

# New Haven & Neurosciences

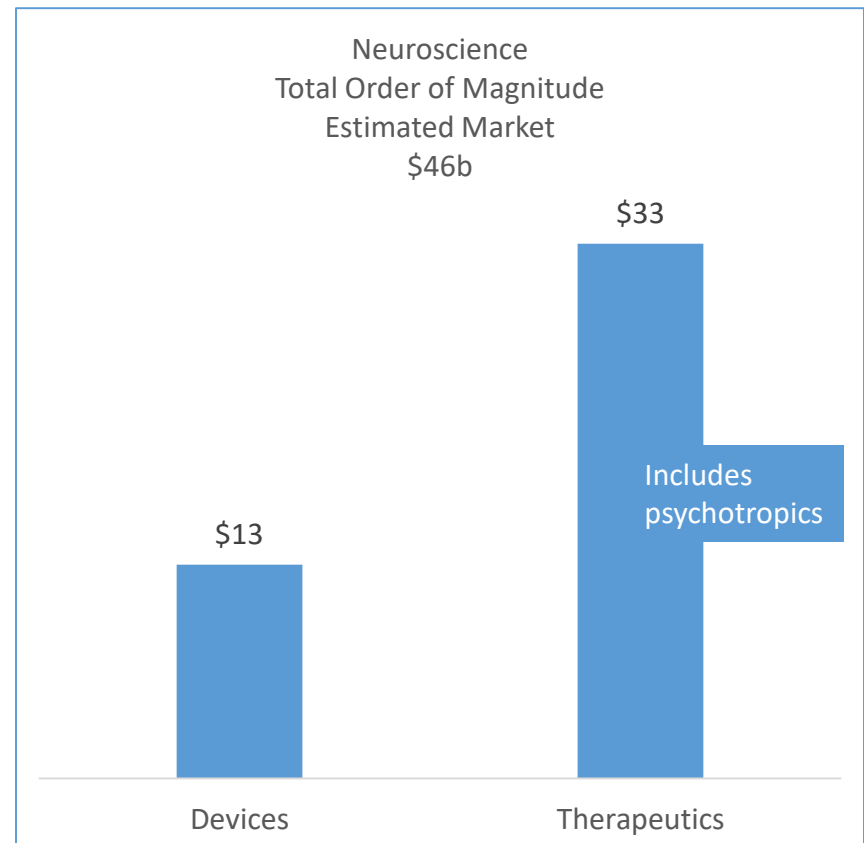
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# Observations

- Neuroscience is a huge field with a variety of definitions and segments depending on who you ask.
  - New Haven presently participates in some selected markets of neuroscience through the clinical enterprise, research, and biopharma
- Yale is a major player in neurosciences and the implementation of its science strategy will likely be a determining factor in expanding commercial neuro-based opportunities.
  - For perspective Yale's NIH prime awards in 2018 was larger than the total for 37 states
- The YNHH Neuroscience Campus is important because it provides state of the art space and concentrates parts of the neuroclinical base in a single location.
  - However, 2 issues to consider
    - Adequacy of office space for clinical faculty (which may have been addressed since the interviews)
    - On-site expansion capability

# Neuroscience market overview

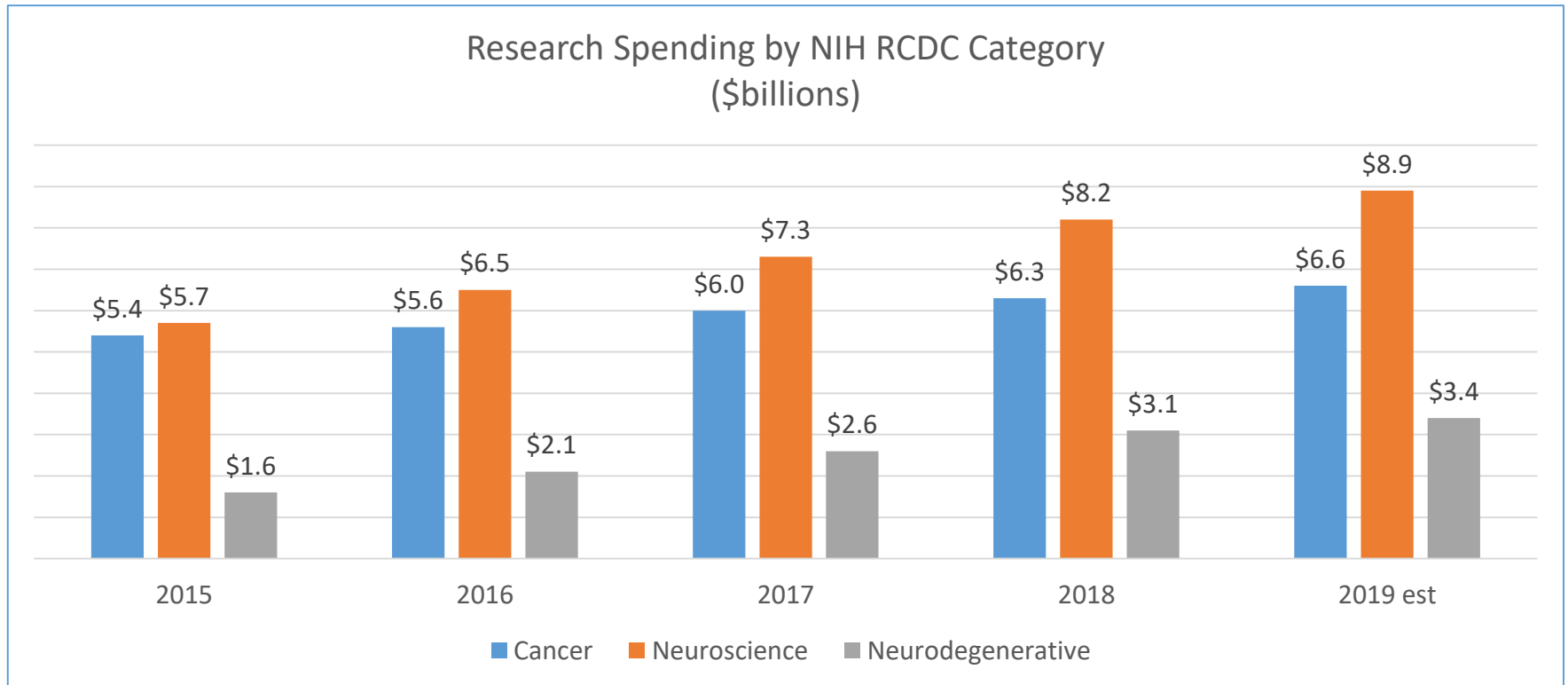
- Increase from 44m to 84m people in US will have some form of neurological disorder by 2050
- Leading cause of disability
- US impact - \$789b in 2014 dollars (annals of neurology 2017)
- Because of demographics Europe expected to also have similar impacts (WHO Global Burden of Neurological Disorders)



Source: composite of several different market research studies

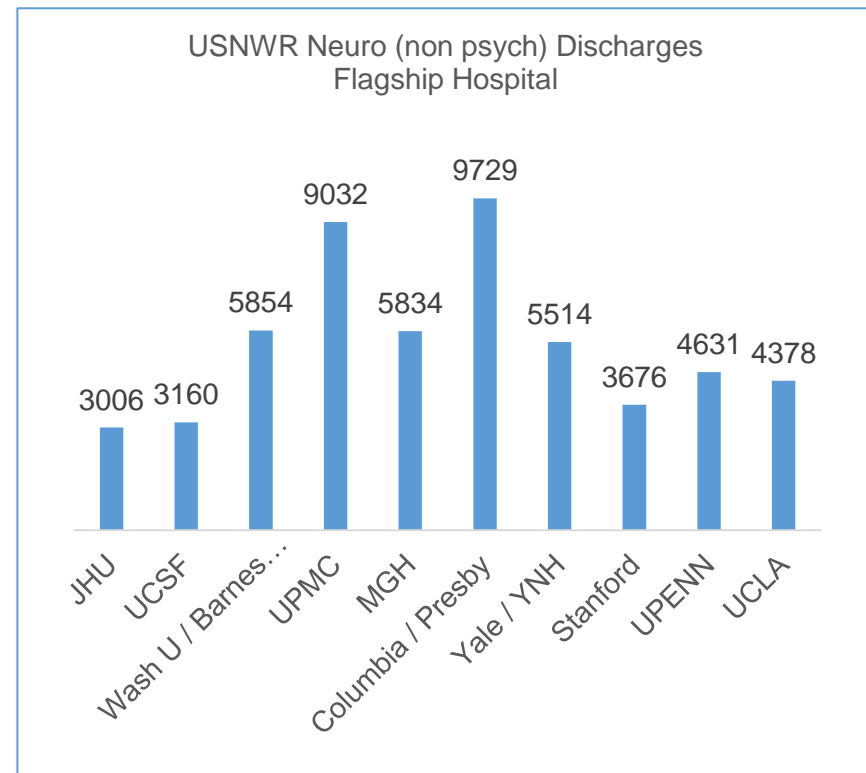
# Neuro now larger than cancer for NIH spending

- Neuro represents 26% of total NIH spending
- 56% increase since 2015



# New Haven has national scale activity in neuro research and clinical volumes

Institution	NIH PRIME AWARDS Total YR 16 to 18	Growth Rate YR 16-18
JOHNS HOPKINS UNIVERSITY	\$ 535,063,112	1.14
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO	\$ 468,313,795	1.40
WASHINGTON UNIVERSITY	\$ 465,566,672	1.41
UNIVERSITY OF PITTSBURGH AT PITTSBURGH	\$ 449,828,280	1.23
MASSACHUSETTS GENERAL HOSPITAL	\$ 436,559,868	1.37
COLUMBIA UNIVERSITY HEALTH SCIENCES	\$ 424,993,155	1.21
<b>YALE UNIVERSITY</b>	<b>\$ 405,070,844</b>	<b>1.17</b>
STANFORD UNIVERSITY	\$ 395,953,411	1.43
UNIVERSITY OF PENNSYLVANIA	\$ 389,884,162	1.12
UNIVERSITY OF CALIFORNIA LOS ANGELES	\$ 359,344,066	1.23



National Funding Growth Rate = 1.27

# In key sub fields of neuro research Yale is a major player

Institution	NIH Mental Health 2018
YALE UNIVERSITY	\$ 80,046,786
UNIVERSITY OF PITTSBURGH AT PITTSBURGH	\$ 78,241,173
UNIVERSITY OF CALIFORNIA LOS ANGELES	\$ 71,700,848
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO	\$ 69,084,615
UNIVERSITY OF CALIFORNIA, SAN DIEGO	\$ 68,467,683
ICAHN SCHOOL OF MEDICINE AT MOUNT SINAI	\$ 66,019,272
JOHNS HOPKINS UNIVERSITY	\$ 62,921,809
STANFORD UNIVERSITY	\$ 62,002,683
UNIV OF NORTH CAROLINA CHAPEL HILL	\$ 60,804,054
UNIVERSITY OF WASHINGTON	\$ 54,664,630

Institution	NIH Degenerative 2018
WASHINGTON UNIVERSITY	\$ 110,425,033
JOHNS HOPKINS UNIVERSITY	\$ 84,279,057
COLUMBIA UNIVERSITY HEALTH SCIENCES	\$ 82,709,266
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO	\$ 82,582,165
UNIVERSITY OF SOUTHERN CALIFORNIA	\$ 80,189,066
MASSACHUSETTS GENERAL HOSPITAL	\$ 73,355,844
UNIVERSITY OF PITTSBURGH AT PITTSBURGH	\$ 59,776,397
UNIVERSITY OF CALIFORNIA, SAN DIEGO	\$ 54,449,012
UNIVERSITY OF PENNSYLVANIA	\$ 53,882,371
UNIVERSITY OF CALIFORNIA-IRVINE	\$ 50,090,134
UNIVERSITY OF WISCONSIN-MADISON	\$ 48,410,899
NORTHWESTERN UNIVERSITY AT CHICAGO	\$ 46,692,703
UNIVERSITY OF MICHIGAN AT ANN ARBOR	\$ 44,893,229
STANFORD UNIVERSITY	\$ 44,051,195
EMORY UNIVERSITY	\$ 41,834,804
UNIVERSITY OF WASHINGTON	\$ 40,984,566
NEW YORK UNIVERSITY SCHOOL OF MEDICINE	\$ 38,199,258
ICAHN SCHOOL OF MEDICINE AT MOUNT SINAI	\$ 37,879,342
UNIVERSITY OF ALABAMA AT BIRMINGHAM	\$ 36,837,017
YALE UNIVERSITY	\$ 36,452,393

Note: Prime awards



# New Haven is CT's play in neurosciences

- 85% of state NIH neuroscience research
- As of 2017 – all of the graduate degree recipients in neurosciences
- Only nationally ranked Neurology and Neurosurgery clinical program
  - 30% larger clinical volumes than next largest hospital
- Virtually all the life science companies with development programs in neurosciences are in the New Haven suburbs / metro
  - Pfizer's 2018 elimination of its neuro program in Groton makes New Haven the leader

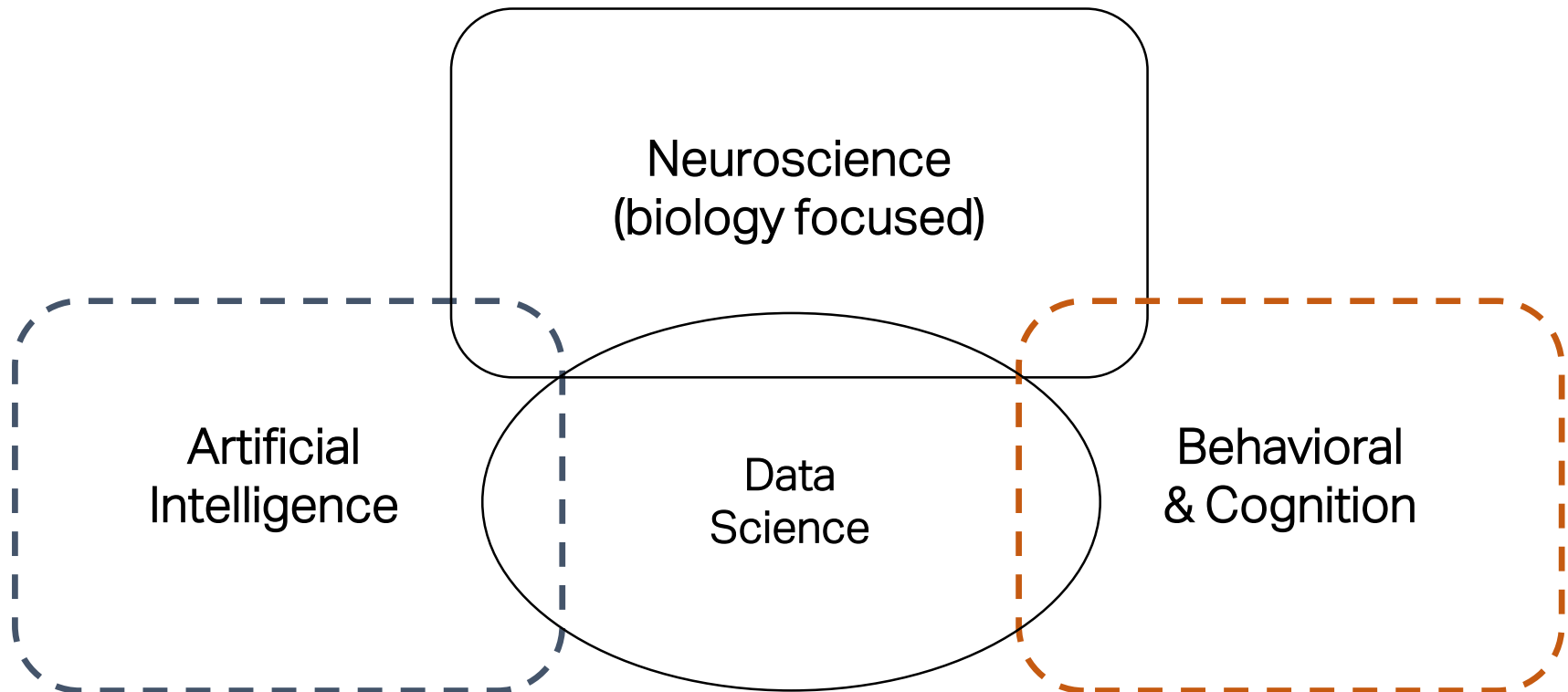


# Neuroscience Strategic Direction for New Haven

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# Neuroscience has several related adjacent fields



- Market estimate \$16b to \$191b by '25
- For New Haven – this is opportunistic

- Previously discussed

- Consumer neuro
- Wellness / behavior change
- Learning / training
- Broad-based CT opportunity where New Haven

# Behavior / Cognition

Consumer neuro



**MOVE TO IMPROVE WORKPLACE SAFETY**  
GLOBAL CHALLENGE HAS HELPED 200+ ORGANISATIONS IMPROVE THEIR EMPLOYEES' WELLBEING

**0.48** BMI REDUCTION AVERAGE  
**64%** LOST WEIGHT IN THE OVERWEIGHT & OBESSE CATEGORY  
**3.3** KG LOST ON AVERAGE



Source: 2018 Pulse Health Challenge Final Report



**TRAVELERS** JOIN OUR TALENT COMMUNITY

## 2VP, Behavioral Science / Behavioral Insights

**Job ID:** 21432BR  
**Job Category:** Claim  
**Location:** Hartford, CT  
**Posted Date:** January 4, 2020

[Apply](#)



- 20 neuroscientists
- 16 research labs
- Largest holder of “brain reading patents” with over 100 (source: SharpBrain)



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Designed in collaboration with Apple.

# Neuroscience - biology

*Overly simplified illustration*

## Neuro degenerative

- Example:
- Alzheimer's
  - Parkinson's
  - ALS

## Neuro muscular

- Example:
- Muscular Dystrophy
  - ALS

## Neuro developmental

- Example:
- Down's Syndrome
  - Fragile X
  - Intellectual Disabilities

## Neuro conditions

- Example:
- Multiple Sclerosis
  - Epilepsy

## Psychiatry

- Example:
- Schizophrenia
  - BiPolar disorders

## Neurotrauma

- Example:
- Stroke
  - TBI
  - SCI

## NeuroOncology

- Example:
- Glioblastoma

"Markets"

Biomarkers & therapeutics e.g., monoclonal antibodies

Neurotech e.g., Imaging, diagnostics, implantable devices, brain machine interface,

Small Molecule Pharmaceuticals e.g., pill form

Cell and Gene Therapy

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# New Haven area neuro asset base

## Research

- Yale Neuroscience Institute
- Yale Center for Customer Insights
- John B Pierce Labs (affiliated with Yale)
- Haskins Laboratory (affiliated with Yale)
- Institute Neurodegenerative Diseases
- SCSU

## Clinical

- Yale New Haven
- Connecticut Mental Health Center
  - Research unit

## Local Networks

- Cognitive NeuroScience Meetup Group (15 members)
- Yale Causality and Inference Reasoning Working Group (36 members)

## Companies

- Alexion (neuro team in Boston)
- Arvinas
- Alva Health
- ReNetX
- Bioxcel Therapeutics
- Trevi Therapeutics
- BioHaven Pharmaceuticals
- Aria Therapeutics (Hamden)
- BioAsis (Guilford)
- IsoPlexis (Branford)
- Recombinant (Cheshire)
- VistaraBio (Woodbridge)

## Research & Technology Examples

- Blood brain barrier delivery mechanism
- Protein degradation
- Flavor perception and neural coding
- Neuron regeneration
- Data neuroscience

# Asset base is proximate to the Med School



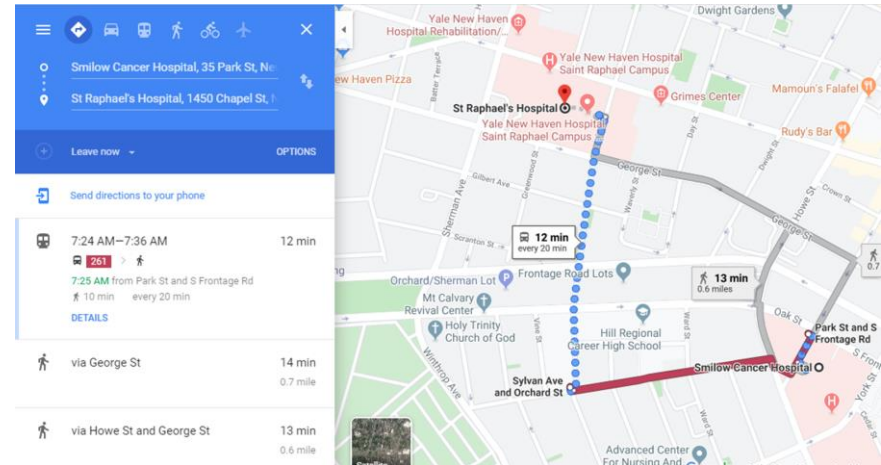
Yale noted during its Science Strategy process that its research capabilities in this field were scattered across the campus. While the assets appear scattered, companies have flocked to where there is space and with few exceptions remain within proximity to key research assets.

During interviews one of the key points identified was as Yale looks to consolidate and co-locate research teams, the clinical enterprise is becoming physically separated from the research enterprise creating potential translational challenges as well as reducing the tendency for staff "collisions".

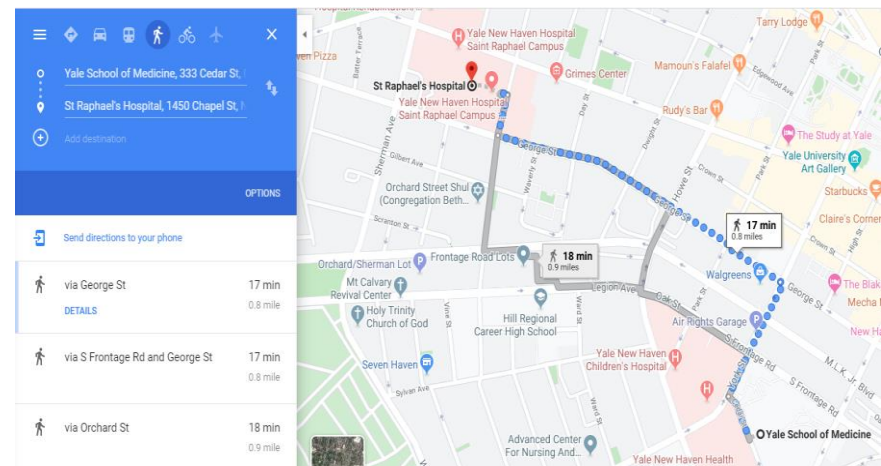
At the new neuro campus, while there may be some "white box" clinical translational lab space, at the time of the interviews there was no faculty office space due to space constraints.

Given the current size of the neuro program and the expected growth in demand for services as well as research, campus expandability is also consideration.

# While the core of the medical district is close to the Neurocampus walkability is an issue



- It is just at the edge of “too far” from key locations
- Quality of the walk is mixed
- Transit except for Yale shuttles is not a viable option based on frequencies





# Strategic drivers for neuro in New Haven

## YNHS Neuro Campus

- Provides state of the art clinical care facilities – does not include psychiatric care and limited clinical lab space
- Most of the economic impact is concentrated in the construction of the facility

## Yale Science Strategy

- Creation of Yale Neuroscience Institute that aligns neuro-related faculty and facilities to support interdisciplinary research
- Creation of dedicated space to house 35-40 research teams
- Additional investment in new areas including disease modeling and AI/machine learning
- Focus on inflammation science and immunobiology (core strength) including co-location of research teams
- Key variable – further investment in engineering and applied sciences

## Life Sciences Company Neuro Hit

- Development of an approved neurotherapeutic in New Haven would add further depth to the talent ranks particularly in key areas such as clinical development, quality, marketing and related fields critical to scaling businesses. It would also raise attention to the research and development activity in New Haven, attracting more venture capital “looks”.



Additional clinical growth  
New clinical management tools



New commercial  
opportunities &  
research partnership  
interest



Capital & talent  
attraction

# Strategy concepts

Build lab space to support new companies & pipeline development of new companies

- Appropriate types of lab space and clinical development space is critical for this industry

Leverage 34 corridor to increase connectivity of NeuroCampus to Med District

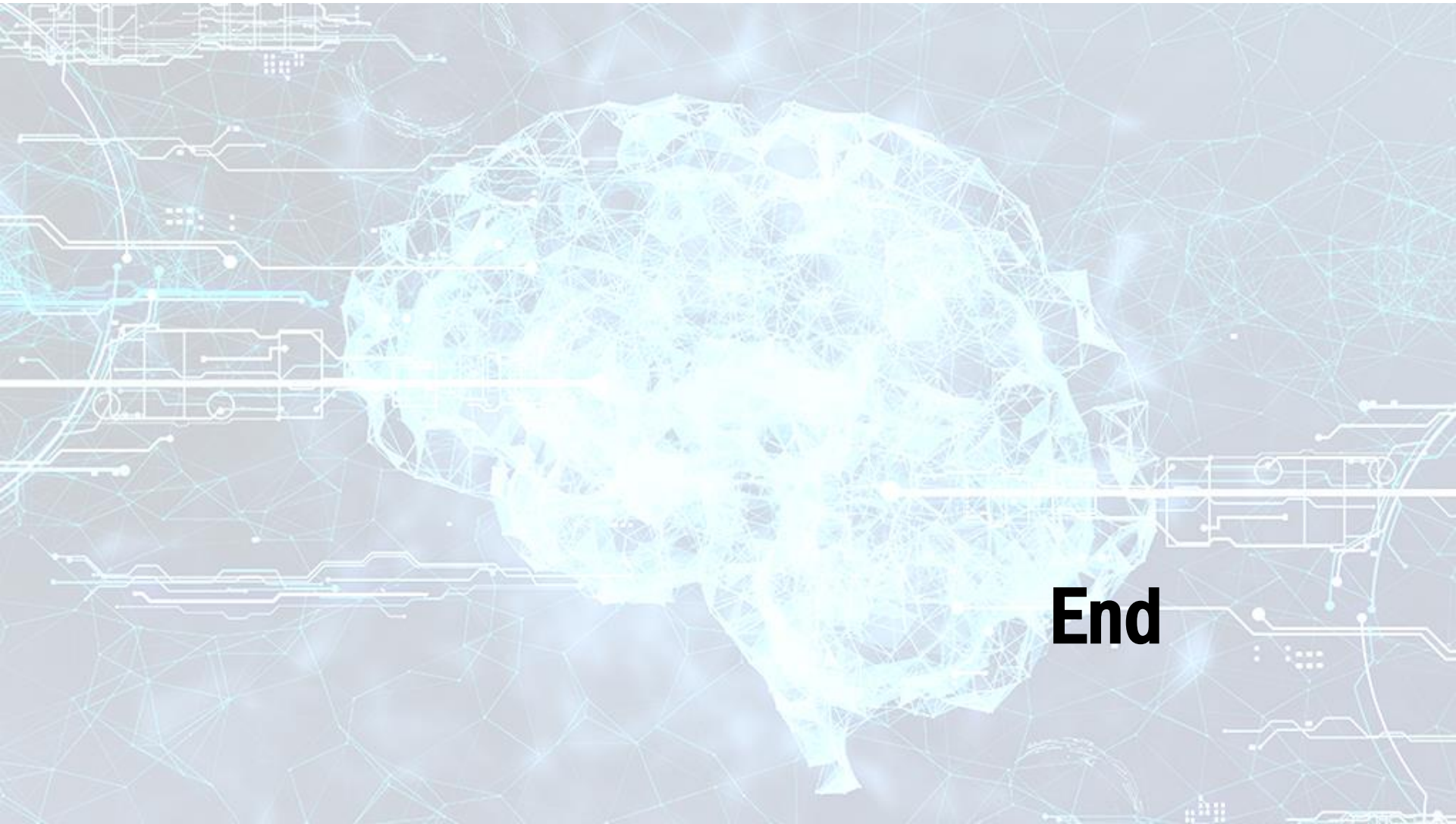
- Reconsider prior planning for 34 corridor to support a "neuro district" to accommodate expansion
- Over time link Campus through to Union Station to facilitate talent movement

Consider market positioning moves to place New Haven as a location for Brain and Neuroscience

- Aimed at both companies and talent
- "Brain Week" to highlight neurosciences and related fields
- "Neuro Hub" in 101 for brain-related companies and start ups
- Potential option of linking NHPS with call for new learning tools

Work with state & Yale (including SOM) to more broadly disseminate its knowledge-base into key parts of the economy

- State's presence in consumer package goods, health insurance, food, care delivery are all potential beneficiaries
  - Next stage in personalized medicine (I-Medicine)
  - Consumer marketing



**End**