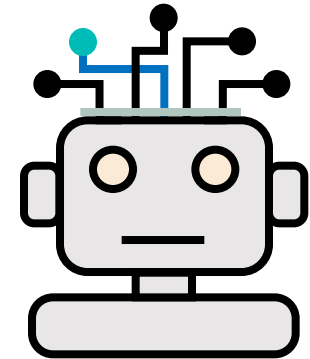
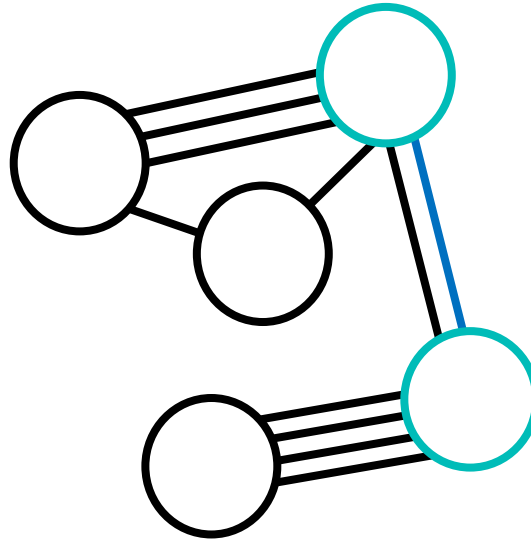
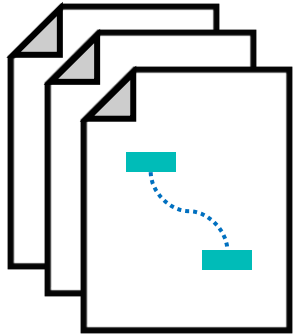


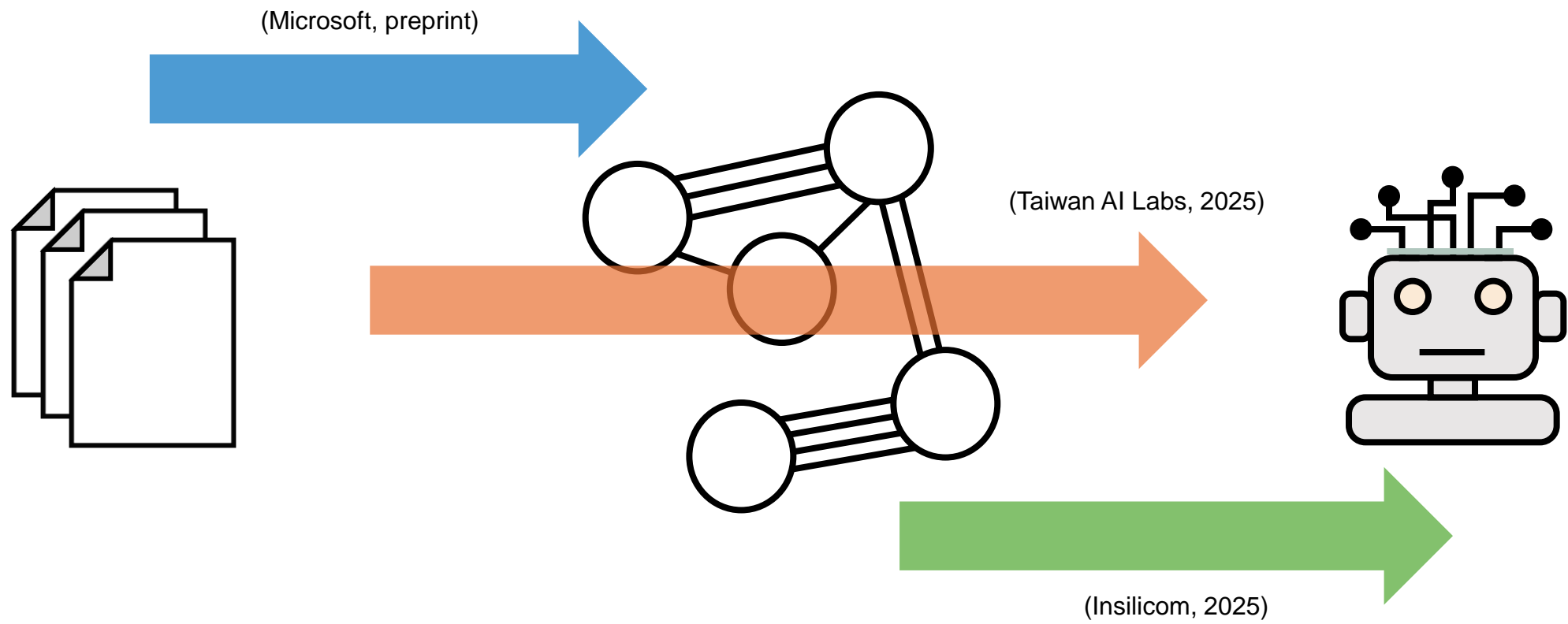
# Knowledge Graph and LLM: Recent Methodologies and Applications

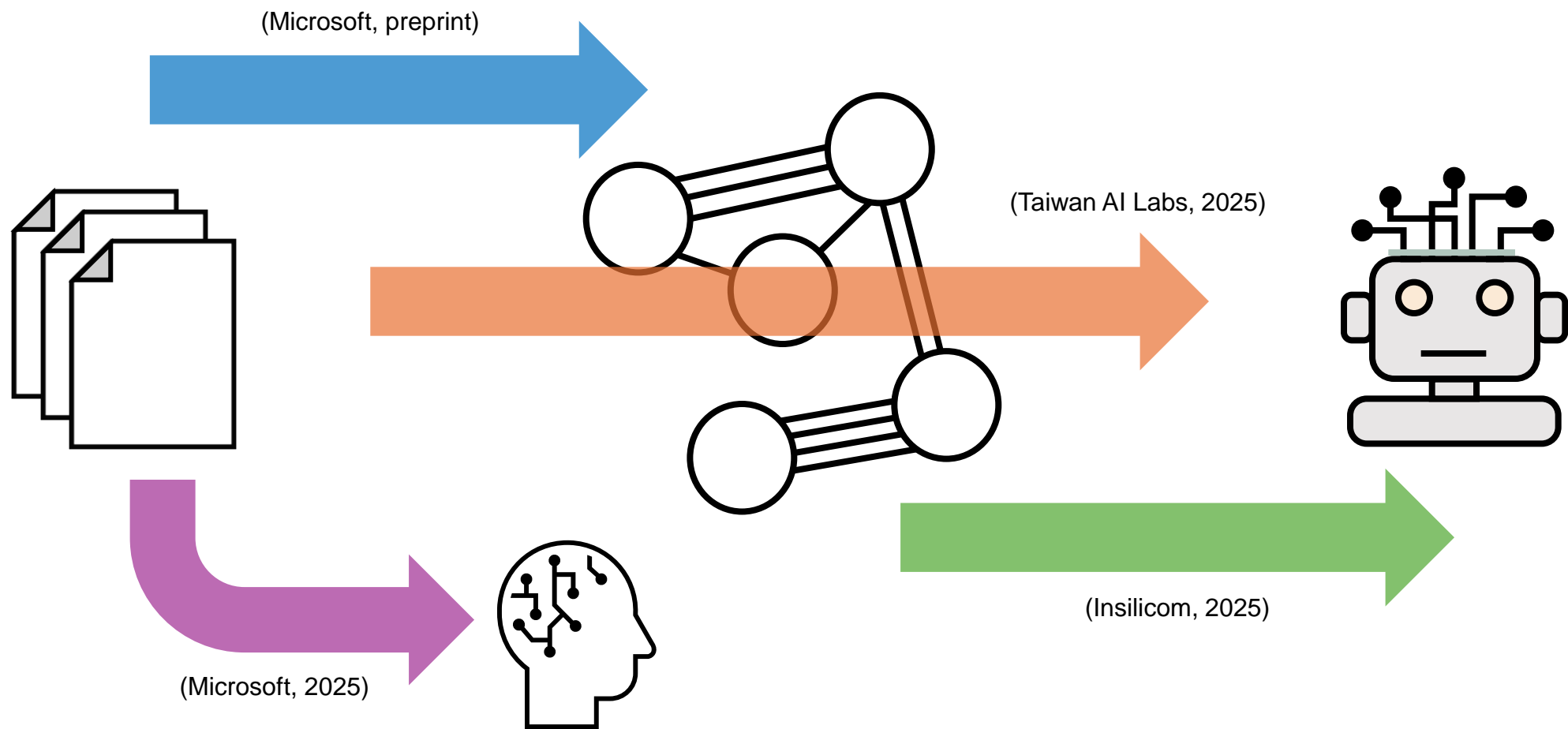
2025-04-22

Li Peng-Hsuan 李朋軒

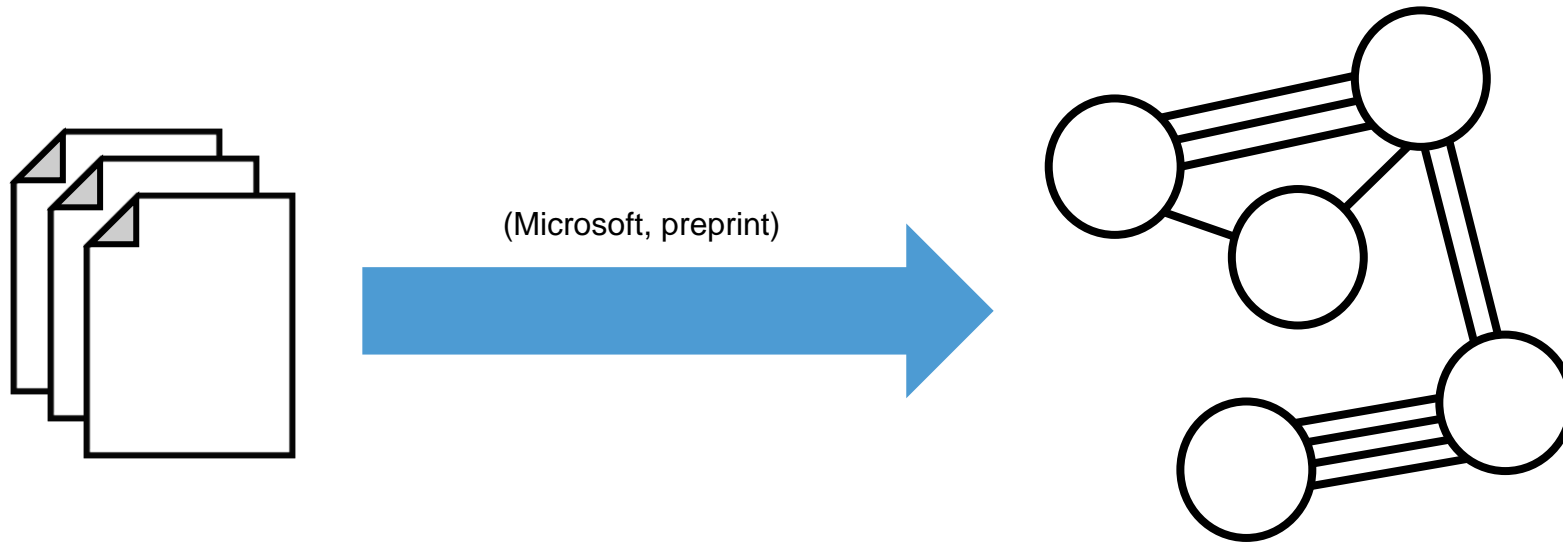
Documents ----- Knowledge Graph ----- Application



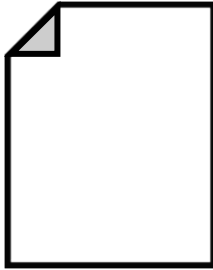




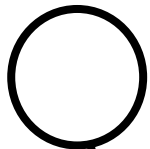
# GraphRAG



# GraphRAG

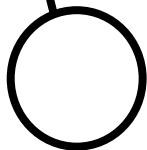


NeoChip's (NC) shares surged in their first week of trading on the NewTech Exchange. However, market analysts caution that the chipmaker's public debut may not reflect trends for other technology IPOs. NeoChip, previously a private entity, was acquired by Quantum Systems in 2016. The innovative semiconductor firm specializes in low-power processors for wearables and IoT devices.



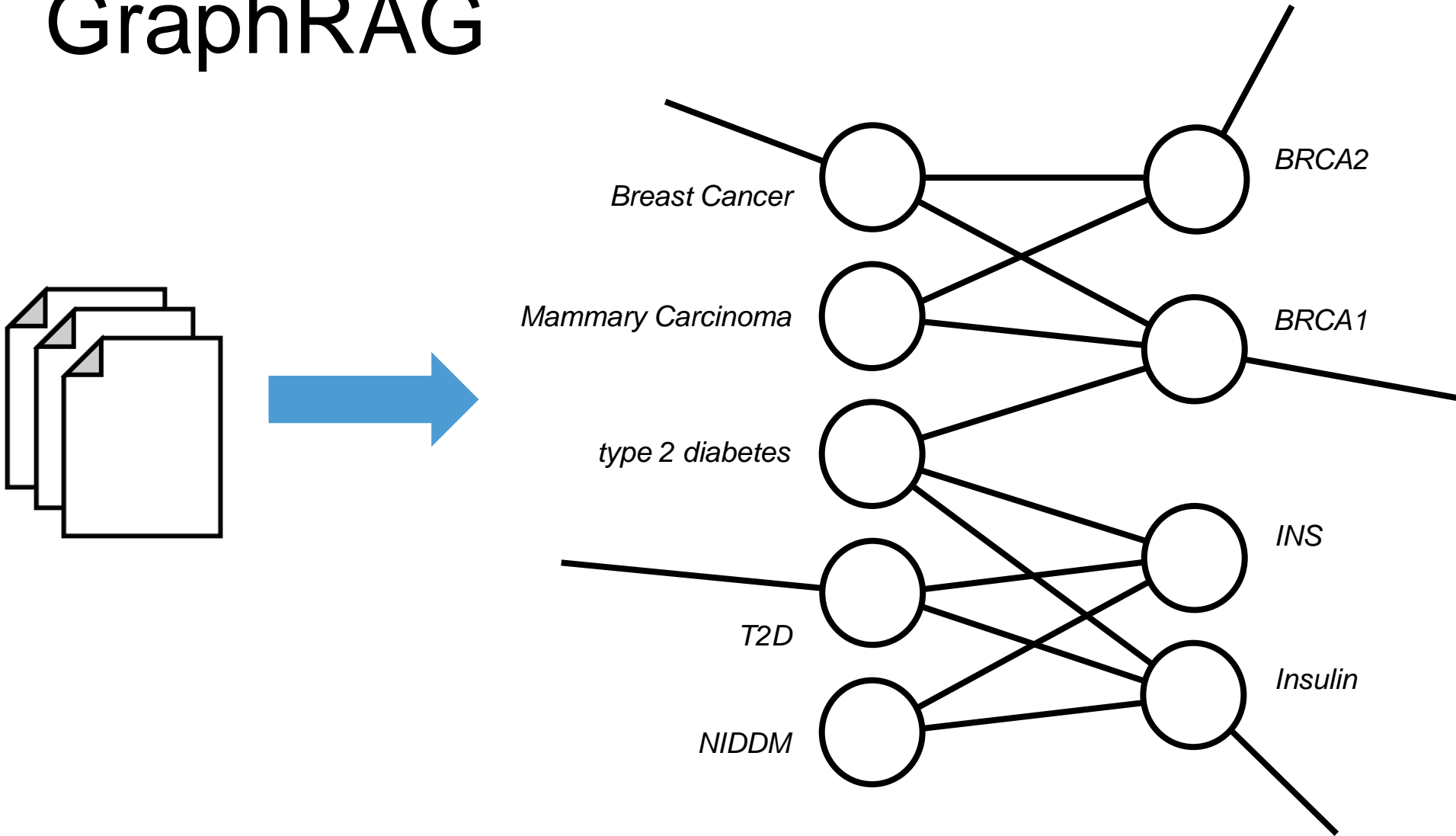
*NeoChip* is a publicly traded company specializing in low-power processors for wearables and IoT devices.

*Quantum Systems* owned *NeoChip* from 2016 until NeoChip became publicly traded.

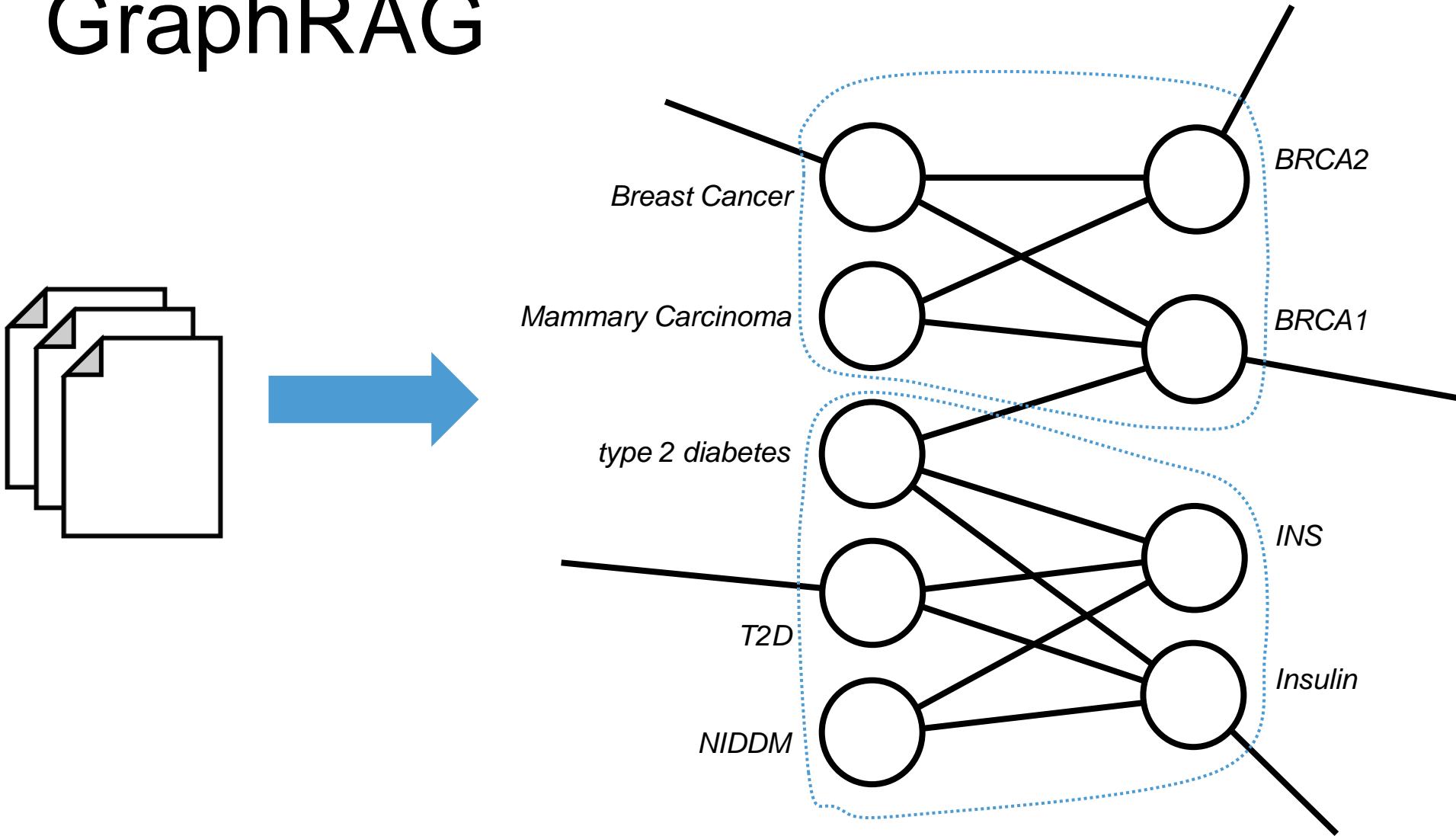


*Quantum Systems* is a firm that previously owned NeoChip.

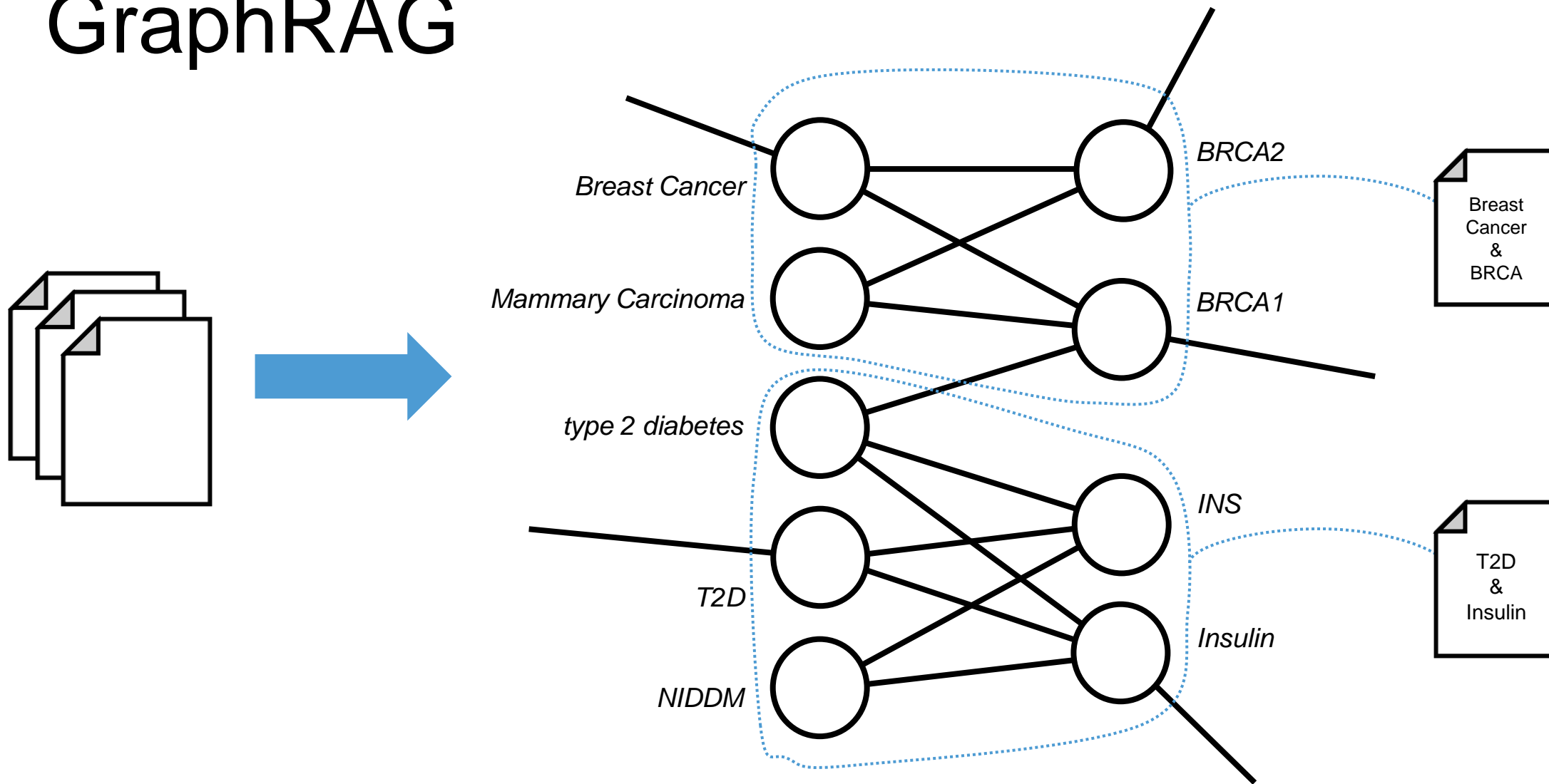
# GraphRAG



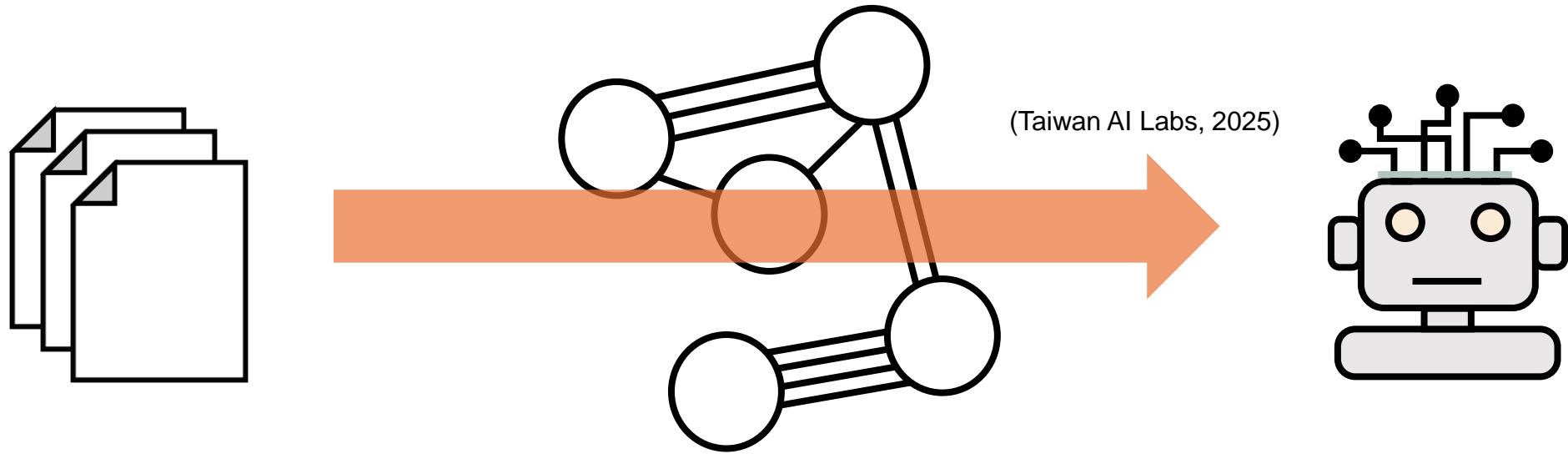
# GraphRAG



# GraphRAG



# LORE



# LORE

Article:

[title] Martin Likes Fish

[text] Martin is an Irish man. He loves sports. Martin also loves eating fish. One day, he has a dream. The dream is about fishing. However, Martin has a strange phobia: large fish scare him. By the way, he has a pet fish. Martin and his pet fish are good friends with each other. Martin's pet fish loves swimming. Martin regularly kills other aquatic creatures for the survival of his pet fish.

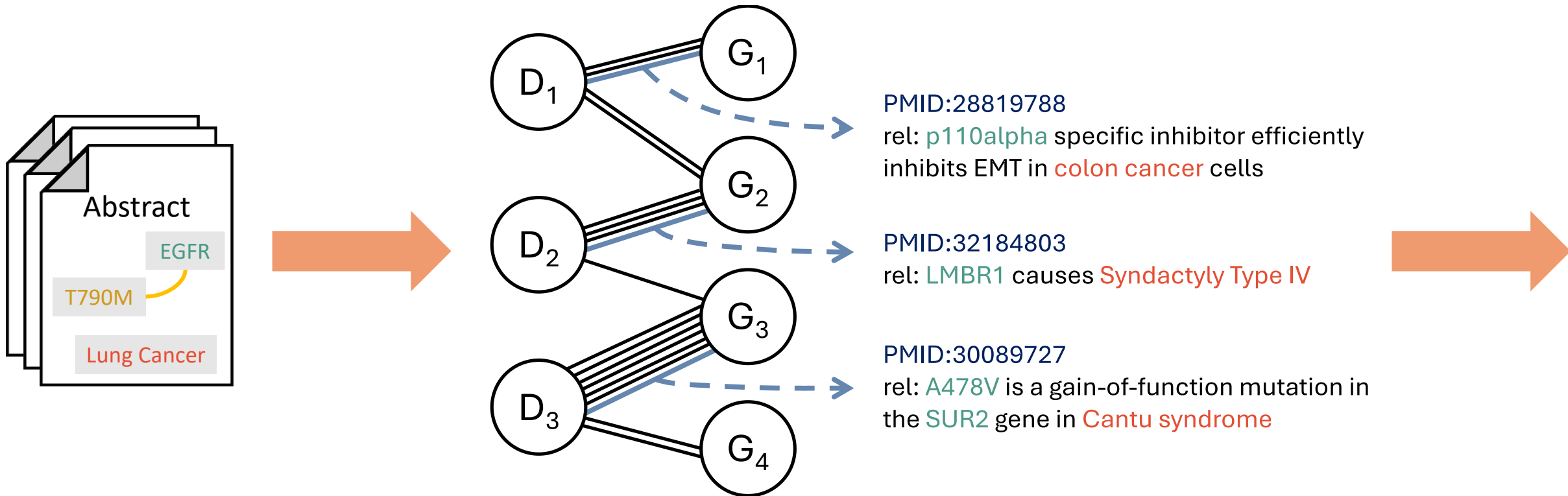
A list of bad relational triples that are not between "Martin" and "fish":

- "Martin", "is", "an Irish man"
- "Martin", "loves", "sports"
- "Martin", "has", "a strange phobia"
- "Martin and his pet fish", "are", "good friends to each other"
- "Martin's pet fish", "loves", "swimming"








A list of good relational triples between "Martin" and "fish":

- "Martin", "likes", "fish"
- "Martin", "loves", "eating fish"
- "Martin", "dreamed about", "fishing"
- "Martin", "scared of", "large fish"
- "Martin", "has", "a pet fish"

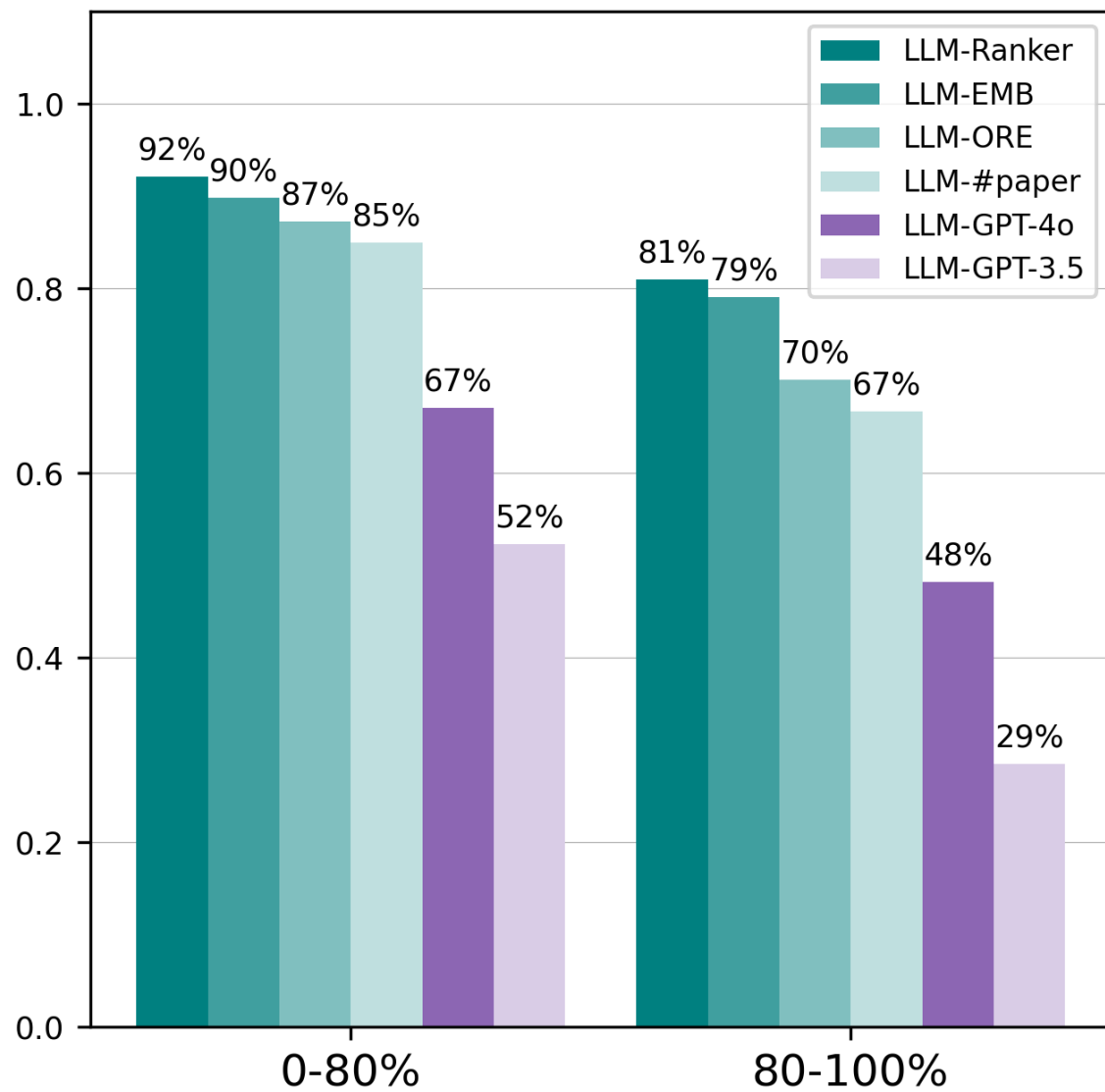
# LORE



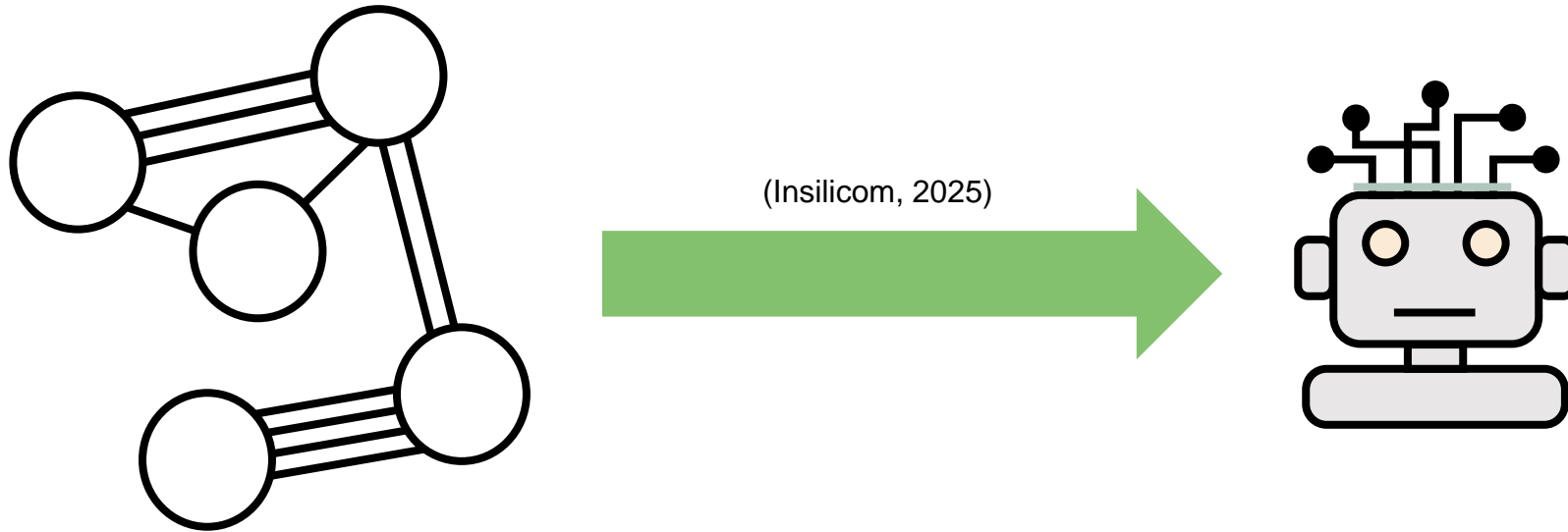
# LORE

Disease	Gene	ClinVar	DG Score	Evidence
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:114798) <b>SLITRK1</b>	Y	(1) 100.0%	 key: 43, other: 96
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:3067) <b>HDC</b>	Y	(2) 80.8%	 key: 27, other: 30
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:83943) <b>IMMP2L</b>	N	(3) 76.4%	 key: 14, other: 18
cause deletion mutation phenotype predisposition to disease mutation previously reported ...	PMID:17043892, <b>IMMP2L</b> possible rare cause of <b>Gilles de la Tourette syndrome</b> PMID:24549057, <b>IMMP2L</b> has intragenic deletions in patients with <b>Tourette syndrome</b> PMID:27932244, <b>IMMP2L</b> dysfunction contributes to the neurodevelopmental phenotype of <b>Tourette syndrome</b> PMID:15103711, <b>IMMP2L</b> shows a tendency for association with <b>Tourette syndrome</b> predisposition PMID:21386874, <b>IMMP2L</b> has previously been proposed as a candidate gene for <b>Tourette syndrome</b> ...			
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:114781) <b>BTBD9</b>	N	(4) 74.1%	 key: 7, other: 42
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:3356) <b>HTR2A</b>	N	(5) 72.9%	 key: 17, other: 56
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:13) <b>AADAC</b>	N	(6) 66.4%	 key: 4, other: 15
(MESH:D005879) <b>Tourette Syndrome</b>	(NCBI:1268) <b>CNR1</b>	N	(7) 66.0%	 key: 6, other: 43
...	...	...	...	...

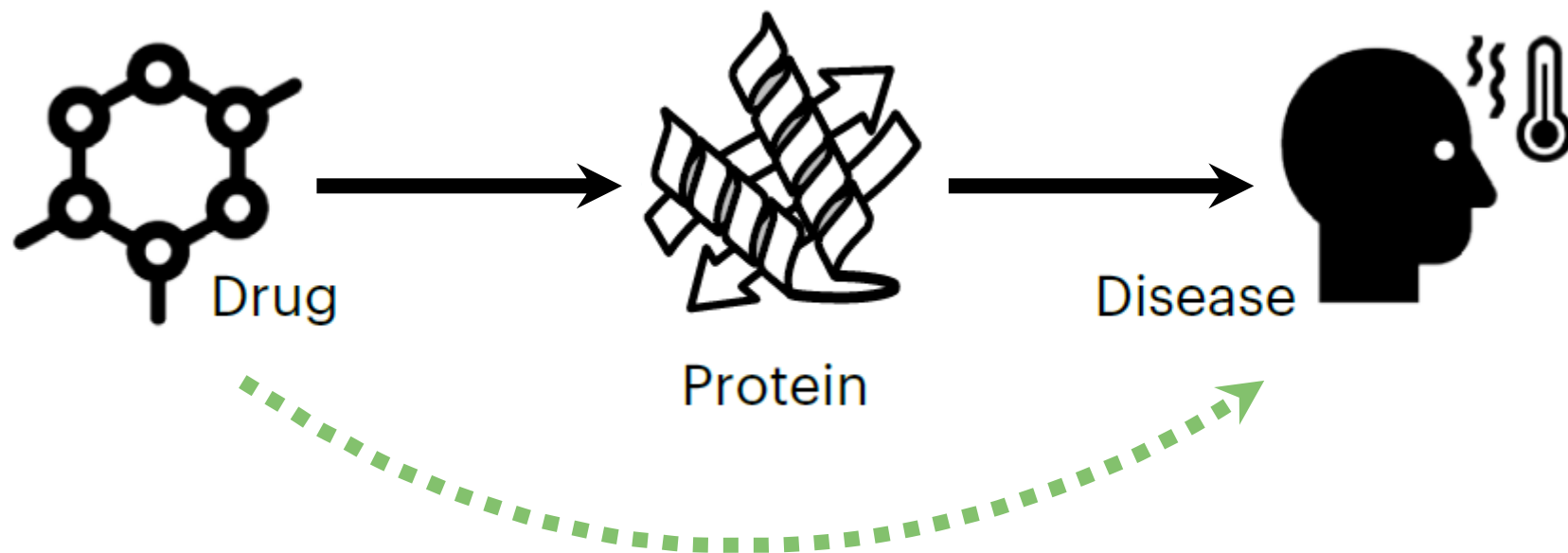
# LORE



# iKraph



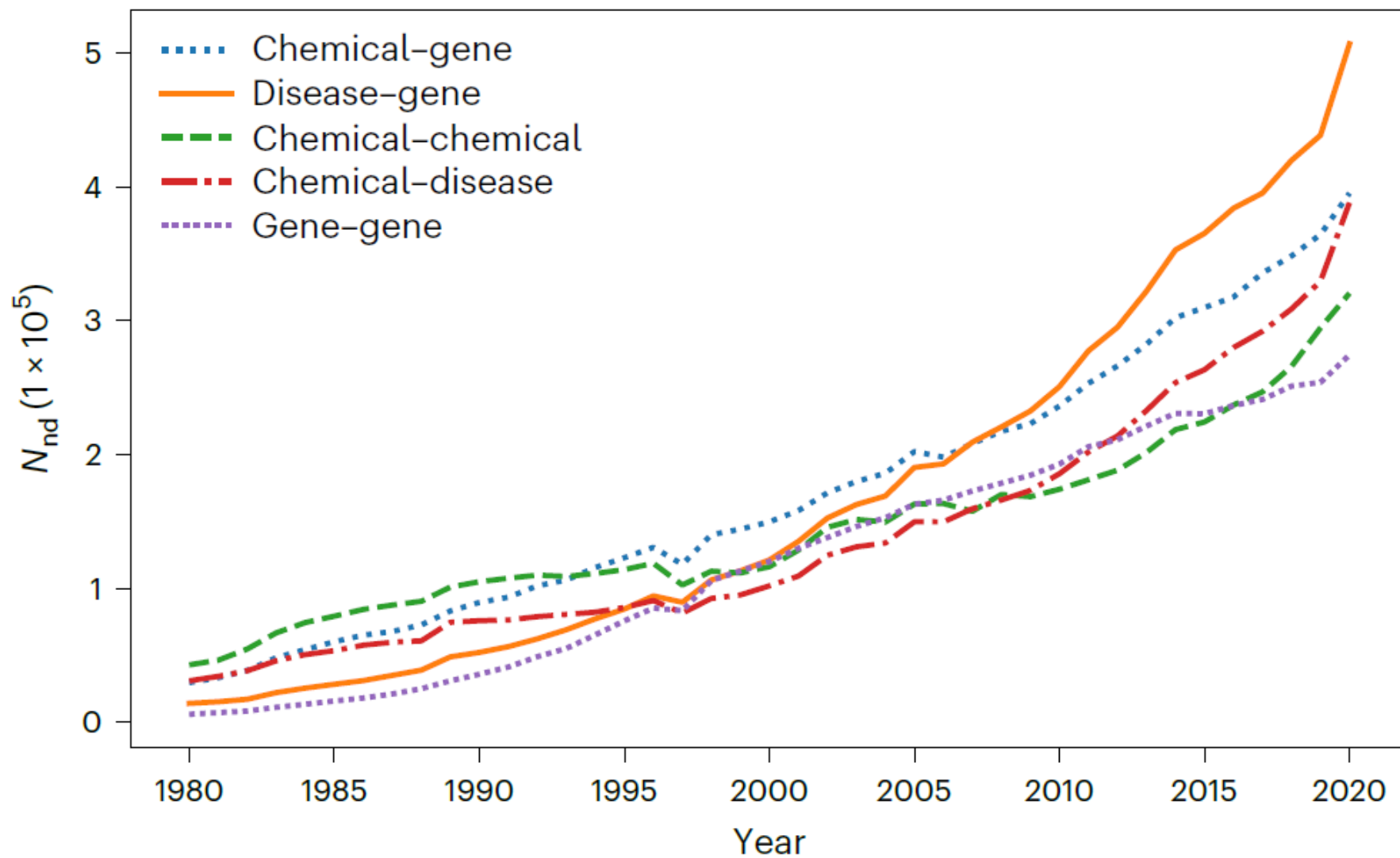
# iKraph



# iKraph

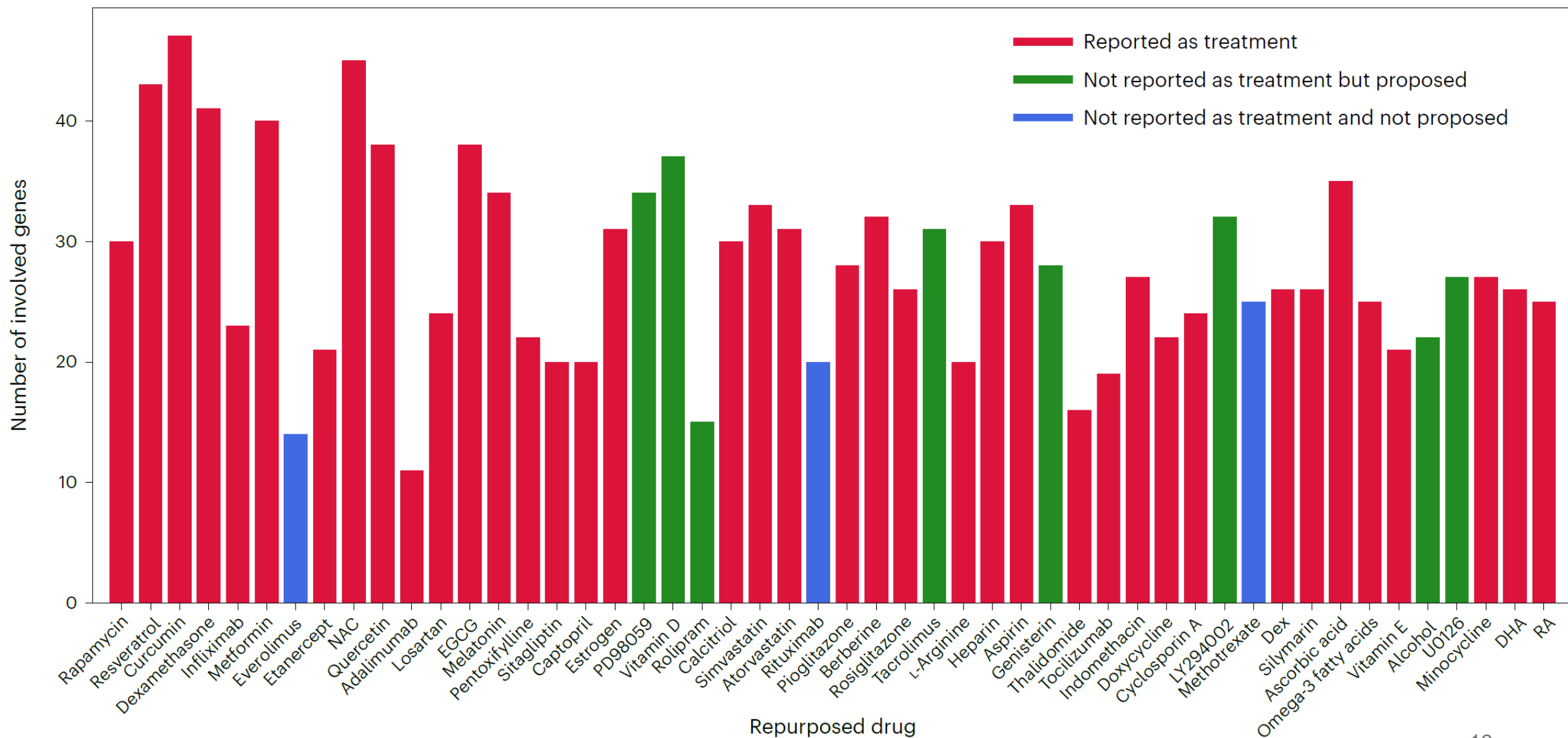


# iKraph



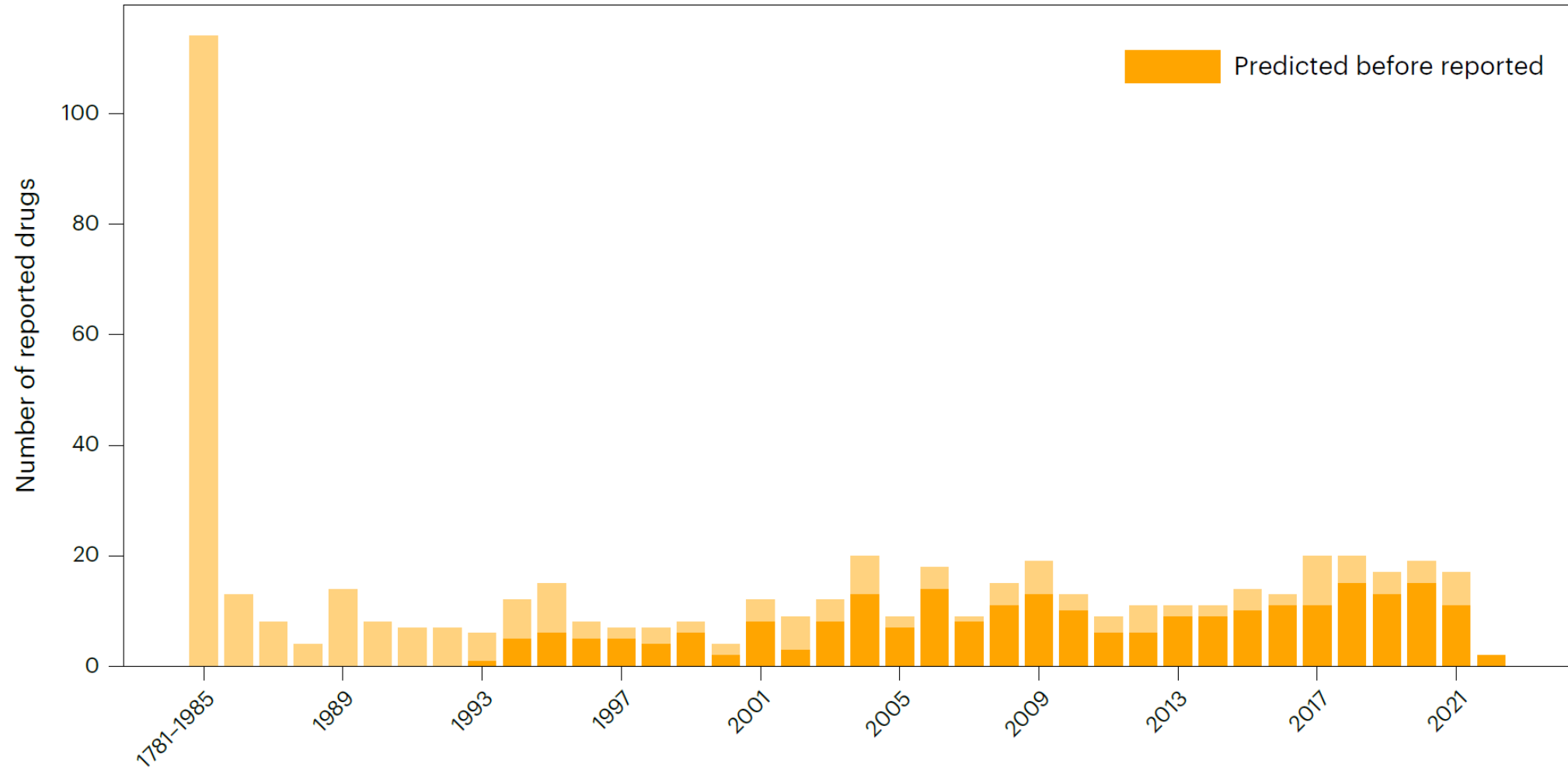
# iKraph

47/50 predicted drugs were later validated or proposed as treatment (COVID-19)

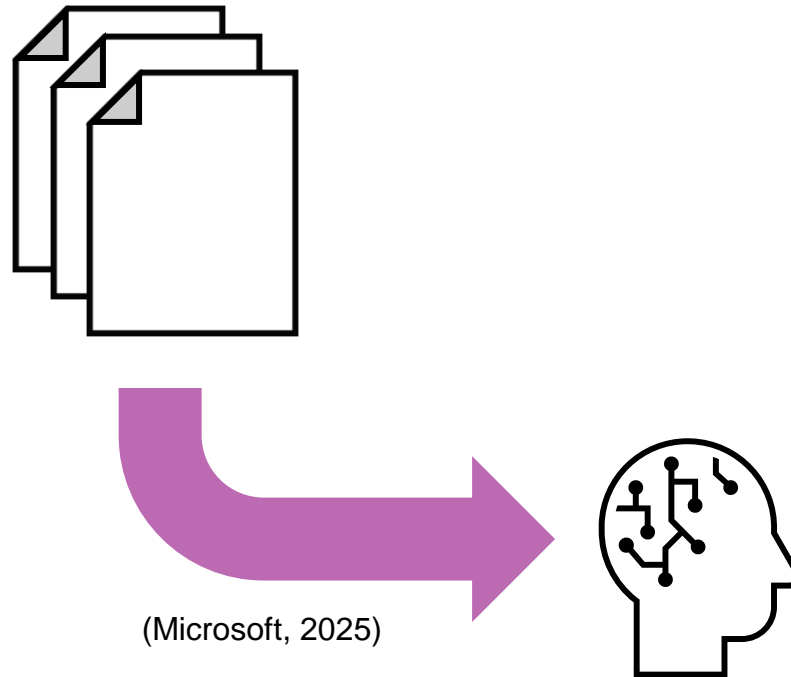


# iKraph

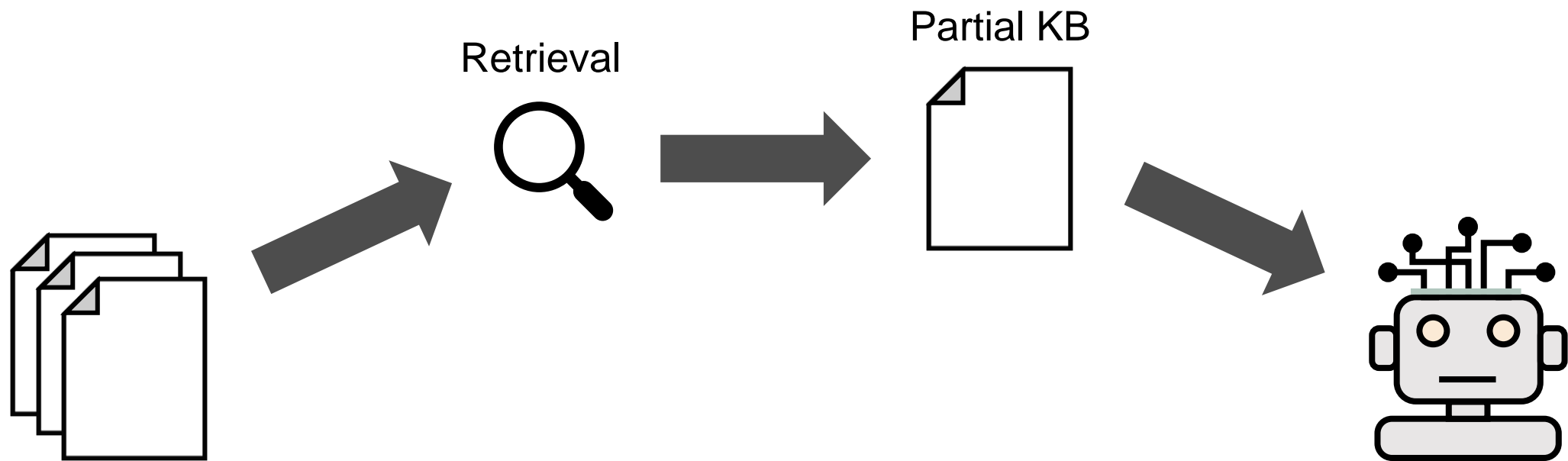
On average, new drugs can be predicted 9.4 years in advance (Cystic Fibrosis)



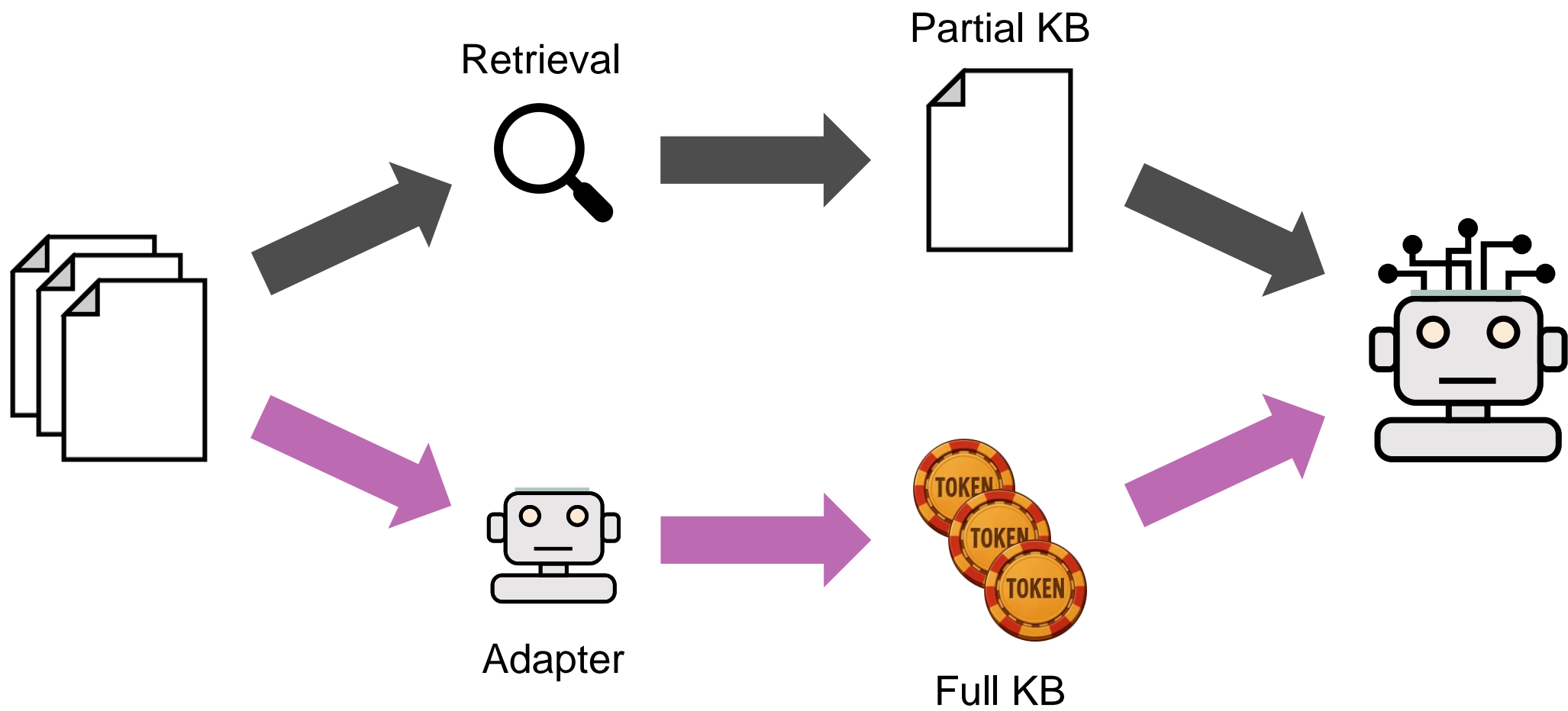
# KBLaM



# KBLaM



# KBLaM



# KBLaM

## KBLaM

Comprehensive



LLM sees full KB

Learnable



End-to-end

Scalable



$O(N)$ -time attention

## RAG

LLM sees partial KB

Retrieval decoupled from LLM

$O(N^2)$ -time attention

