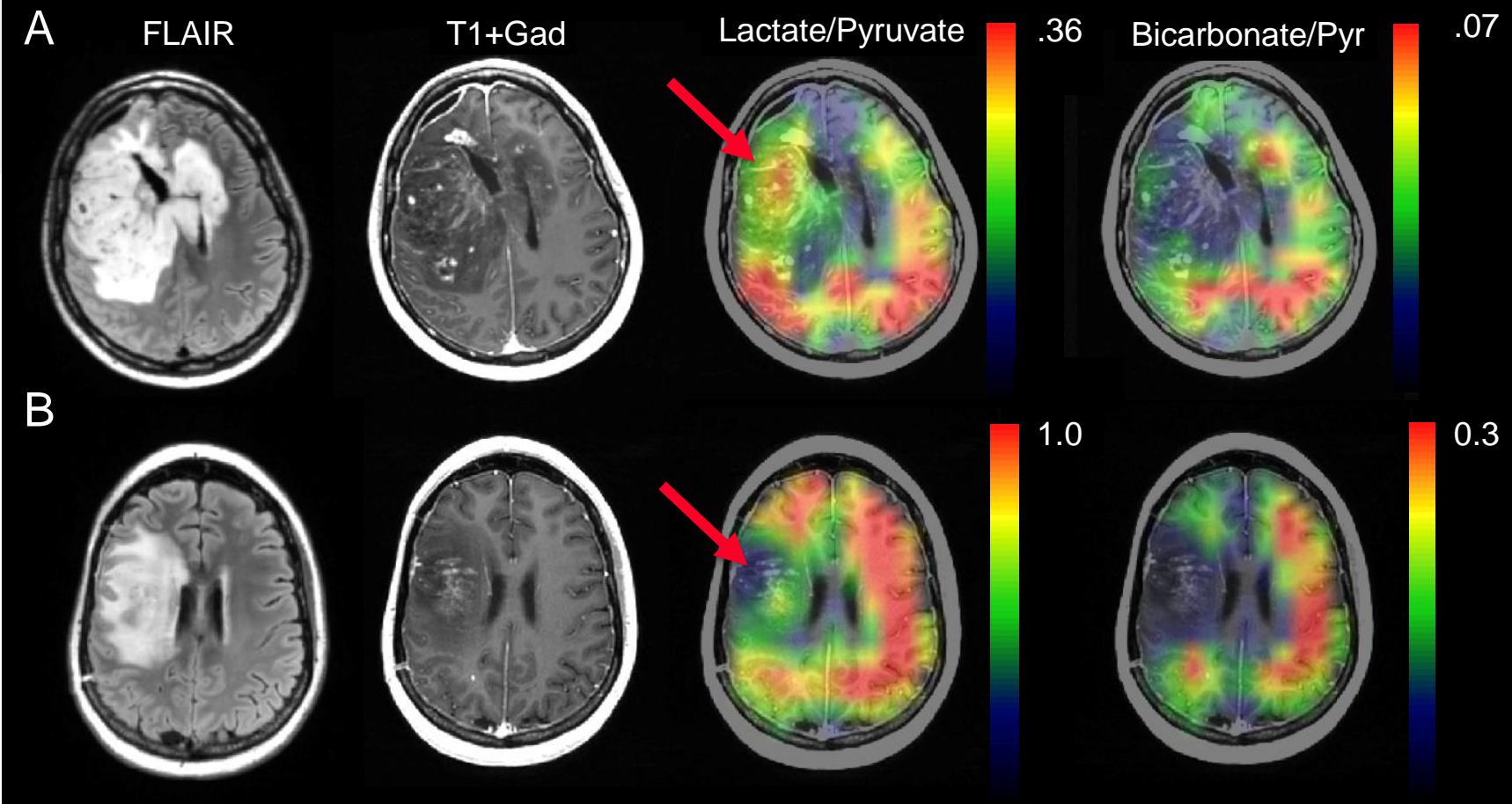
High conversion of Pyruvate to Lactate
& low conversion to Bicarbonate
indicate tumor metabolic
reprogramming

Patient **A** had
progressive tumor at the
time of this exam.

Patient **B** was not
characterizing as
progressing until later
follow-up scans.

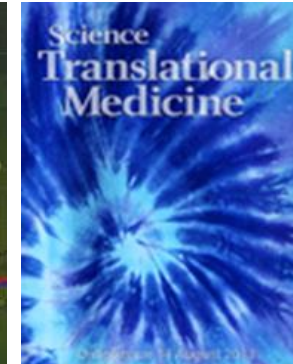
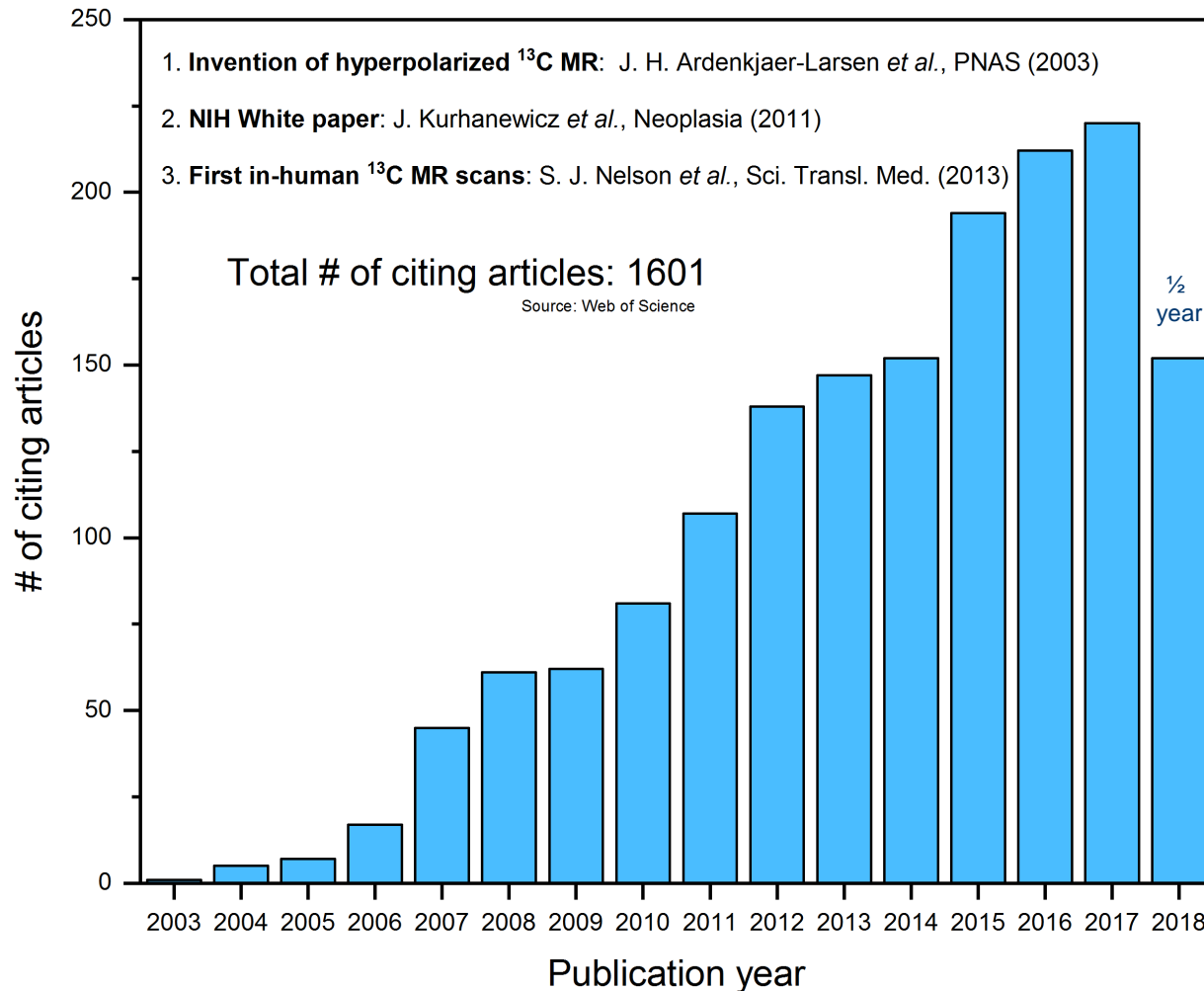


Anatomic & HP C-13 Metabolite Ratio Image Overlays



Accelerating HP MR research and publication

Number of publications



- >1,600 cited articles since 2003
- Two NIH/NCI white papers document the scientific consensus (2011, 2018)*
- Vibrant collaboration community



CAUTION: Sterile compounding equipment. Output of this equipment may only be used for human applications under an approved research study (IND or equivalent).

*Kurhanewicz *et al.*, Neoplasia Feb 2011;
Kurhanewicz *et al.*, Neoplasia 2018 - accepted.



New technology HP MR clinical potential

NIH/NCI White Paper – 2011

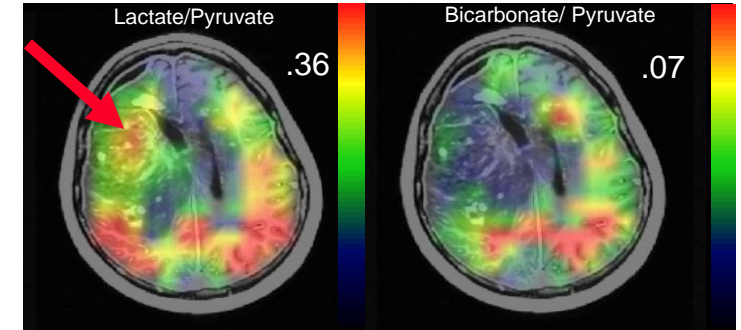
“Imaging of hyperpolarized nuclei provides significant new insights into previously inaccessible aspects of cancer biology”

NIH/NCI White Paper – 2018

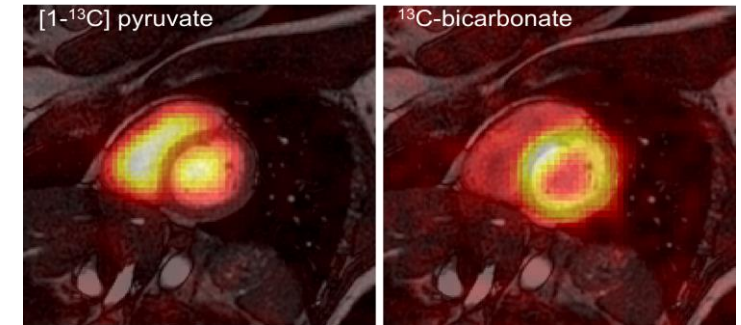
Helps researchers and clinicians:

1. Detect disease prior to clinical manifestation
2. Identify specific sites for tissue biopsy
3. Predict disease progression
4. With early pharmacodynamic measure of drug efficacy
5. Evaluate prognosis and indicate overall response

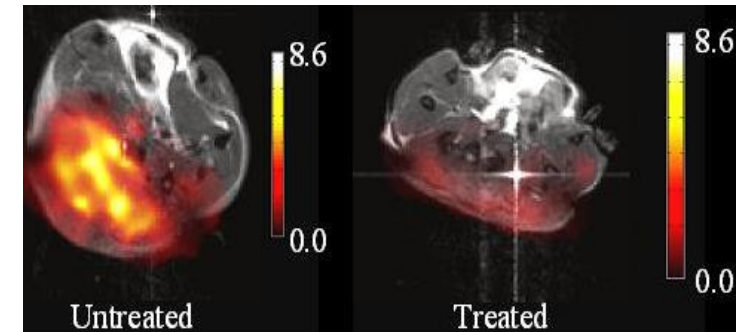
Oncology:
Pyruvate
metabolites²



Cardiology:
Cardiac
energetics³



Therapy
response:
Lactate
reduction⁴

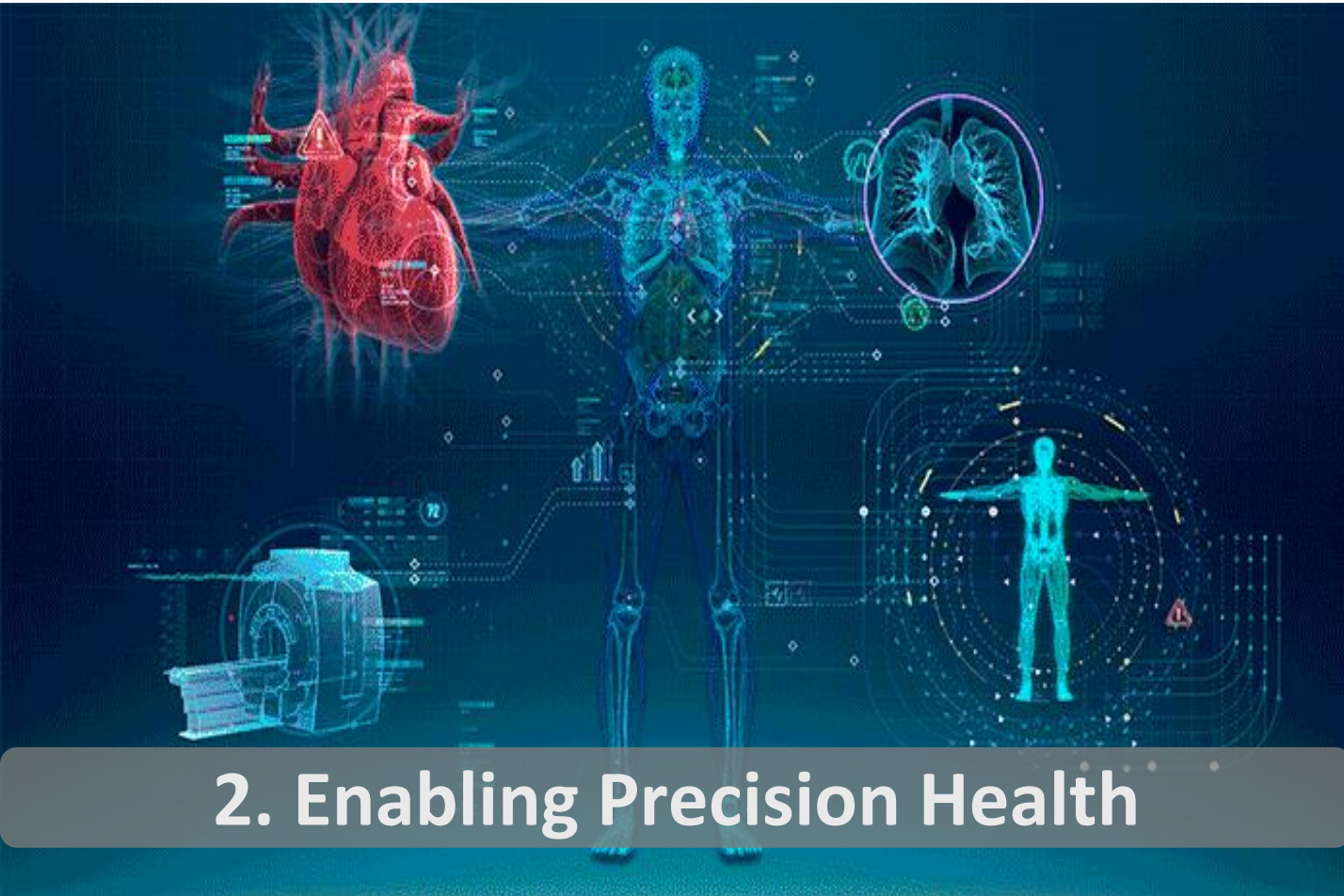


¹Kuranewicz et al., Neoplasia 2018 ²Kuranewicz et al., Neoplasia Feb 2011

³Sarah Nelson, Susan Chang, Ilwoo Park, Dan Vigneron - UCSF ⁴Cunningham et al., Circ. Res. 2016. Sunnybrook Research Institute ⁵Day SE, Nature Medicine 13: 1382–1387.

Detecting tumor response to treatment using hyperpolarized ¹³C

2. Enabling Precision Health



- **The promise of precision health**
 - Goal – right decision, quad aim
 - Clinical and operational
- **Establish full picture**
 - Patient Digital Twin / 360 view
 - In vivo + in vitro
 - Longitudinal
- **The data and analytic challenge**
 - 50PB...4%
 - “Mining” for the other useful
- **Leverage AI across the “chain”**
 - “*Upstream*” (pre/intra scan...protocol mgt, auto positioning, tailored scanning, dose, speed, DLR/IQ, fleet management)
 - “*Downstream*” (post scan...CDS)
 - “*Further downstream*” (360 CDS)

