

Diagnosis and Intervention for FASD: A Look Through the Crystal Ball



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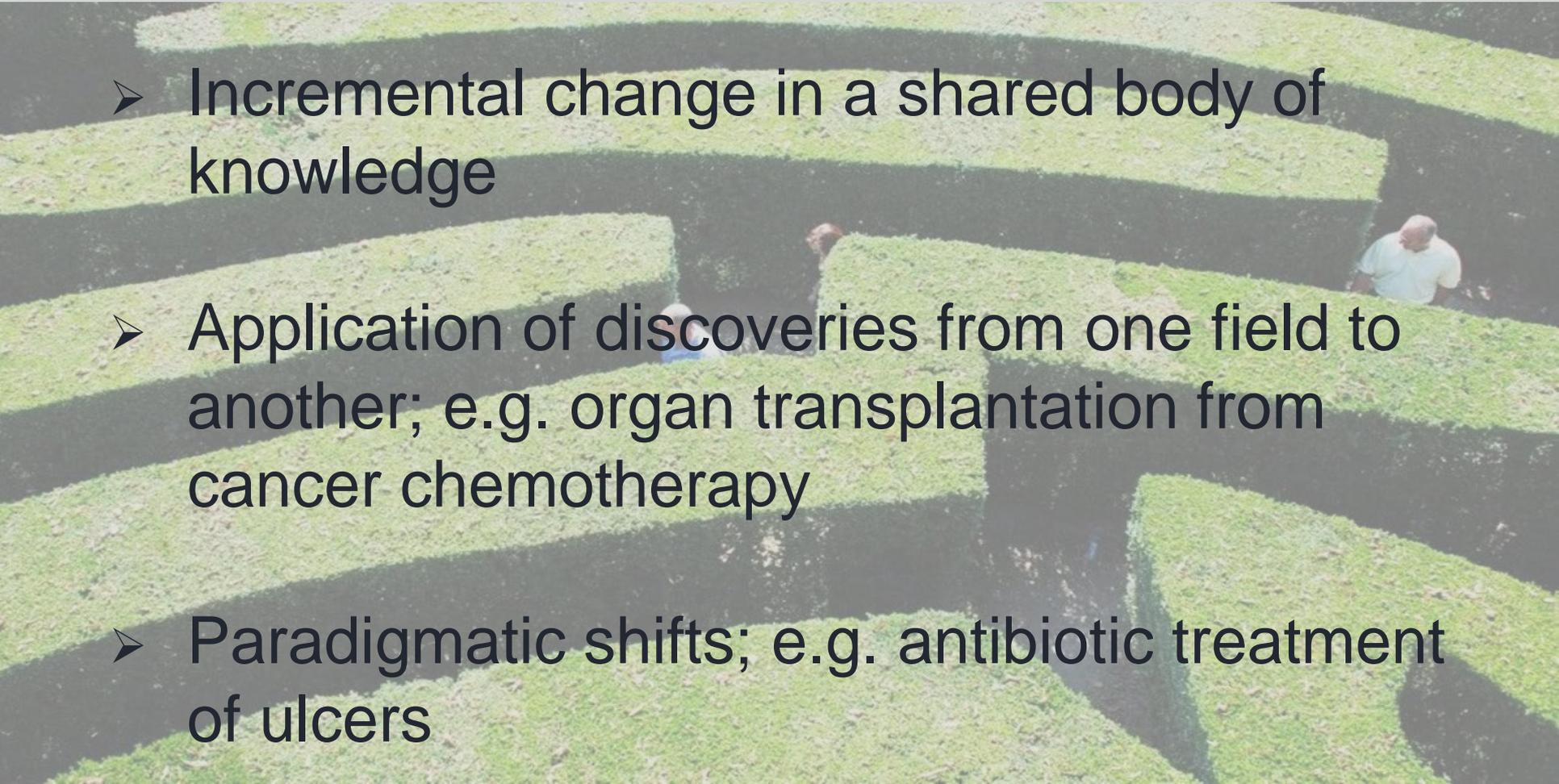
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I have no conflict of interest to report and no financial relationship with any commercial interest mentioned in this talk

The Path of Progress in Science and Medicine



The Path of Progress in Science and Medicine

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- Incremental change in a shared body of knowledge
 - Application of discoveries from one field to another; e.g. organ transplantation from cancer chemotherapy
 - Paradigmatic shifts; e.g. antibiotic treatment of ulcers

The Path of Progress in Research on FASD

- 
- Which research paths will lead to breakthroughs and which are dead ends?
 - Which discoveries in science and medicine will advance diagnosis and treatment of FASD?
 - Which of the current paradigms for diagnosis and treatment of FASD are impeding progress?

A Half Century of Progress in Science, Medicine, and Technology



1972



2019

A Half Century of Progress in Science, Medicine, and Technology

MRI Brain Imaging

Monoclonal antibodies

Electronic Health Record

Molecular Biology Revolution

PCR

Desktop Computers

Minimally Invasive Surgery

Functional Brain
Imaging

Electronic Calculators

Gene Editing

CT Brain Scan

Internet

Genome Sequencing

Promising Sources of New Knowledge



The logo for Adolescent Brain Cognitive Development (ABCD) features a horizontal sequence of four brain-related images. From left to right: a white silhouette of a human head in profile, a 3D brain model colored in shades of green and yellow, another white silhouette of a human head in profile, and a 3D brain model colored in shades of blue and purple. The entire sequence is enclosed in a thin white border with a green-to-blue gradient.

Adolescent Brain Cognitive Development[®]
Teen Brains. Today's Science. Brighter Future.



The CIFASD logo features a stylized illustration of a fetus in a womb, rendered in shades of purple and pink, set against a circular background. To the right of the illustration, the text "CIFASD" is written in a large, white, sans-serif font, followed by a vertical line and the text "Collaborative Initiative on Fetal Alcohol Spectrum Disorders" in a smaller, white, sans-serif font.

CIFASD | Collaborative Initiative on
Fetal Alcohol Spectrum Disorders



Human **Connectome** Project

Million Veteran Program (MVP)



- **Bioinformatics**
- **Augmented Intelligence**
- **Artificial Intelligence**

Gene Editing

- CRISPR/Cas9 already allows precise gene editing
- What genes could be edited to impact FASD



Technology

- Devices will get smaller, faster, smarter
- They will be worthless if we don't apply them to the right problem in the right way

20 years later and all these things fit in your pocket



Global Challenge of

FASD

- Diagnosis and treatment are unavailable for most affected individuals:
 - ✧ Insufficient numbers of clinicians
 - ✧ Geographic inaccessibility
 - ✧ Stigma
- We can't even agree on how to diagnose FASD





The Path Forward for FASD

To move forward, we must agree on where we are going and speak a common language

We need a consensus on diagnosis for FASD

The Tower of Babel,
Peter Bruegel the Elder,
1562

We need a consensus on diagnosis for FASD

NIAAA endorses this goal and will
support its accomplishment



Thoughts and challenges on diagnosis: Where are we going and why

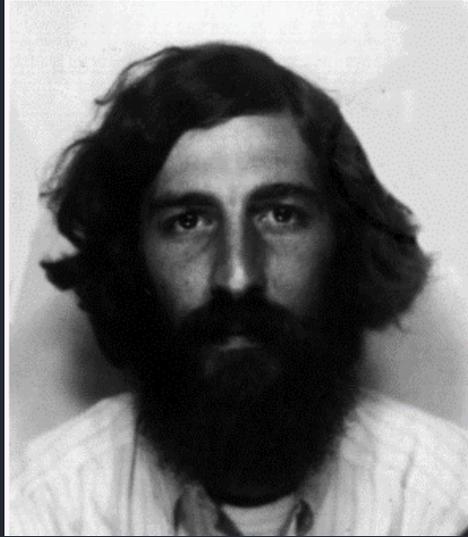
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Things do change



Circa 1975



2018

Diagnostic Guidelines

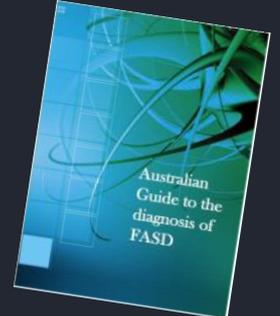
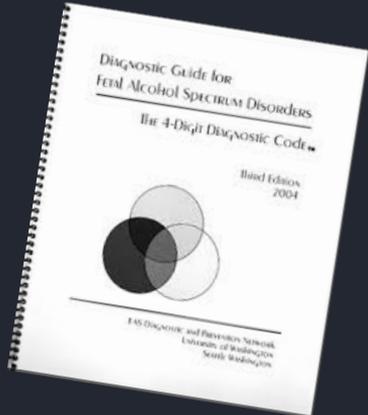
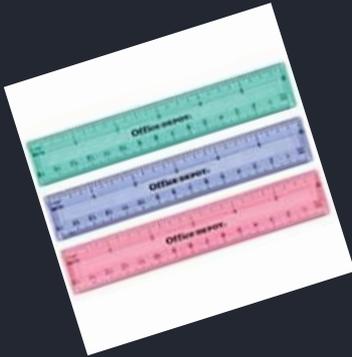
- “A more consistent set of diagnostic procedures and practice guidelines is of utmost importance.”
 - National Institutes of Health Consensus Development Conference Statement on ADHD, 1998
- “one of the primary problems is *inconsistent diagnosing*, which I agree represents a real, ongoing concern across the spectrum of mental disorders.”
 - Grohol, 2018, Psych Central

What do we know?



- There is a large disconnect between the number of diagnostic providers and the number of impacted individuals.
- Lack of a consensus diagnostic schema or classification
 - Revised IOM, Old Canadian guidelines, New Canadian guidelines, Australian guidelines, 4-digit code, etc
- Many health service providers are reluctant to make a diagnosis
 - Lack of confidence, stigma
 - Many physicians have stated that they have seen cases of FAS or FASD and did not make a diagnosis

What do we have



Where are we going?

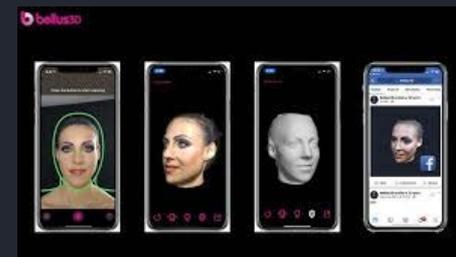
Photographic analysis and telemedicine

- Currently we have a few examples of the use of photographs to assist in diagnosis
 - 2d Imaging
 - Photographic screening tool of the 4 digit code
 - Face2Gene
 - 3d Imaging
 - CIFASD
 - Australian Group
 - South African Group
 - Polish Group
 - Telemedicine
- Photographic screening may be useful in detecting individuals with only subtle facial features, but who do have cognitive or behavioral problems
- Telemedicine may be able to deal with geographical isolation



Where are we going?

Evolution in the technology



FaceScreen Application

- In depth assessment of facial dysmorphology
- Report generation

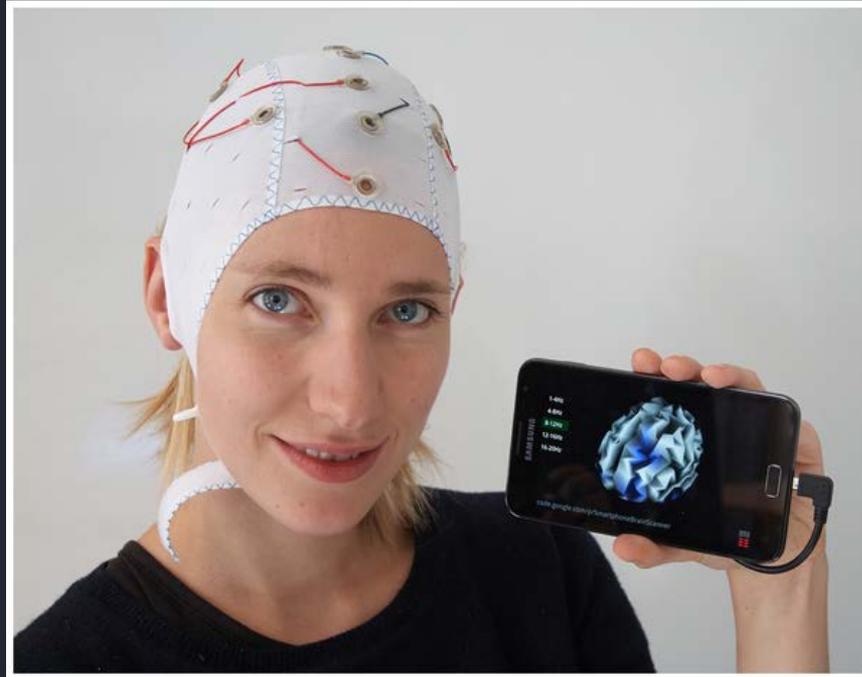


FaceScreen Upload Portal

- No user interaction
- 3D Image upload -> FASD report



Where are we going? Brain Imaging



Stopczynski A, Stahlhut C, Larsen JE, Petersen MK, Hansen LK The Smartphone Brain Scanner: A Portable Real-Time Neuroimaging System. PLOS ONE 9(2): e86733. <https://doi.org/10.1371/journal.pone.0086733>
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0086733>

Figure 4. Snapshot of the SBS2 real time brain imaging system running on a Samsung Galaxy Note 2.

Where are we going?

Ehealth technologies

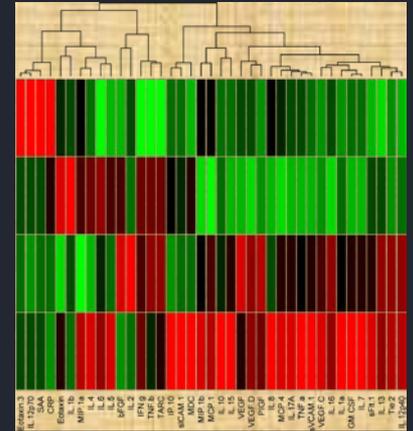


- NEBA is the first of a new kind of medical device cleared by FDA that uses brainwaves (EEG) to help clinicians more accurately diagnosis ADHD in children and adolescents (ages 6 – 17.99 years).

Where are we going?

Biomarkers

- Need evidence of exposure
 - Several proposed biomarkers in the affected individual
 - miRNA
 - Immunological markers
 - Epigenetic markers
 - Metabolomics
 - Proteomics
 - Alcohol metabolites in dried blood spots



But is it possible?

- The number of applications for molecular-based blood tests has risen dramatically.
- A \$20 billion market in 2017, projected to be \$25 billion in 2022
- Devices that can download results directly to an electronic medical record are more common
- Tests that use analytes other than blood—saliva, urine, or even breath
- Looking for the startrek body scanner
 - Xprimo by Beigene 10 million \$ prize



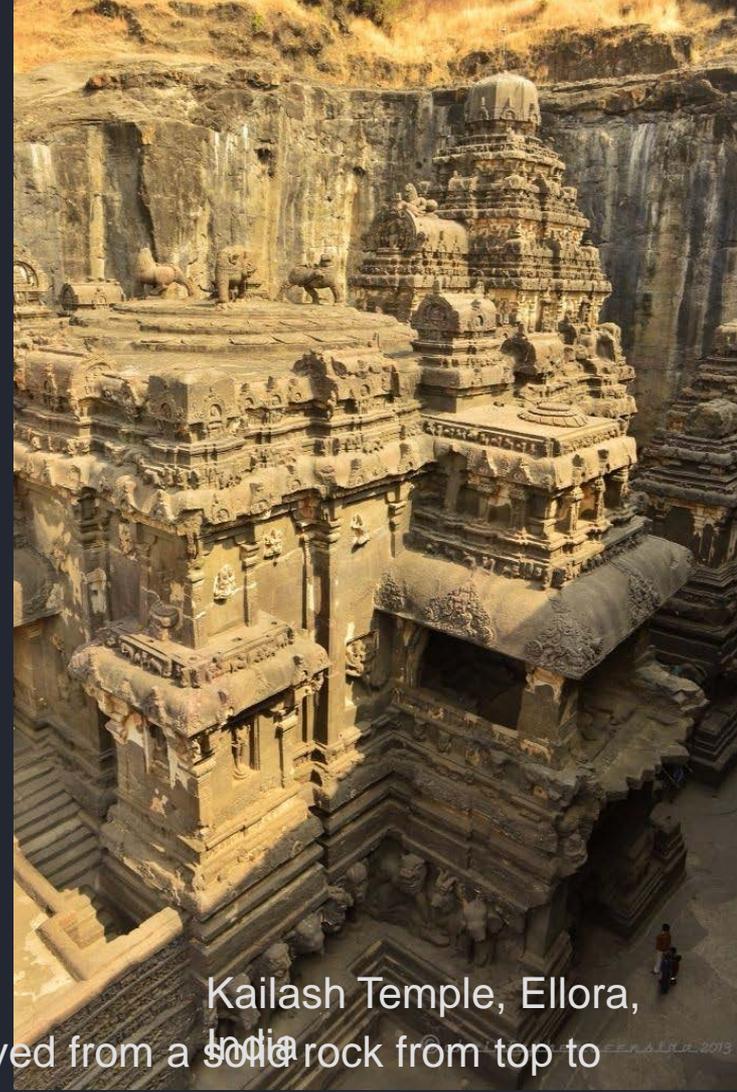
Ethical issues

- Consent
- Privacy



THANK YOU

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Kailash Temple, Ellora,
India
Carved from a solid rock from top to bottom