

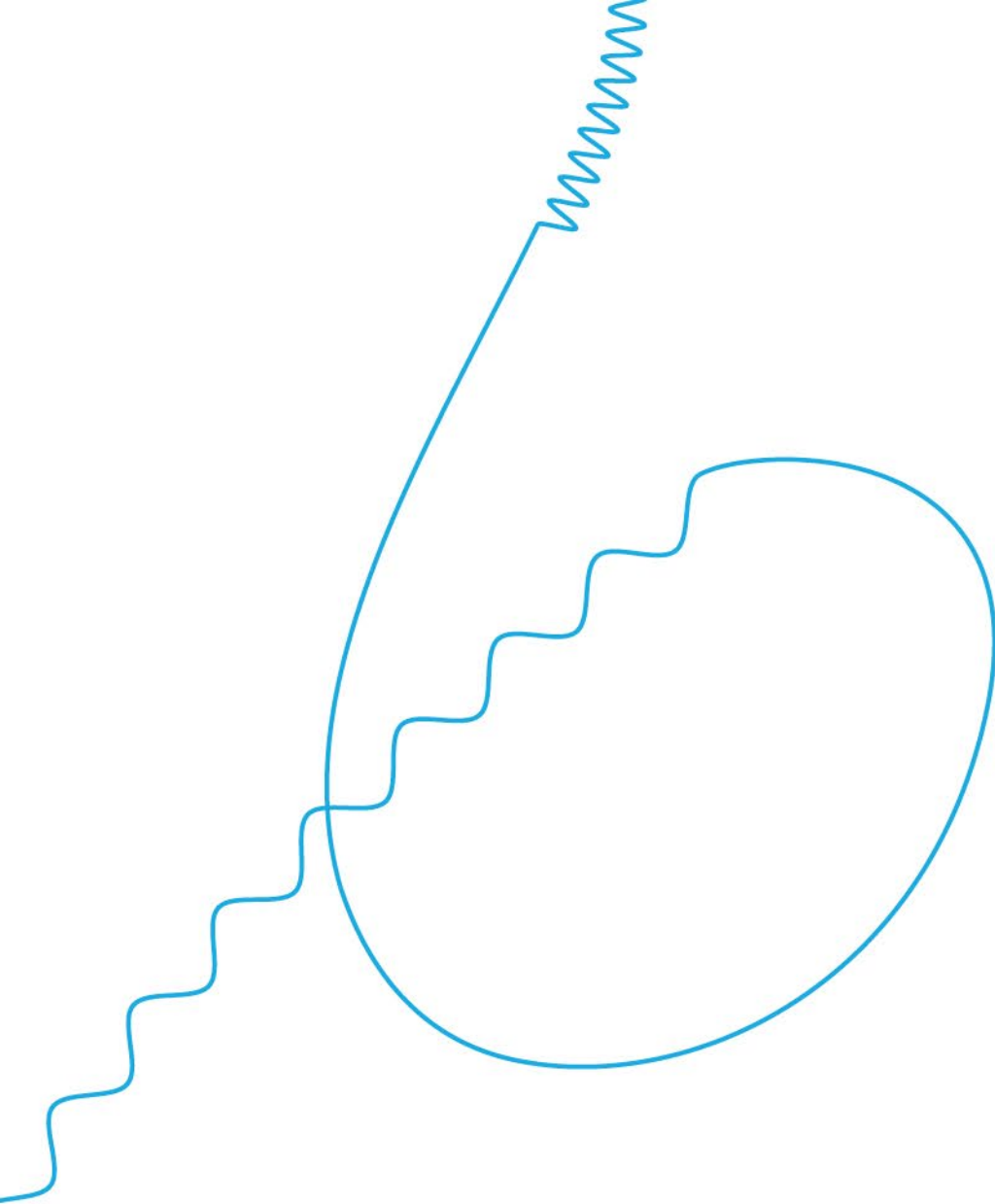
# Moderna Digital Investor Event

November 8, 2023

moderna®

# Forward-looking statements and disclaimer

This presentation contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, as amended, including statements regarding: the potential advantages of Moderna's mRNA platform, including probability of technical success and for greater capital efficiency; Moderna's potential to scale using, and applications for, artificial intelligence (AI); the potential for Moderna to launch up to 15 products in the next 5 years, and advance new products into clinical studies; Moderna's discussions with regulators and the potential for accelerated, conditional or other product approvals in certain markets; and the potential for Moderna's individualized neoantigen therapy (INT) to treat different types of cancers, and its potential for approval. The forward-looking statements in this presentation are neither promises nor guarantees, and you should not place undue reliance on these forward-looking statements because they involve known and unknown risks, uncertainties, and other factors, many of which are beyond Moderna's control and which could cause actual results to differ materially from those expressed or implied by these forward-looking statements. These risks, uncertainties, and other factors include, among others, those risks and uncertainties described under the heading "Risk Factors" in Moderna's Annual Report on Form 10-K for the fiscal year ended December 31, 2022, filed with the U.S. Securities and Exchange Commission (SEC), and in subsequent filings made by Moderna with the SEC, which are available on the SEC's website at [www.sec.gov](http://www.sec.gov). Except as required by law, Moderna disclaims any intention or responsibility for updating or revising any forward-looking statements contained in this presentation in the event of new information, future developments or otherwise. These forward-looking statements are based on Moderna's current expectations and speak only as of the date of this presentation.



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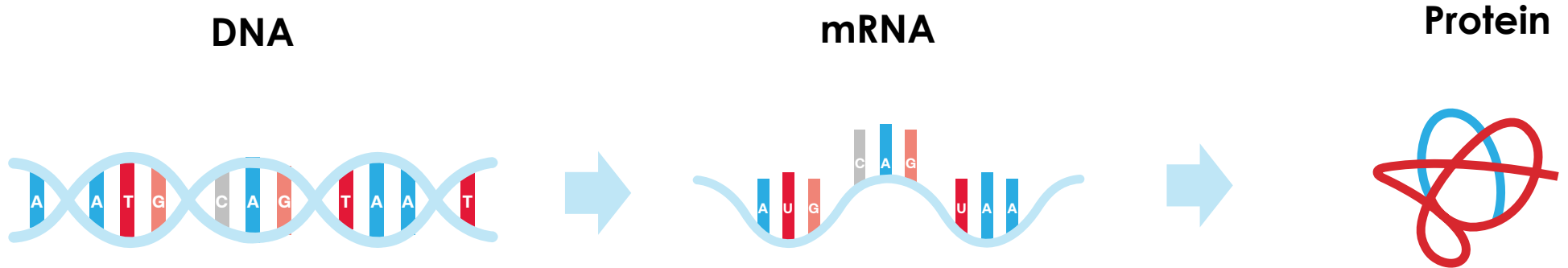
# Introduction

**Stéphane Bancel**

CEO



# Moderna was built on the premise that the natural flow of information in life can be used to develop medicines



## Storage

DNA stores instructions for proteins in the nucleus

## Software

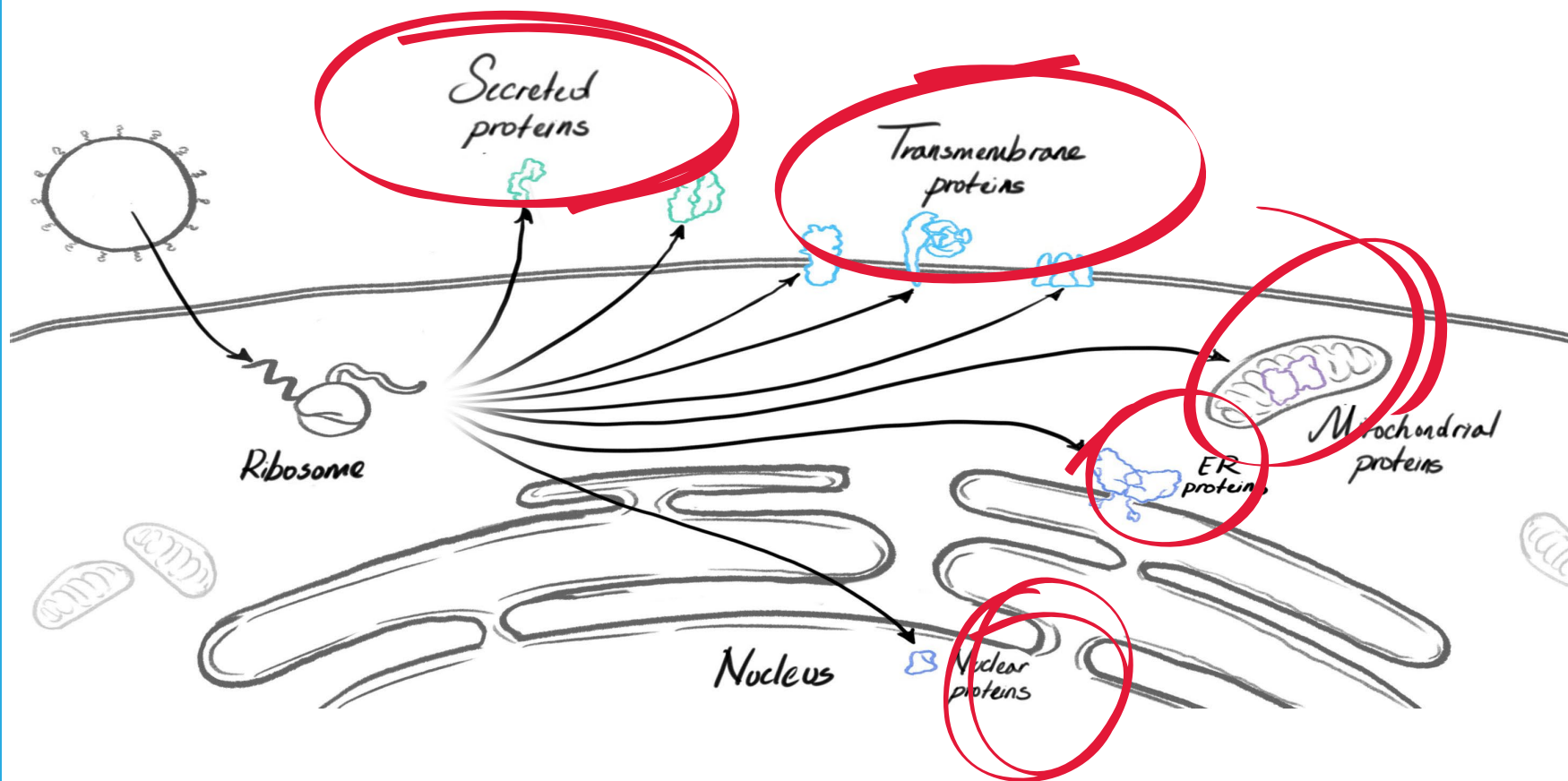
mRNA is a temporary set of instructions for cells to make a protein; mRNA is made using DNA

## Applications

Proteins form the basis of life by performing the functions required by every cell; proteins are made using mRNA

**mRNA is an information molecule**

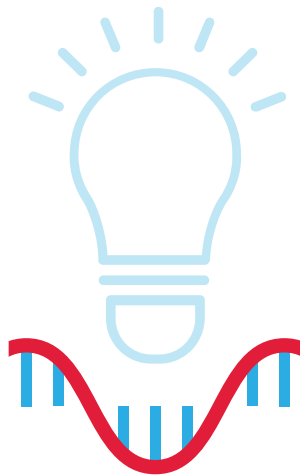
# The promise of mRNA



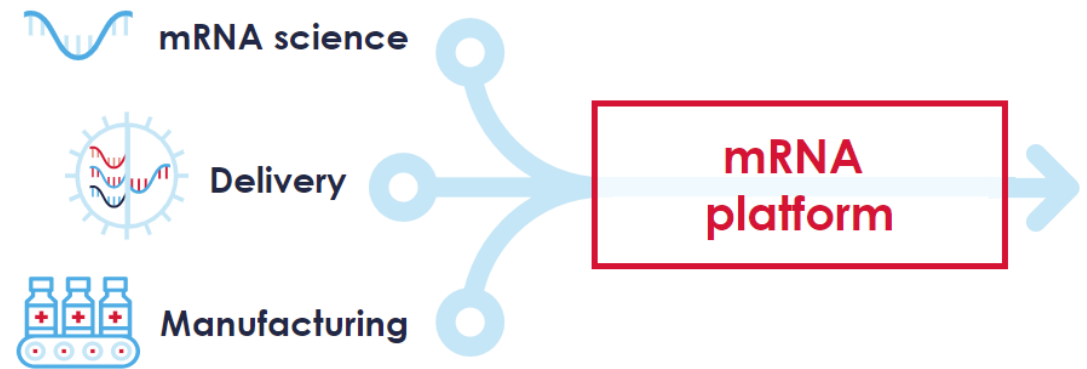
- 1 Large product opportunity
- 2 Higher probability of technical success
- 3 Accelerated research and development timelines
- 4 Greater capital efficiency over time vs. recombinant technology

# Moderna's foundational imperatives

Obsess over learning rapidly to be the global leader in mRNA science

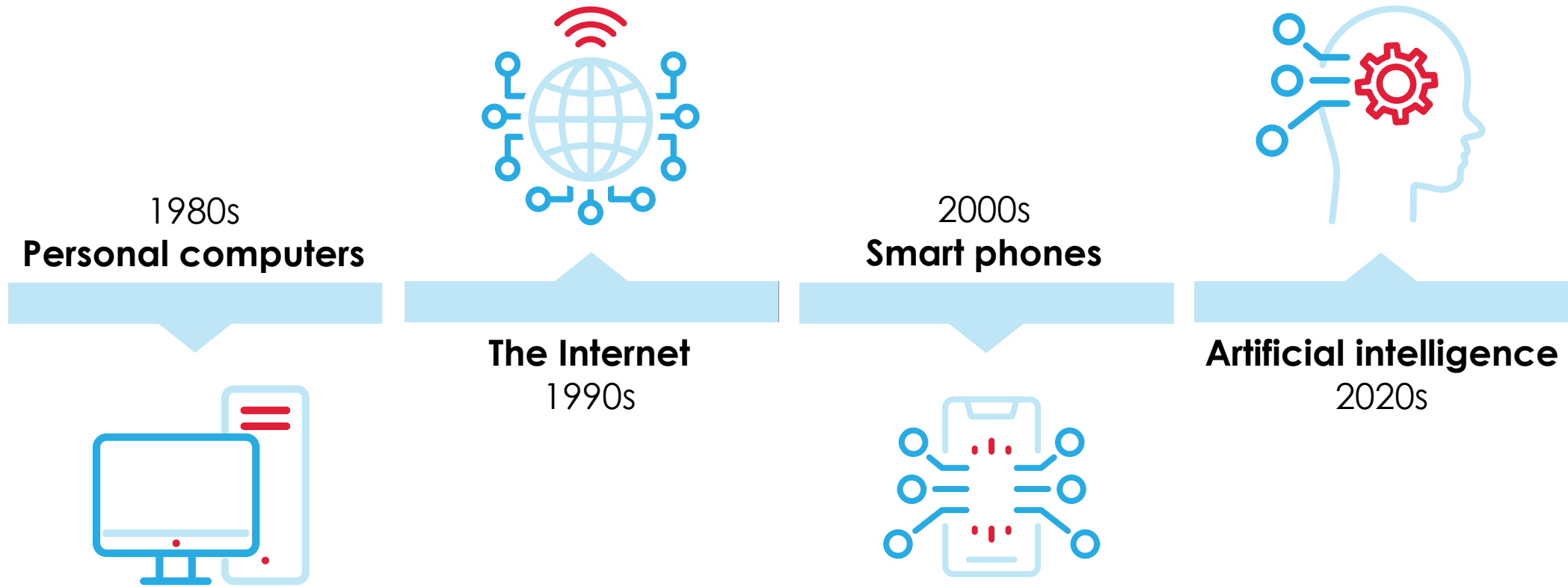


Build a platform to enable many medicines

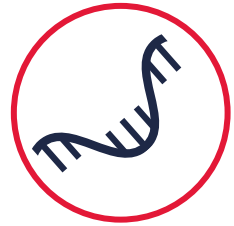


We decided very early to build digital and robotics to enable scale AND speed

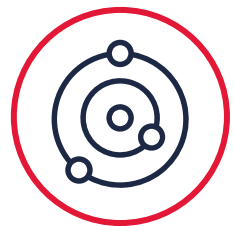
# AI is driving the next technological revolution in the way we work



# Moderna is well positioned to scale using AI



**We are a platform company**



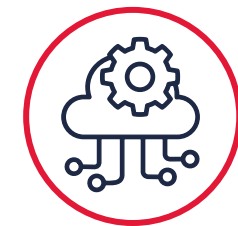
**We are an integrated AI ecosystem**



**We are a data-centric company**

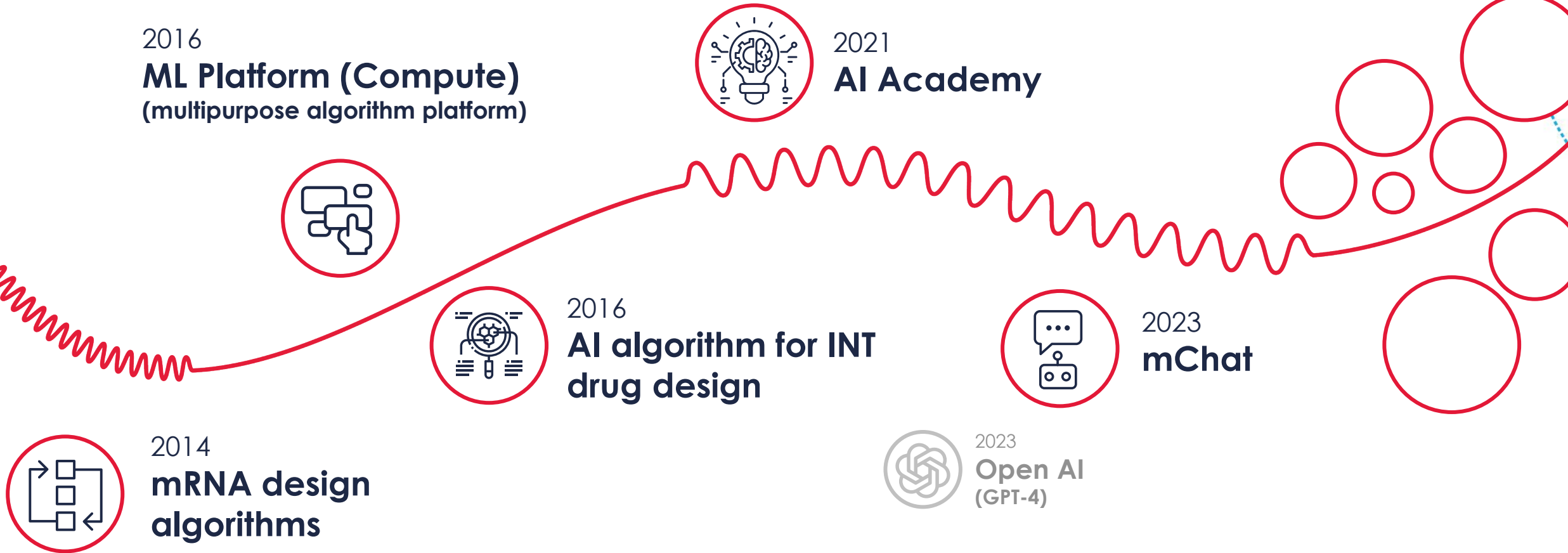


**We are cloud native**





# AI is not new to Moderna



# Anticipating up to 15 product launches over the next 5 years

Our mRNA platform is delivering across cancer, rare disease, and infectious diseases

	Respiratory vaccines	Latent/other vaccines	Oncology	Rare disease			
by 2025	<b>RSV (older adults)</b> mRNA-1345	<b>Seasonal Flu</b> mRNA-1010					
	<b>Flu/COVID</b> mRNA-1083	<b>NextGen COVID</b> mRNA-1283					
by 2028	<b>Flu/COVID/RSV</b> NextGen	<b>RSV/hMPV (older adults)</b> mRNA-1365	<b>CMV</b> mRNA-1647	<b>INT (adjuvant melanoma)</b> mRNA-4157	<b>MMA</b> mRNA-3705	<b>PA</b> mRNA-3927	
	<b>RSV (2-18Y)</b> mRNA-1345	<b>Pandemic Flu</b> mRNA-1018	<b>EBV (IM)</b> mRNA-1189	<b>Lyme</b> mRNA-1975/-82	<b>INT (undisclosed indication)</b> mRNA-4157	<b>PKU</b> mRNA-3210	<b>GSD1α</b> mRNA-3745
	<b>NextGen Flu</b> mRNA-1011/-1020	<b>Endemic hCOV</b> mRNA-1287	<b>VZV</b> mRNA-1468	<b>HSV</b> mRNA-1608	<b>INT (adjuvant NSCLC)</b> mRNA-4157		

Subject to regulatory discussions<sup>1</sup>

Note: Subject to positive clinical data and regulatory discussions/approvals  
 1 Subject to future regulatory discussions, there may be potential for accelerated or conditional approvals in some markets  
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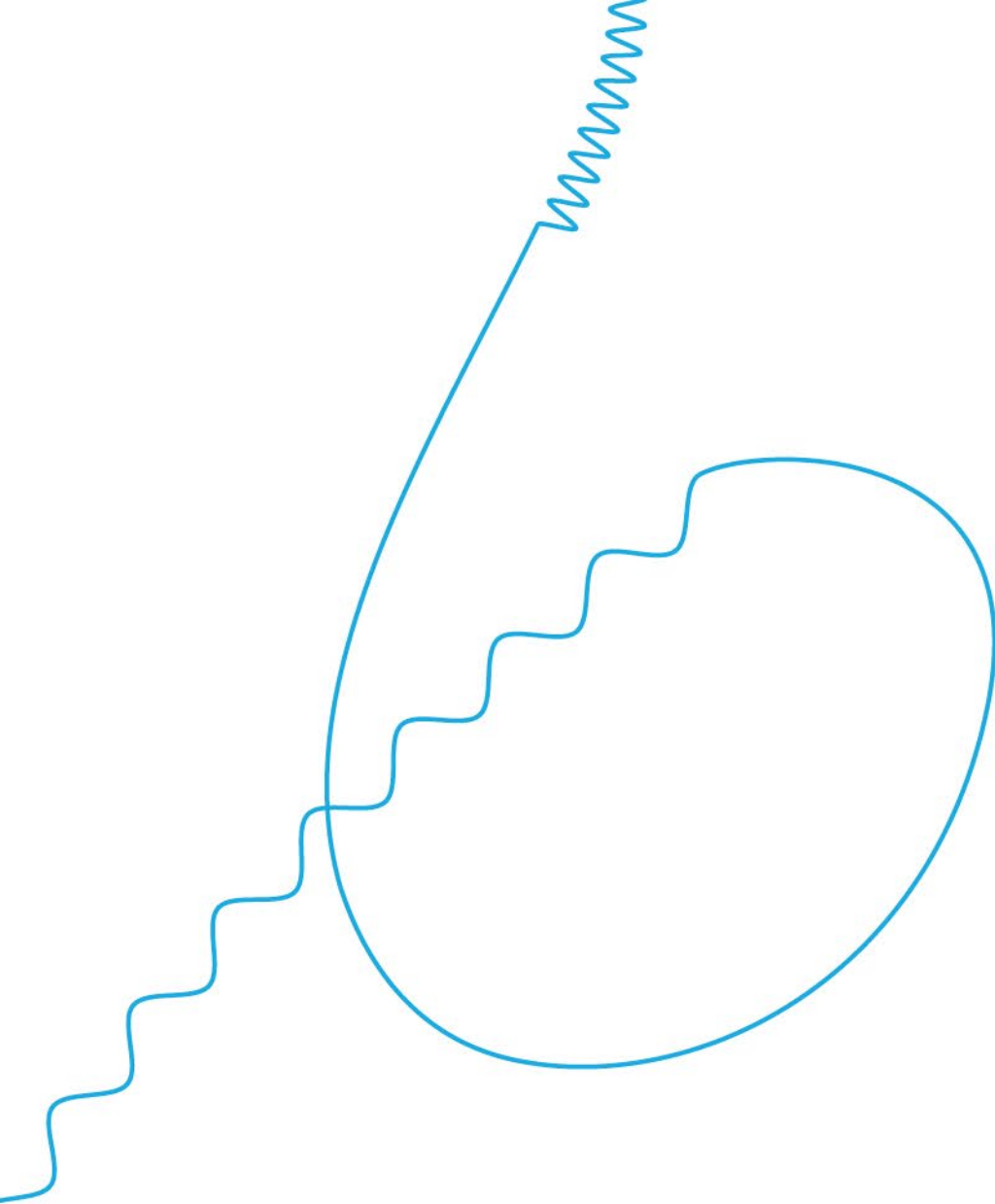
# Introduction to Brad Miller



**Chief Information Officer, Moderna**

Previous roles at:





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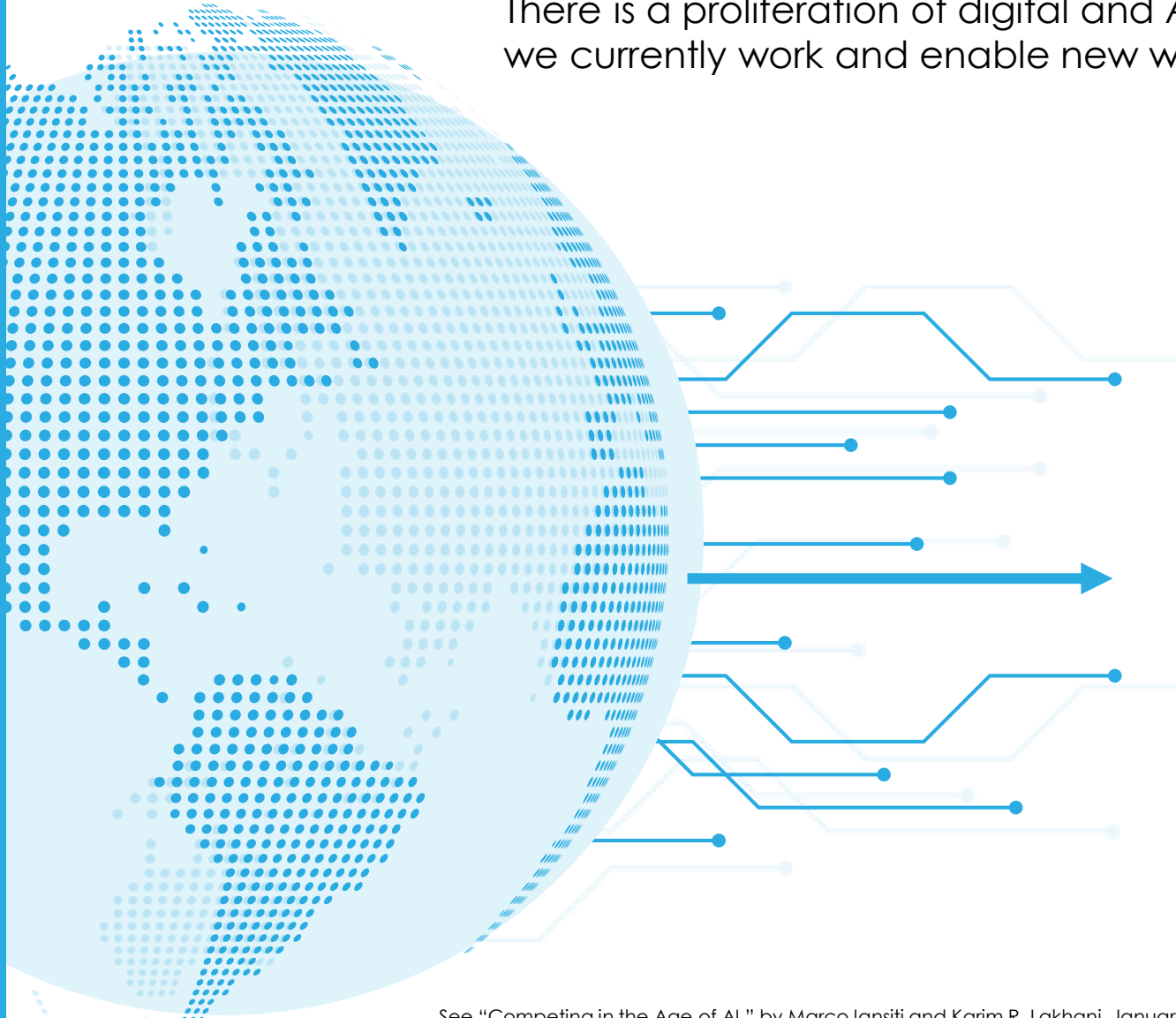
# Vision of AI at Moderna

**Brad Miller**

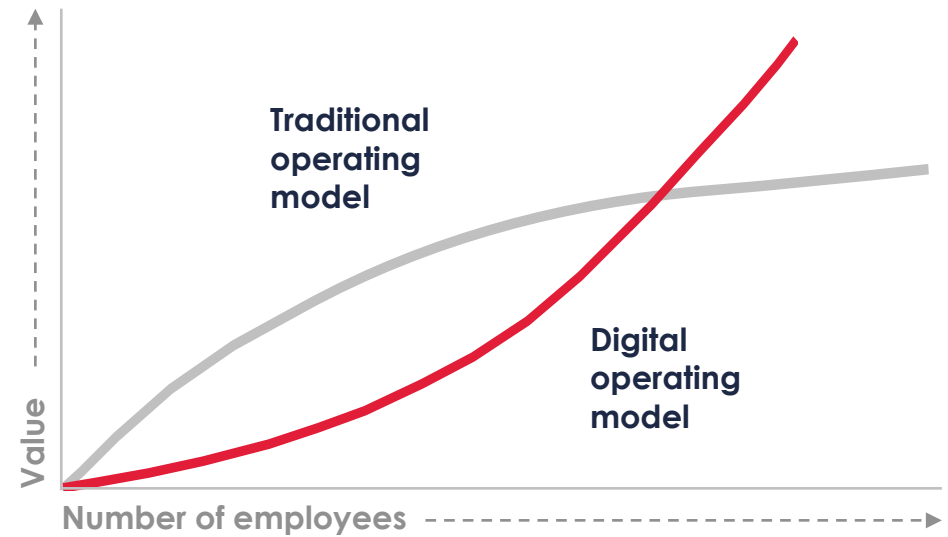
*Chief Information Officer*

# Embracing AI is key to enhancing workforce value

There is a proliferation of digital and AI tools available to disrupt the way we currently work and enable new ways to work

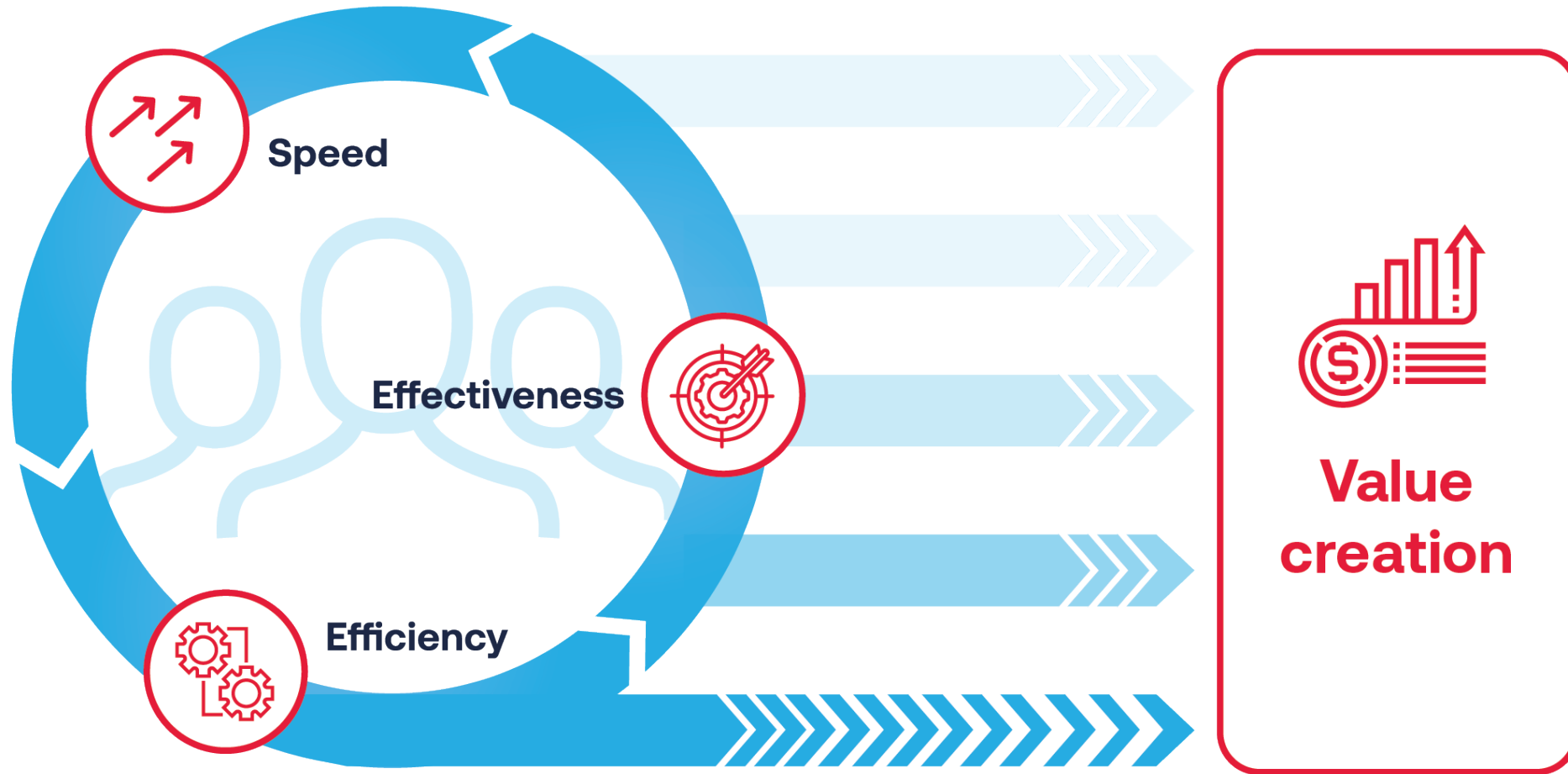


**Traditional operating models require large workforces as business scale**



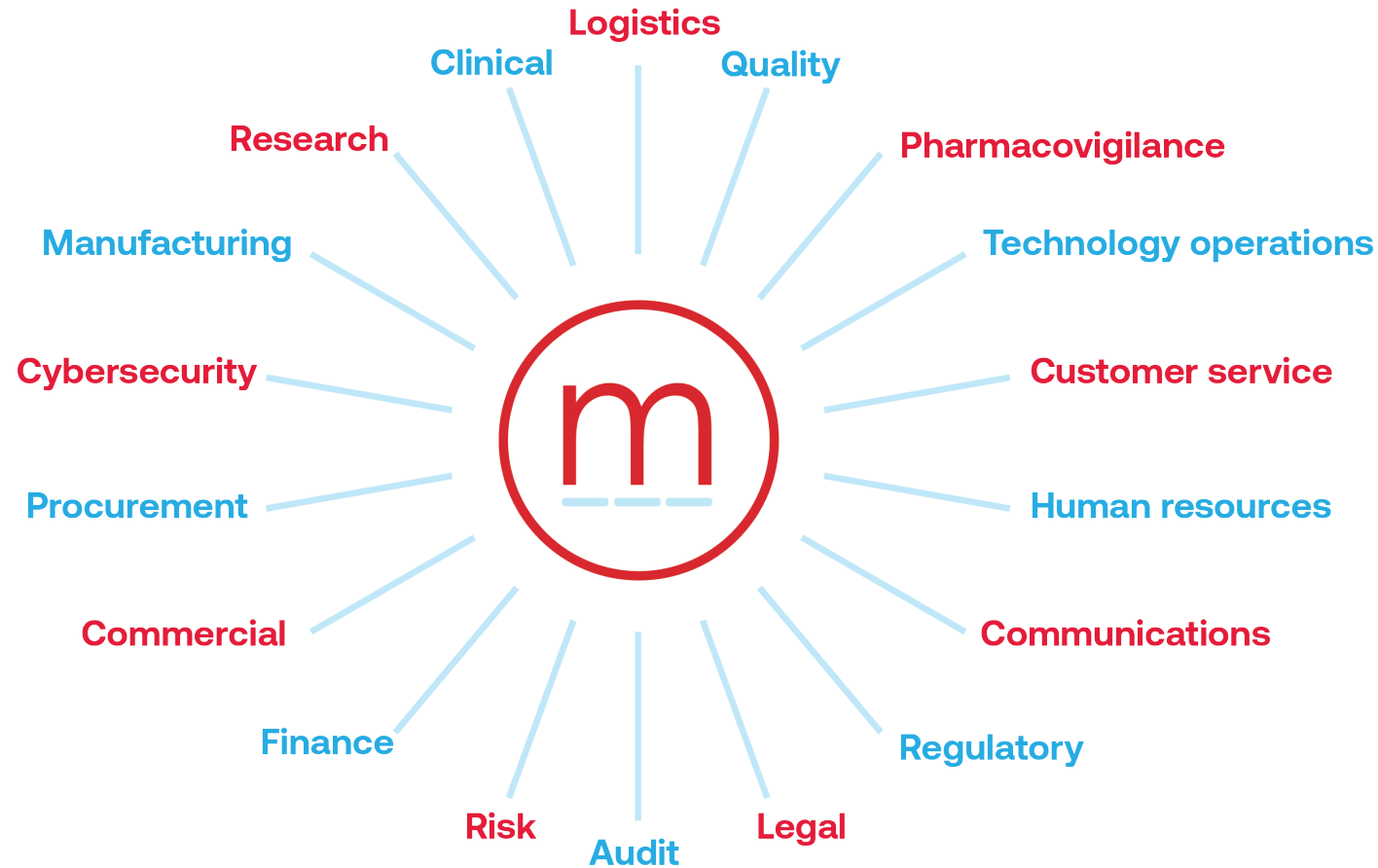
**Real-time AI companies scale the value of their people**

# The impact of digitalization and AI



Our mission is to deliver the greatest possible impact to people through mRNA medicines.

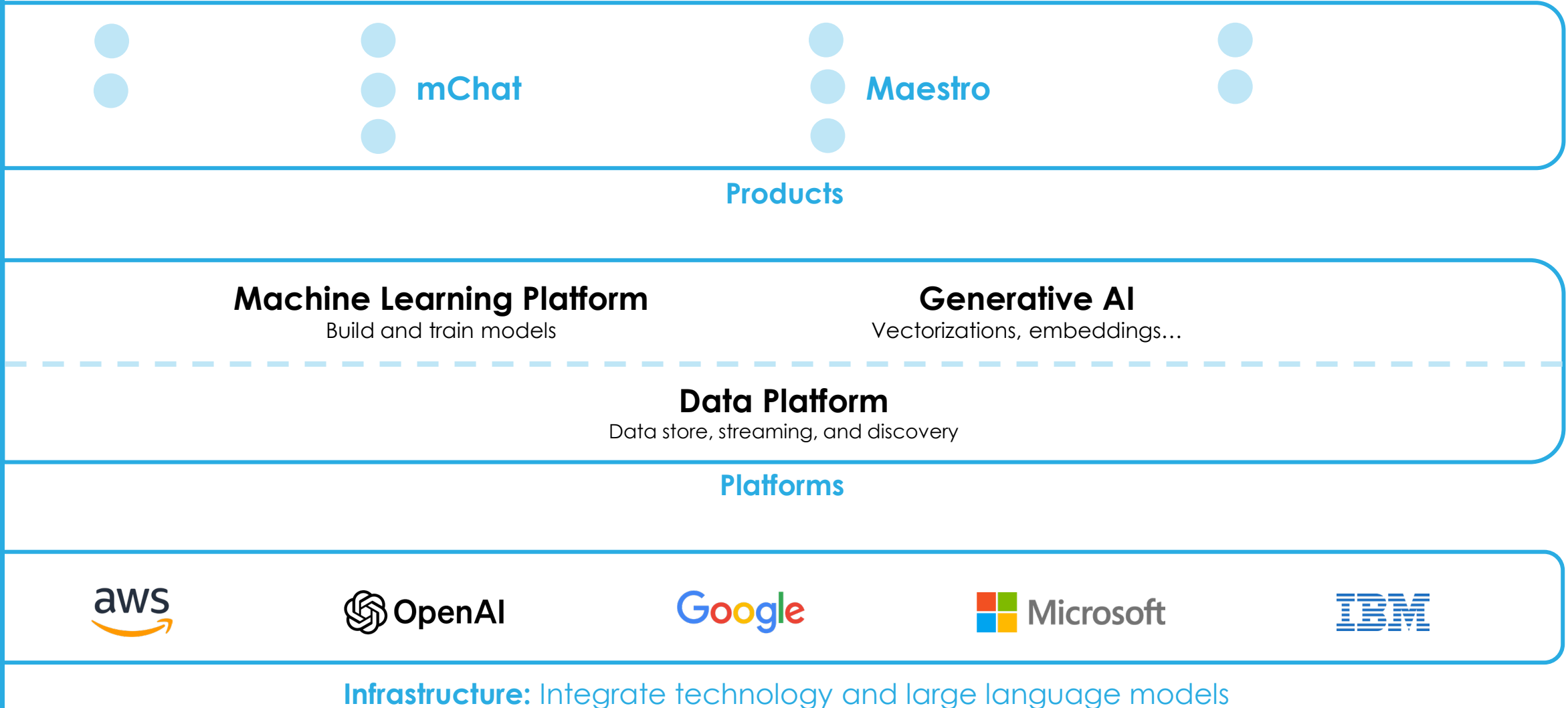
# AI vision: AI is everywhere at Moderna



We are building a real-time AI company



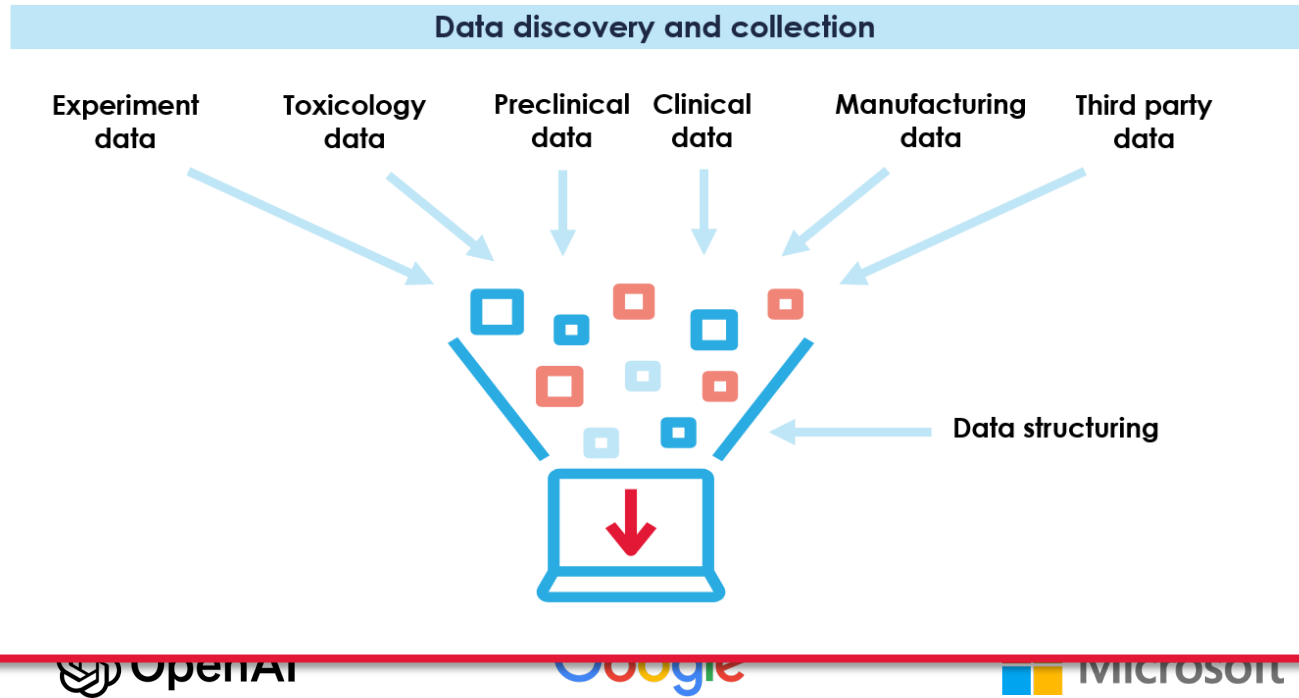
# The architecture of AI at Moderna





# The architecture of AI at Moderna

For more than 10 years Moderna has been building a large library of data, creating our own proprietary data ecosystem

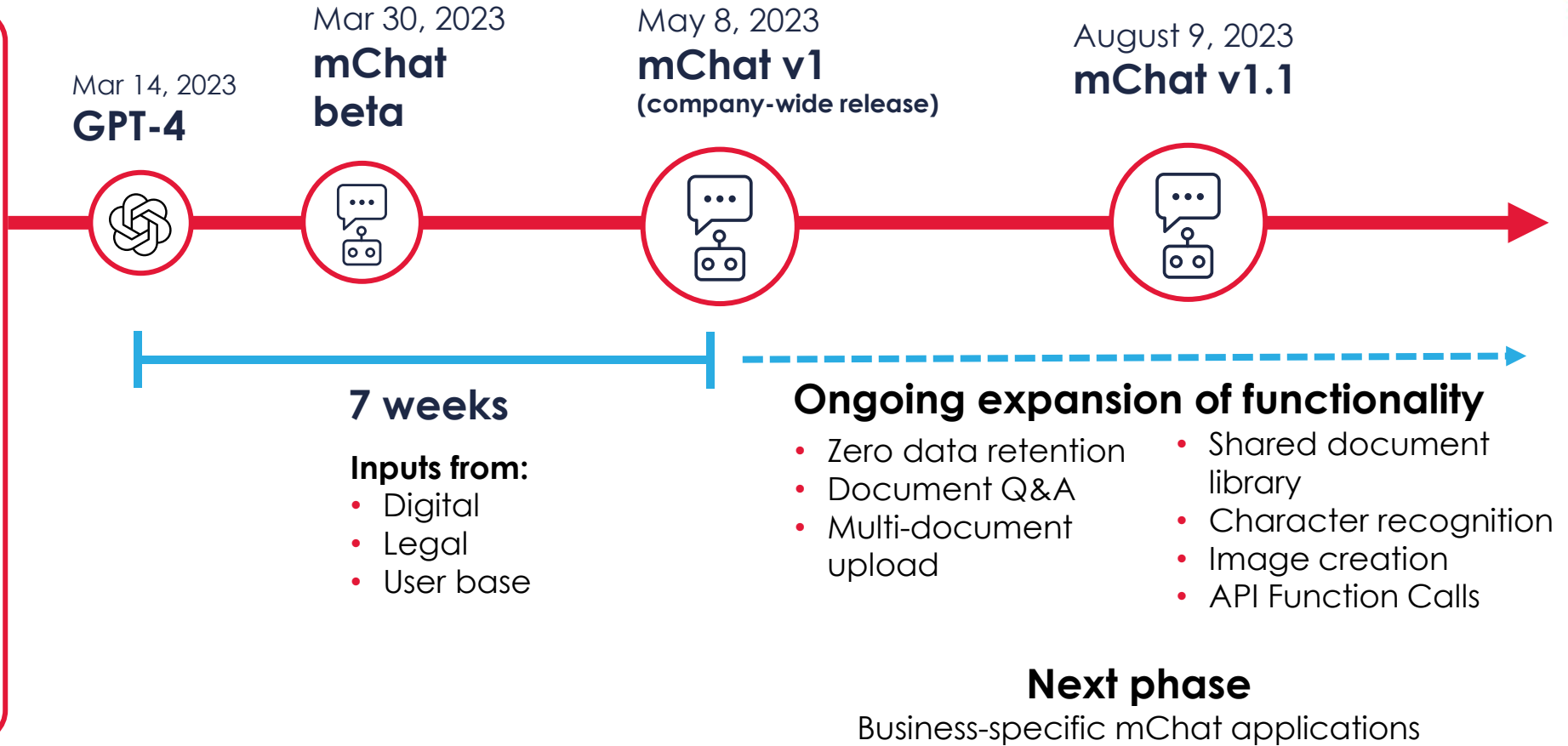


**Infrastructure:** Integrate technology and large language models

# Moderna's Large Language Model application: mChat

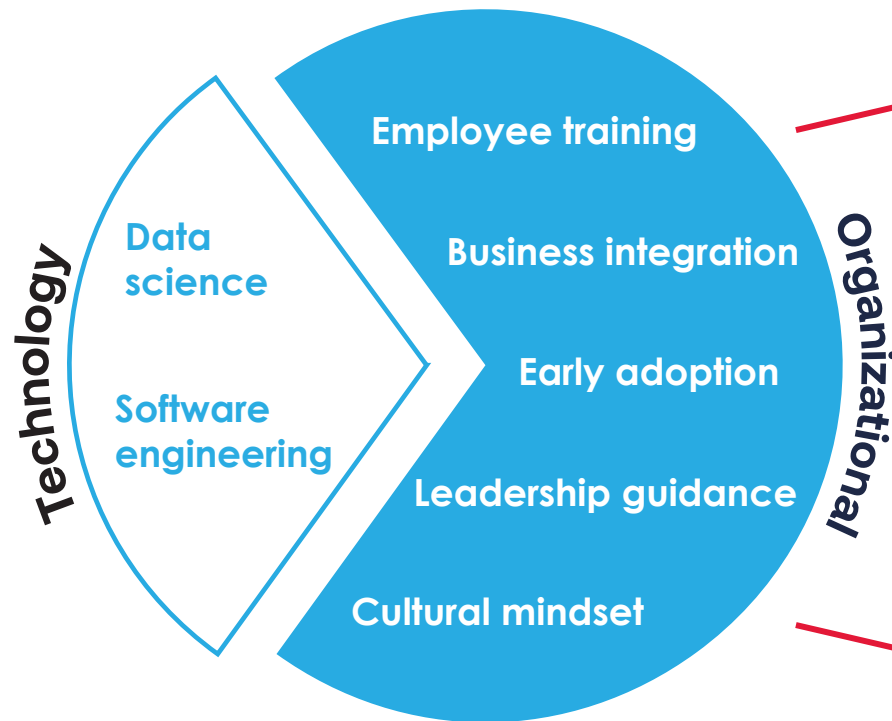
## Why did we need our own application to use GPT-4?

- Access to Moderna data
- Secure data policy
- Expanded capabilities
- Customized workflow
- Adoption and proficiency tracking
- Model agnostic interface to embrace the GenAI revolution



# Technology alone doesn't drive transformation - people do

“There’s a rough rule of 30/70, 30% is tech, 70% is organizational”<sup>1</sup>



## Our AI transformation pillars

**Productize AI with self-service business driven platforms**

**Generate early success symbols in every business line**

**Empower all users and leaders with action learning and events**

**Grow the AI culture from a core of Champions and Enthusiasts**

<sup>1</sup>: <https://hbr.org/podcast/2023/05/how-generative-ai-changes-productivity>

# Agenda

<b>Introduction</b>	<b>Stéphane Bancel</b> , <i>Chief Executive Officer</i>
<b>Vision of AI at Moderna</b>	<b>Brad Miller</b> , <i>Chief Information Officer</i>
<b>Data Science</b>	<b>Dave Johnson</b> , <i>Chief Data and Artificial Intelligence Officer</i>
<b>Transformation</b>	<b>Brice Challamel</b> , <i>Vice President, Data &amp; AI Transformation, Generative AI</i>
<b>Conclusion</b>	<b>Brad Miller</b>
<b>Q&amp;A</b>	<b>Stéphane Bancel, Brad Miller, Dave Johnson, Brice Challamel</b>

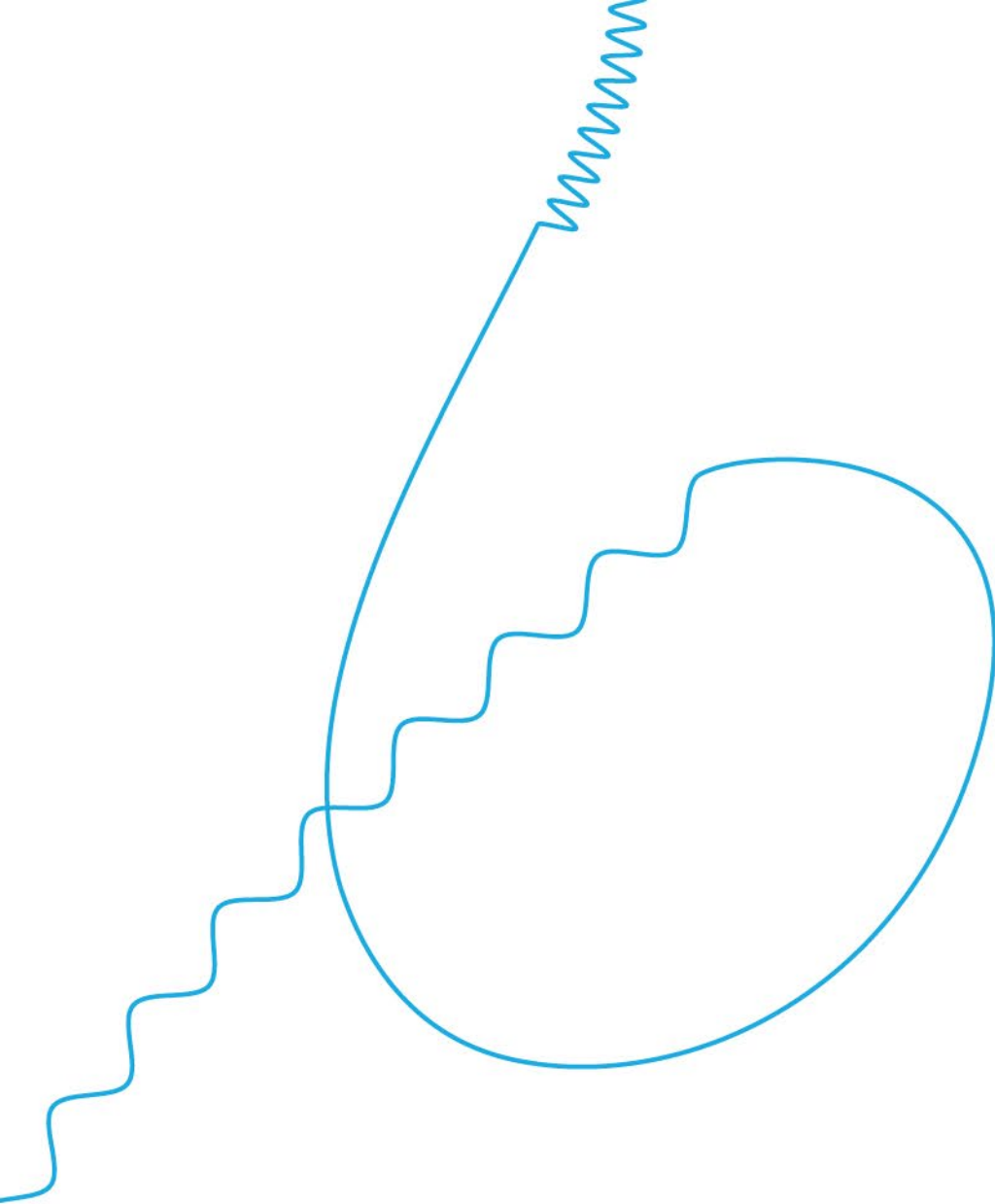
# Introduction to Dave Johnson



**Chief Data and Artificial Intelligence Officer, Moderna**

**Previous roles at Moderna:**

- Vice President, Informatics, Data Science and AI
- Senior Director, Informatics
- Lead, Automation Integration and Data Analytics



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# Data Science

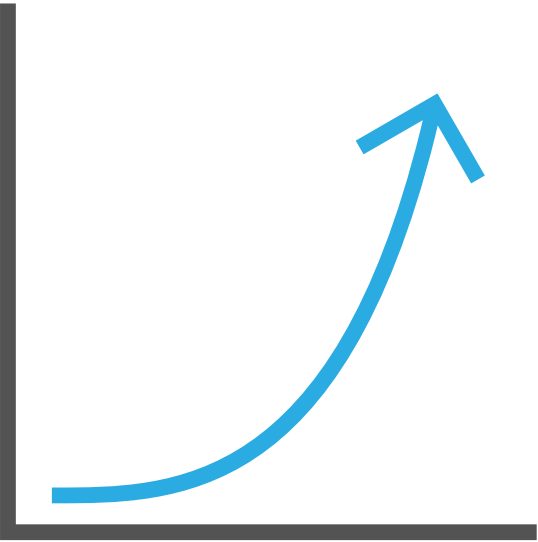
**Dave Johnson**

*Chief Data and Artificial Intelligence  
Officer*



# The data science challenge

Enterprises are struggling to realize the value creation potential of implementing AI



**9 out of 10 of tech execs believe AI is center of next tech revolution**



**Only 1 in 10 AI projects make it into production**

Source: VentureBeat (2019)  
<https://venturebeat.com/2019/03/11/edelman-91-of-tech-execs-believe-mundane-tasks-will-be-relegated-to-machines/>  
<https://venturebeat.com/2019/07/19/why-do-87-of-data-science-projects-never-make-it-into-production/>

# Components of Moderna's early successful AI projects

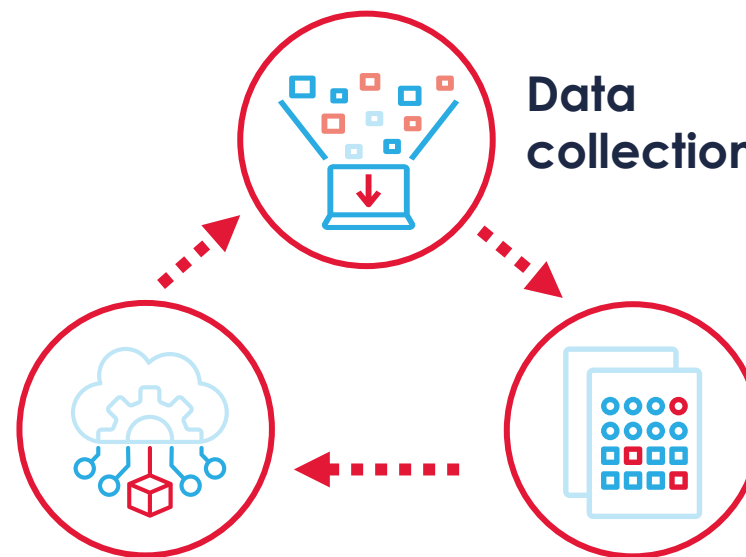
Moderna takes a platform approach



## Impactful use cases

Valuable and actionable use cases that AI can effectively impact the business

### ● Research



## Predictive models

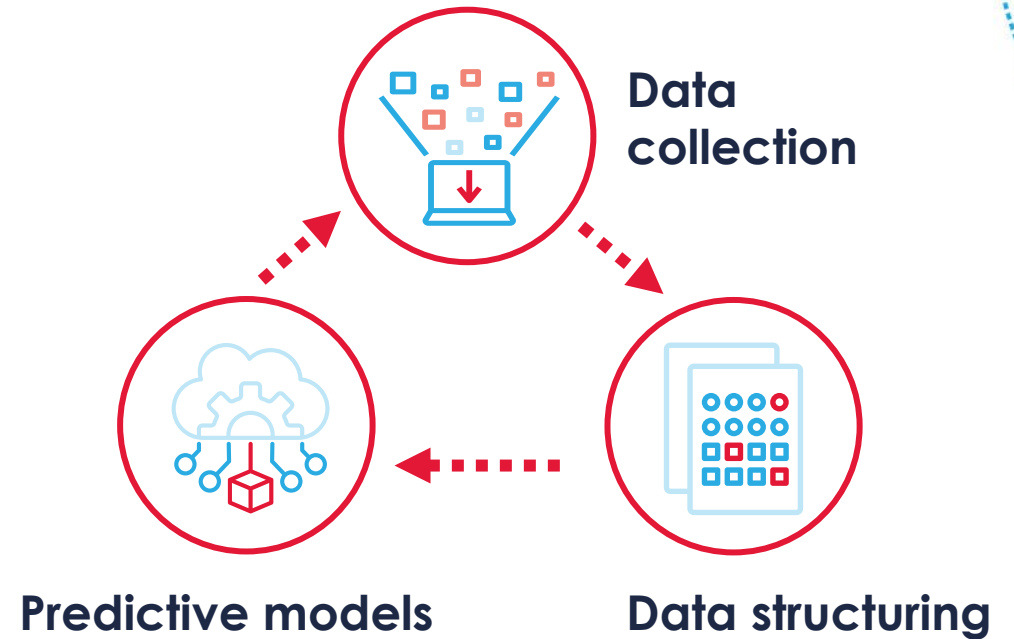
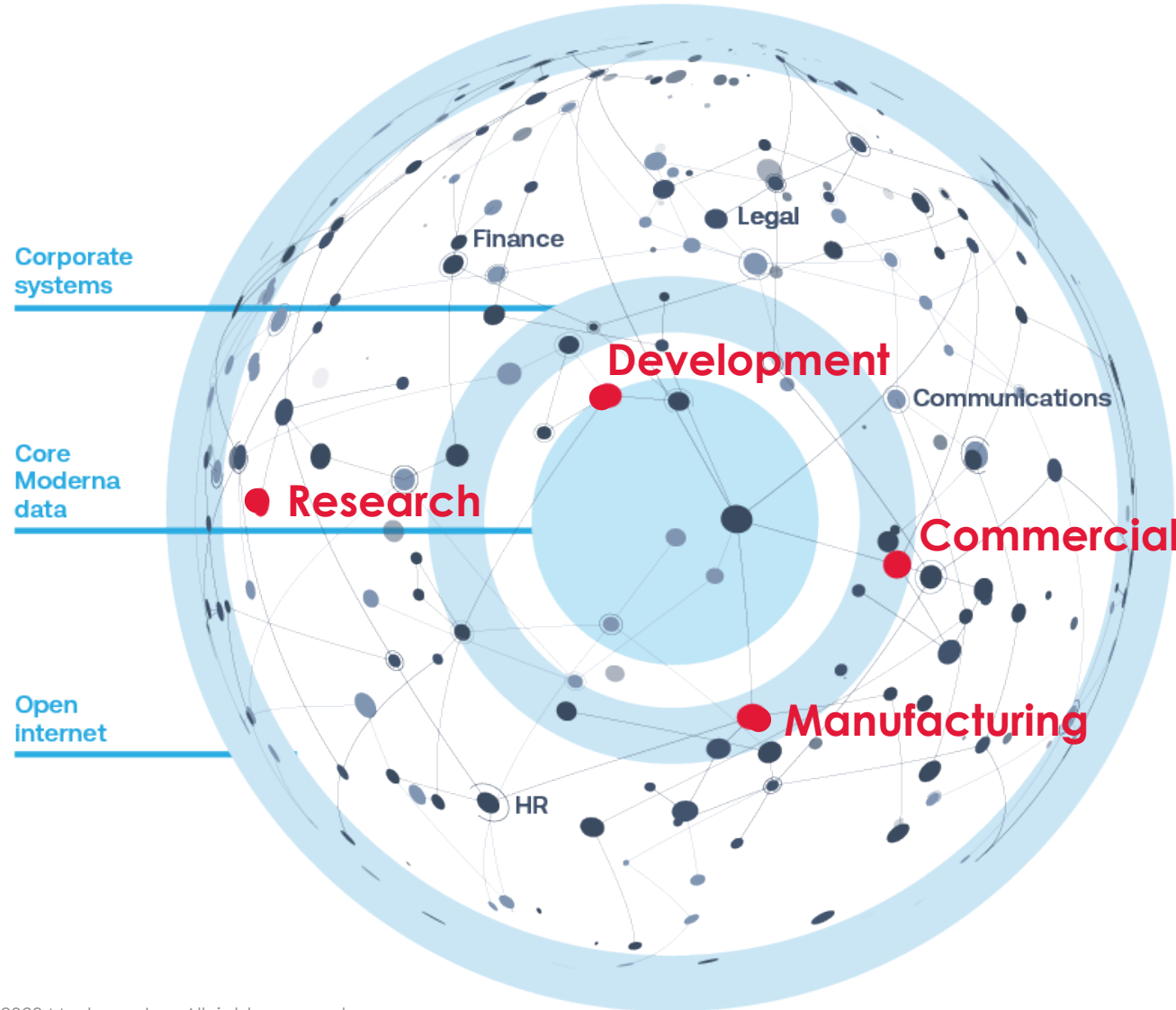
Application of data science techniques and algorithms to business problems

## Data structuring

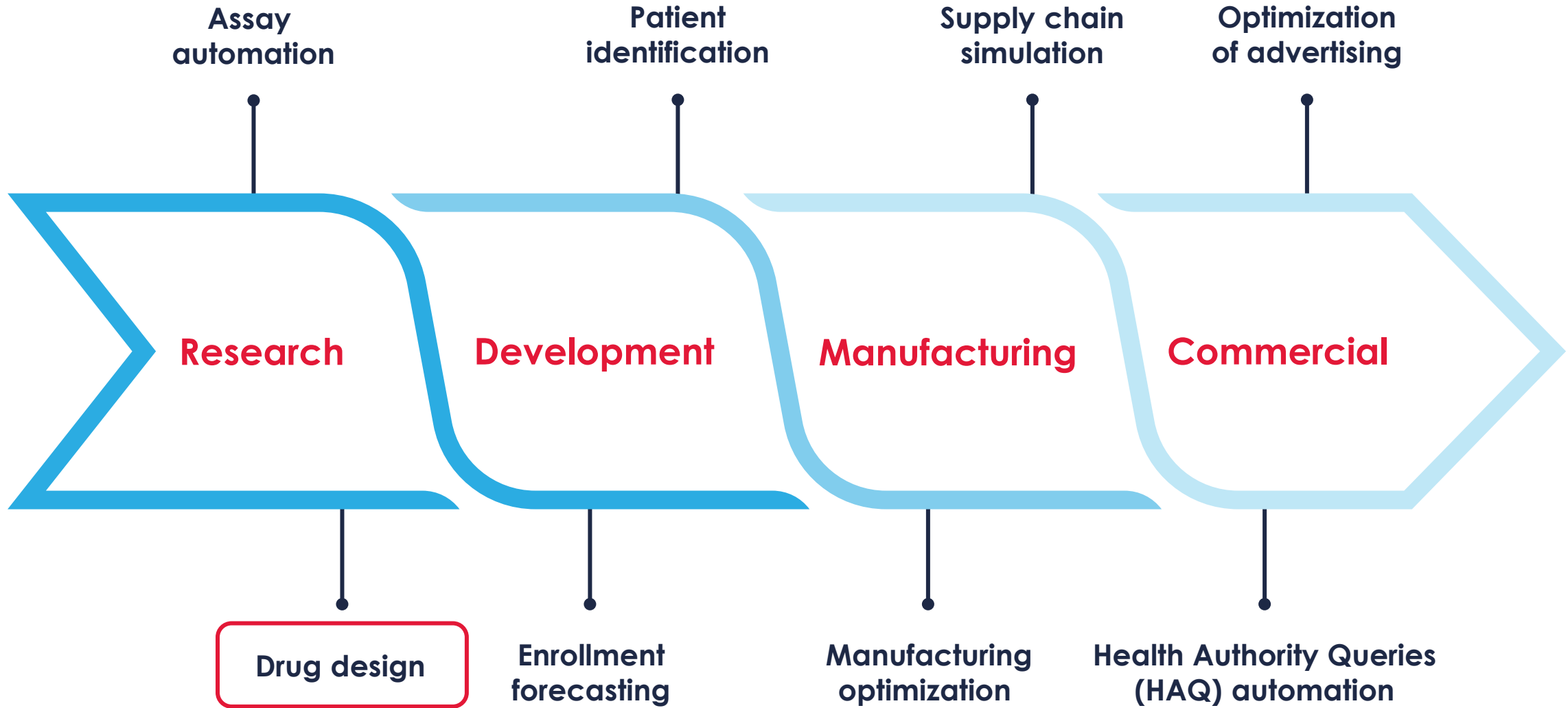
Structured, integrated, clean, machine-readable, accessible, wide scale



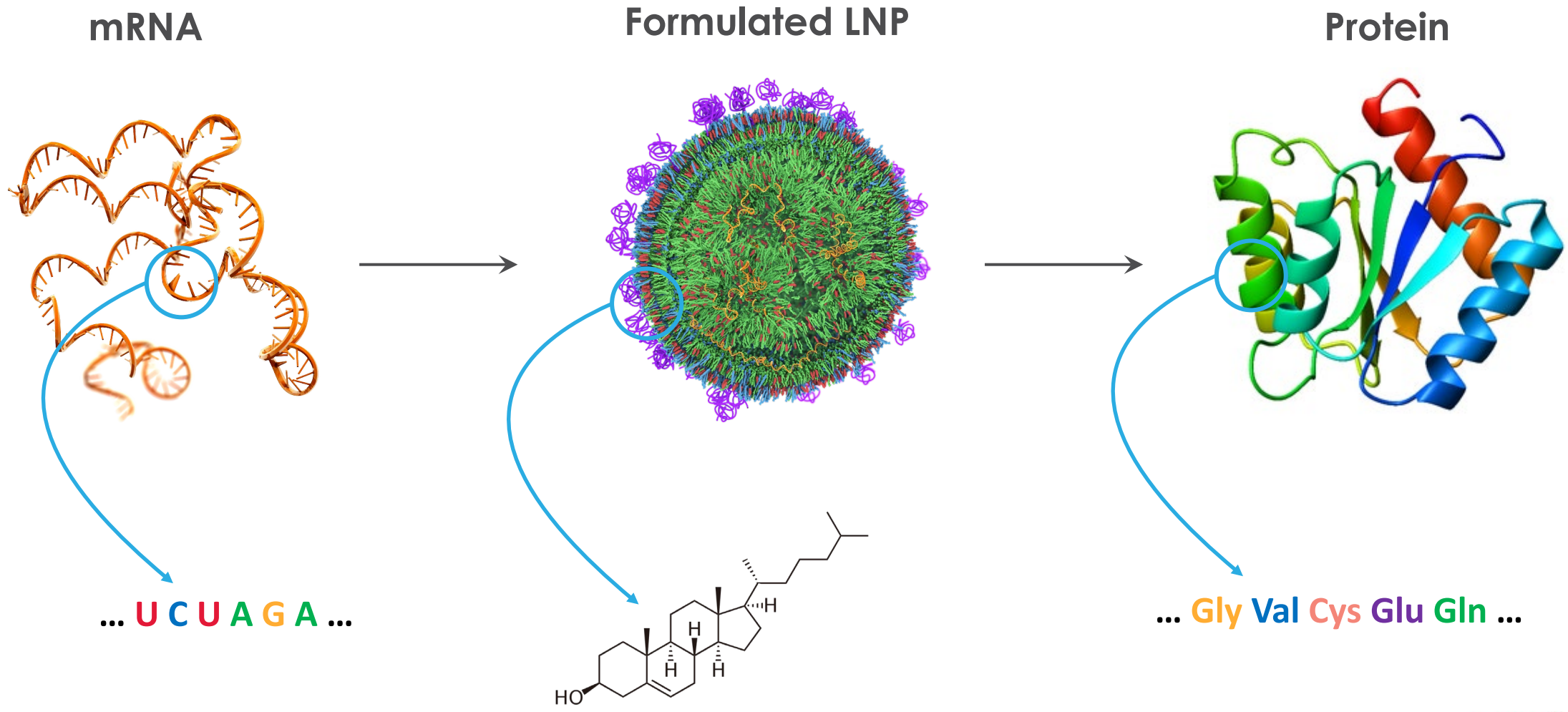
# Successful deployment of Machine Learning (ML) in research paved the way for Moderna's integrated AI ecosystem



# AI applications across the value chain



# Informational nature of mRNA technology lends itself to design and optimization algorithms



# Using AI for mRNA drug design



## Challenges

- Design space is *vast*
  - Proteins:  $20^{\text{(sequence length)}}$
  - mRNA:  $(\text{codon choices})^{\text{(sequence length)}}$
  - Chemistry:  $10^{60}$  or more
- Relationship between sequence, structure and function can be obscure
- Manual exploration/experimentation is slow and expensive



## Goal

Design or optimization mRNA, protein, and LNP components with desired properties:

- Reduced toxicity
- Increased stability
- Increased expression
- Increased manufacturability
- Desirable biodistribution

**AI models form/function relationships, generate new candidates, and help effectively explore design space**

# AI interfaces for drug design



**mRNA  
Backtranslation**



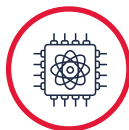
**mRNA  
Design**



**Protein  
Generation**



**IBM Chemical  
Generation**



**IBM Quantum  
Computing**



**DNA Template  
Design**



**Antibody  
Humanization**

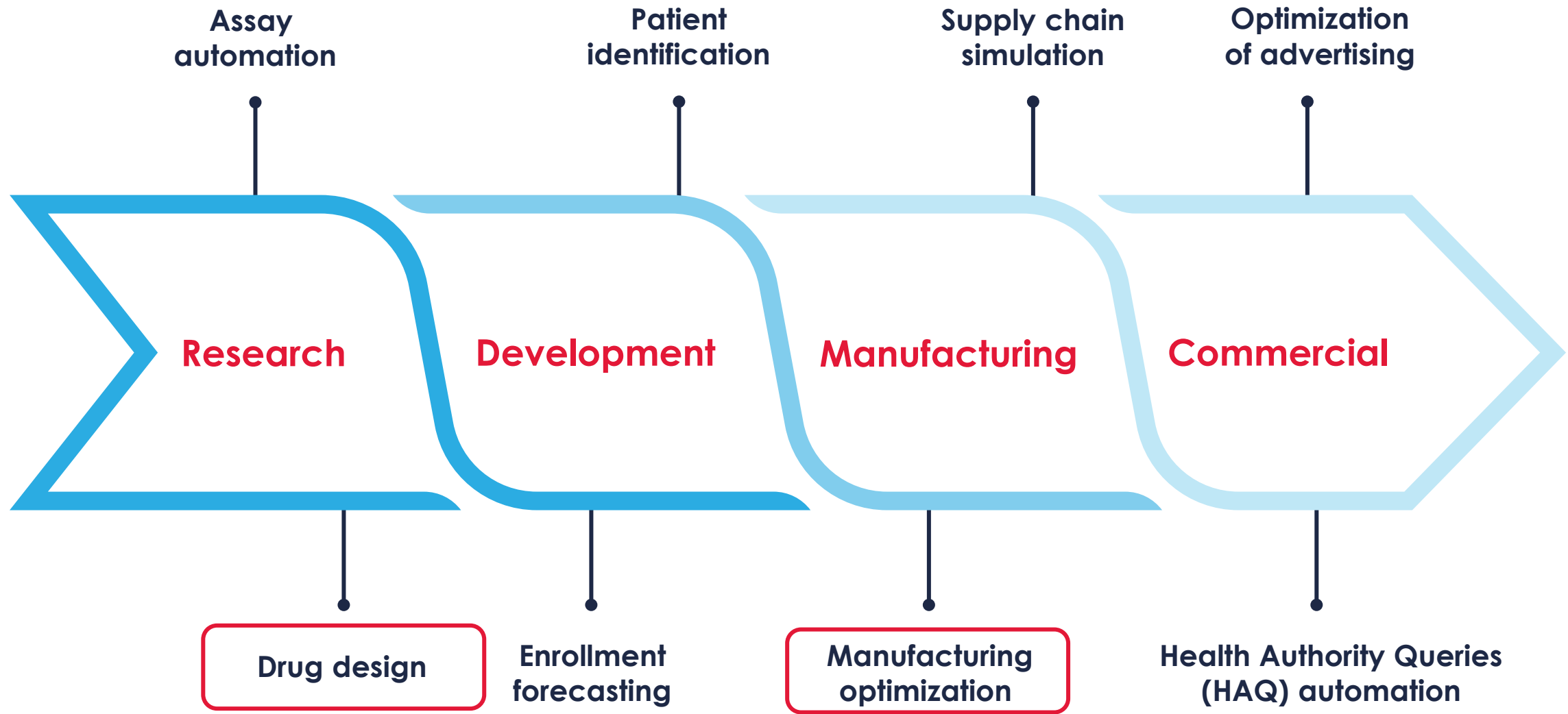


**MHC Affinity  
Prediction**



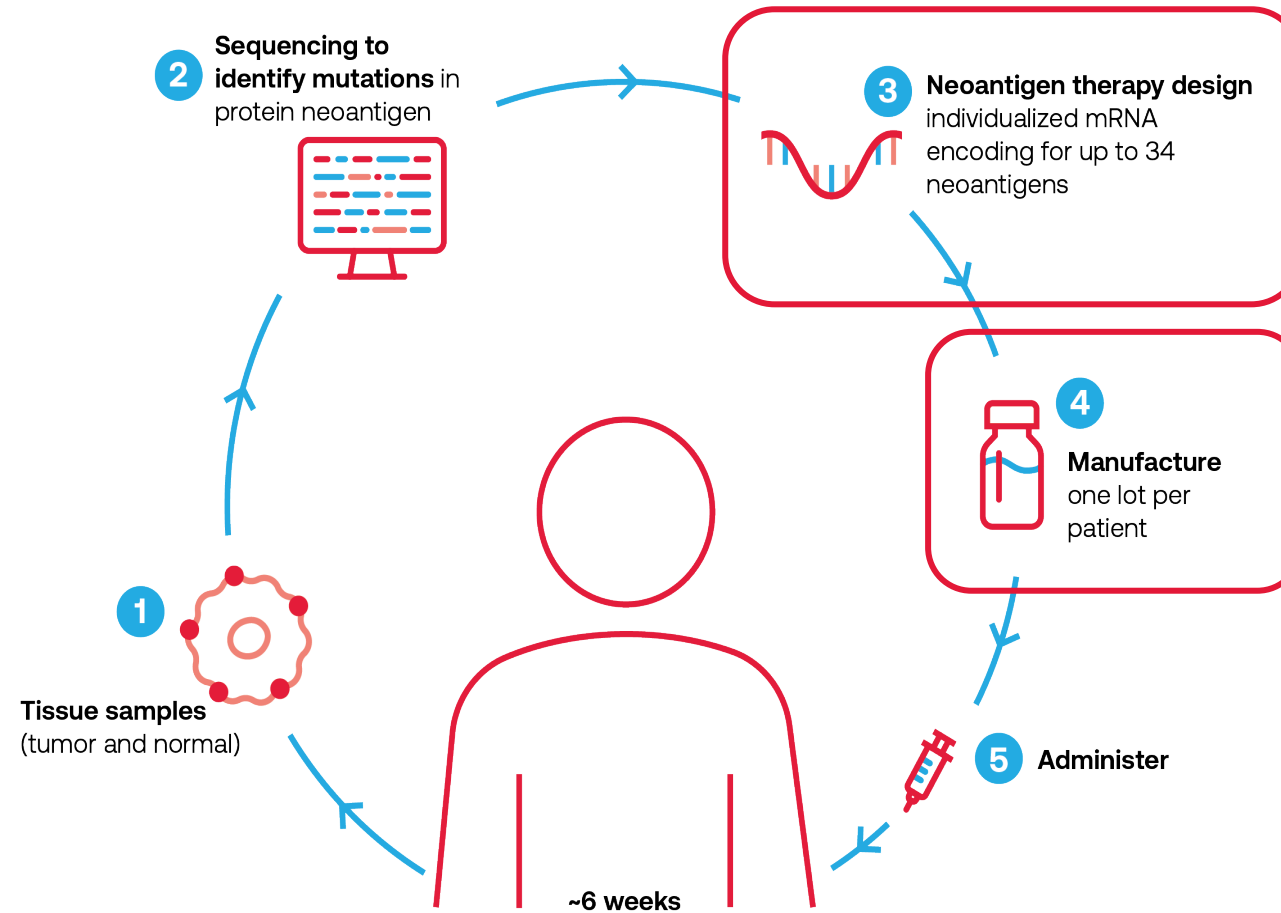
**Rapid Formulation  
Design**

# Individualized neoantigen therapy (INT) use case



# mRNA-4157 (V940): An Individualized Neoantigen Therapy (INT)

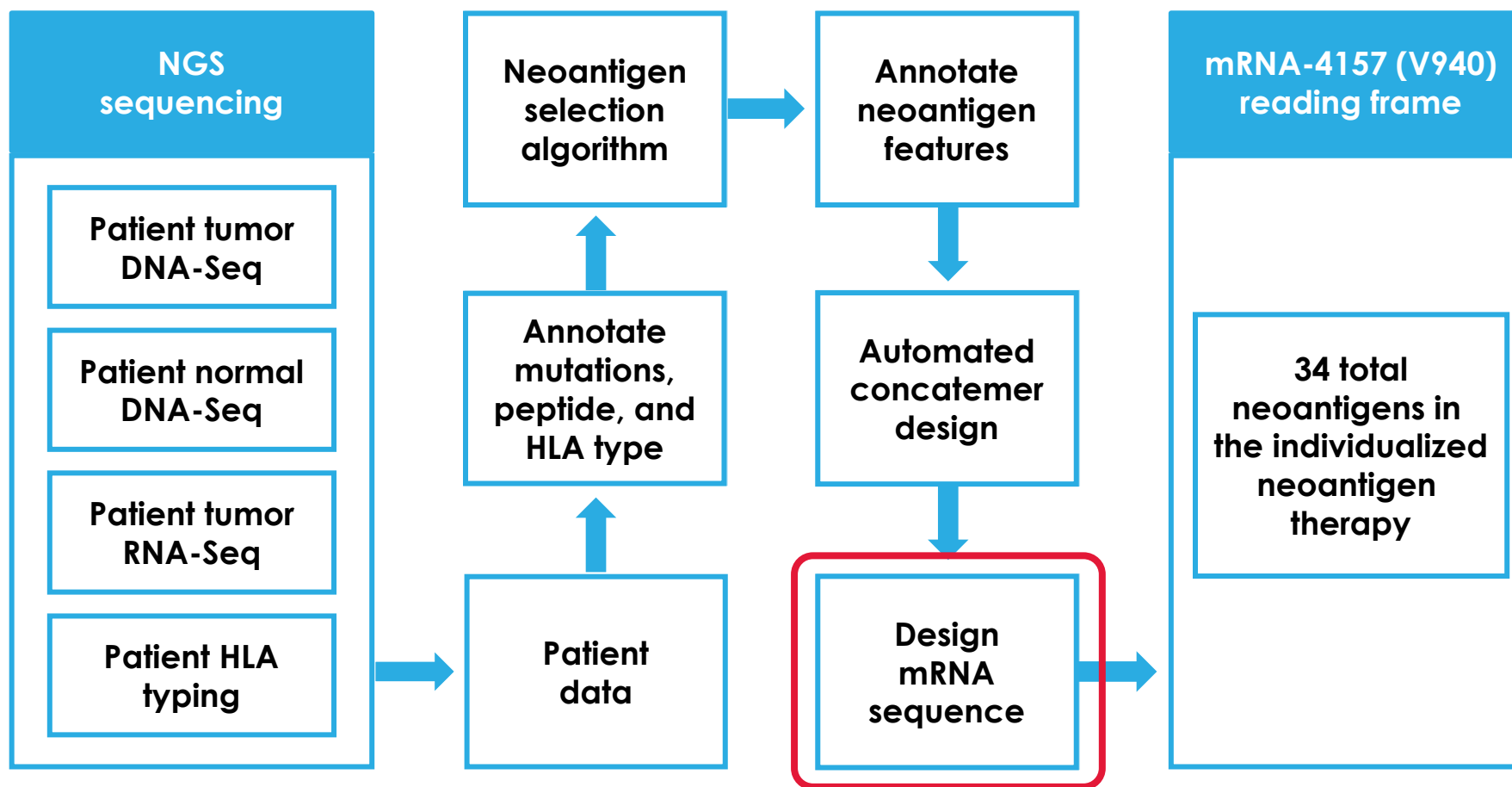
Our individualized neoantigen therapy is designed to target an individual patient's unique tumor mutations and encodes up to 34 neoantigens



DNA-Seq, DNA sequencing; HLA, human leukocyte antigen; mRNA, messenger RNA; NGS, next-generation sequencing; RNA-Seq, RNA sequencing.

# INT drug design algorithm

Our individualized neoantigen therapy is designed to target an individual patient's unique tumor mutations and encodes up to 34 neoantigens



DNA-Seq, DNA sequencing; HLA, human leukocyte antigen; mRNA, messenger RNA; NGS, next-generation sequencing; RNA-Seq, RNA sequencing.



# Impactful use case: Integrated INT manufacture scheduling



## Objective

- Create an infrastructure that enables every mRNA-4157 (V940) patient to receive their initial administration of INT within 6 weeks of enrolling in the study
- Create a digital solution that enhances scheduling for manufacturing of a novel completely individualized therapy, considering the unique aspects of global clinical trials and the intrinsic variability in patient screening and dosing timelines
- Manufacturing adjustments must be executed on a real-time basis to accommodate variability and updates to patient schedule by clinical sites, as well as to ensure a patient-centric approach



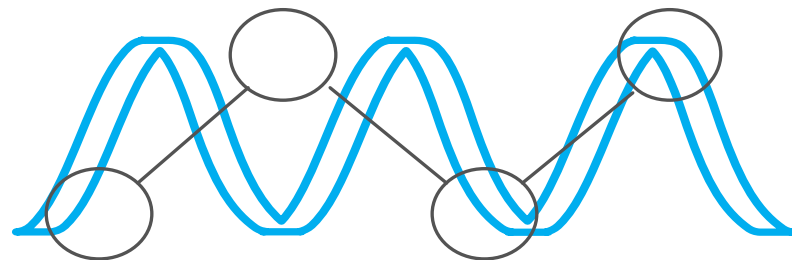
## Solution

- An integrated end-to-end solution to enable the best site and patient experience
- A site-facing interface to connect to individual patient schedules
- AI-optimized manufacture scheduling ensuring timely INT administration for each patient

[Link to webcast to view video presentation](#)



# New products leveraging Moderna's AI architecture



- Competitive intelligence
- Toxicology reports
- PV narratives
- Clinical trials
- QA analytics for SOPs
- Customer 360
- Employee engagement
- RegBot

# The architecture of AI at Moderna

- mChat
- Competitive intelligence
- Toxicology reports
- PV narratives
- Maestro
- Clinical trials
- QA analytics for SOPs
- Customer 360
- Employee engagement
- RegBot

## Products

### Machine Learning Platform

Build and train models

### Generative AI

Vectorizations, embeddings...

### Data Platform

Data store, streaming, and discovery

## Platforms



**Infrastructure:** Integrate technology and large language models

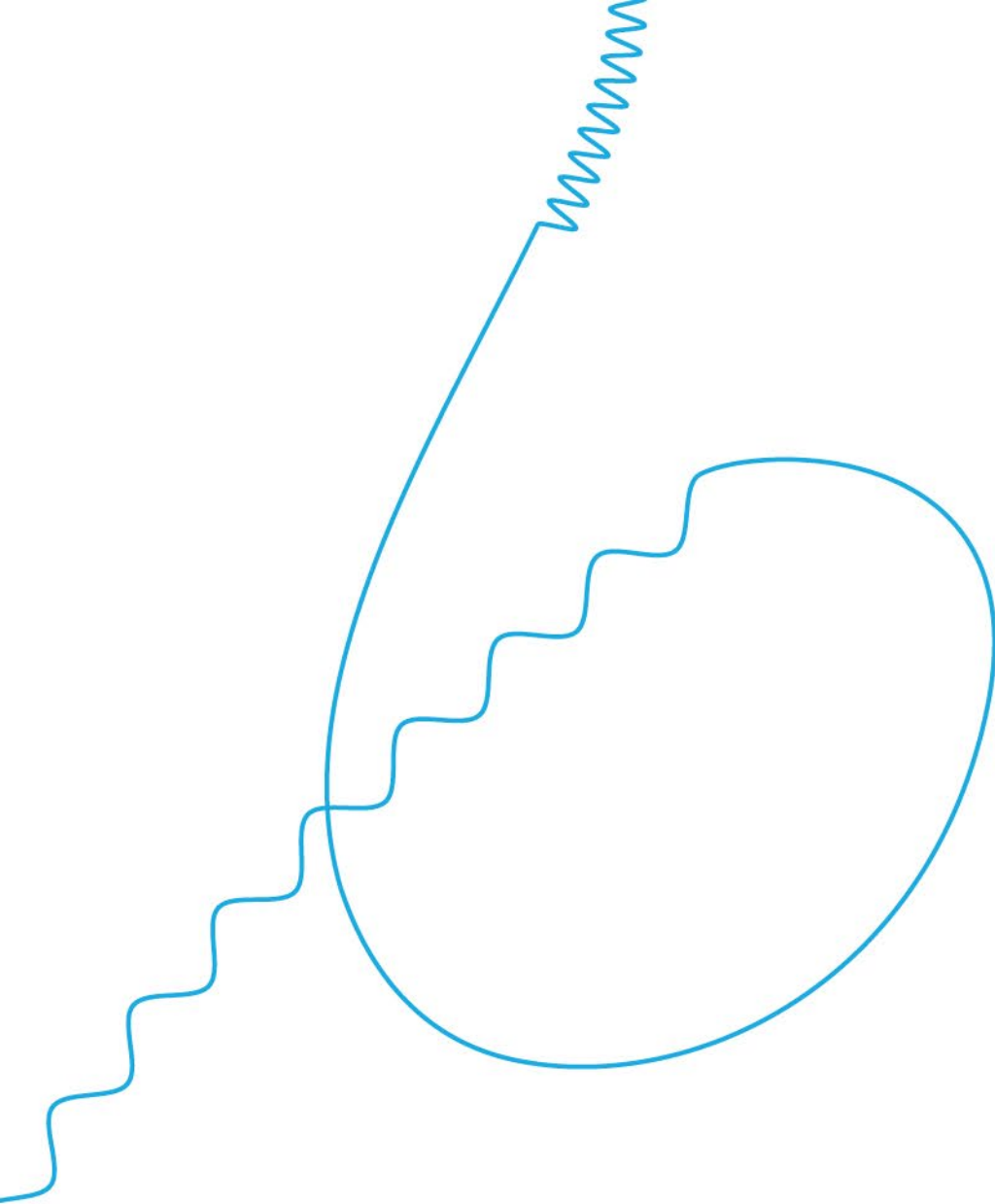
# Introduction to Brice Challamel



**Vice President, Data & AI Transformation, Generative AI**

Previous roles at:





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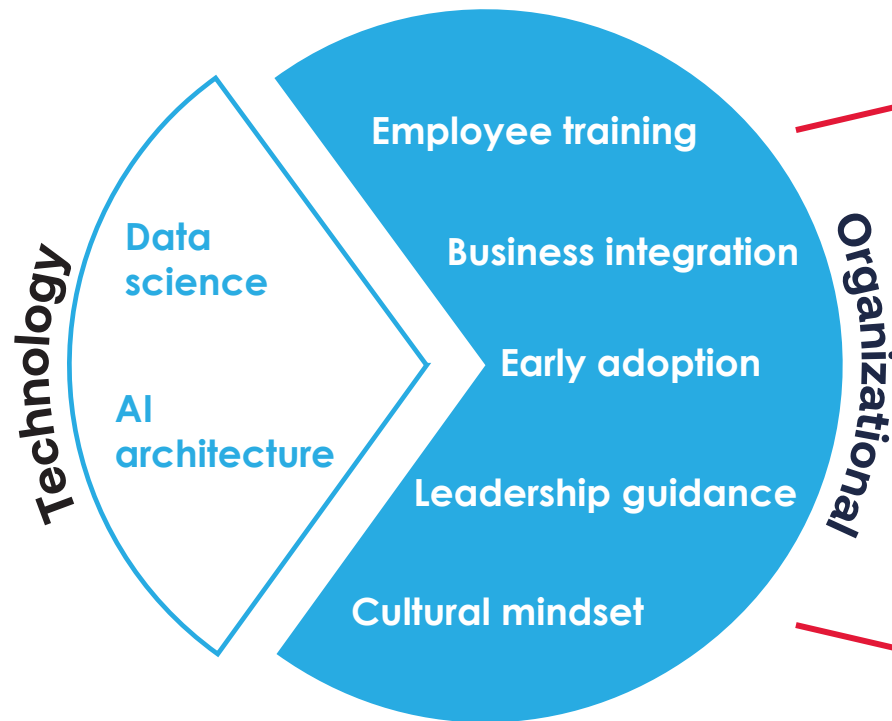
# AI Transformation

**Brice Challamel**

VP, Data & AI Transformation,  
Generative AI

# Successful AI implementation relies on enhancing data science and driving organizational transformation

“There’s a rough rule of 30/70, 30% is tech, 70% is organizational”<sup>1</sup>  
 - Karim Lakhani, HBS



## Our AI transformation pillars

- Productize AI with self-service business driven platforms
- Generate early success symbols in every business line
- Empower all users and leaders with action learning and events
- Grow the AI culture from a core of Champions and Enthusiasts

<sup>1</sup>: <https://hbr.org/podcast/2023/05/how-generative-ai-changes-productivity>  
<sup>2</sup>: <http://dx.doi.org/10.2139/ssrn.4573321>

# Successful AI implementation relies on enhancing data science and driving organizational transformation

## Our AI transformation pillars

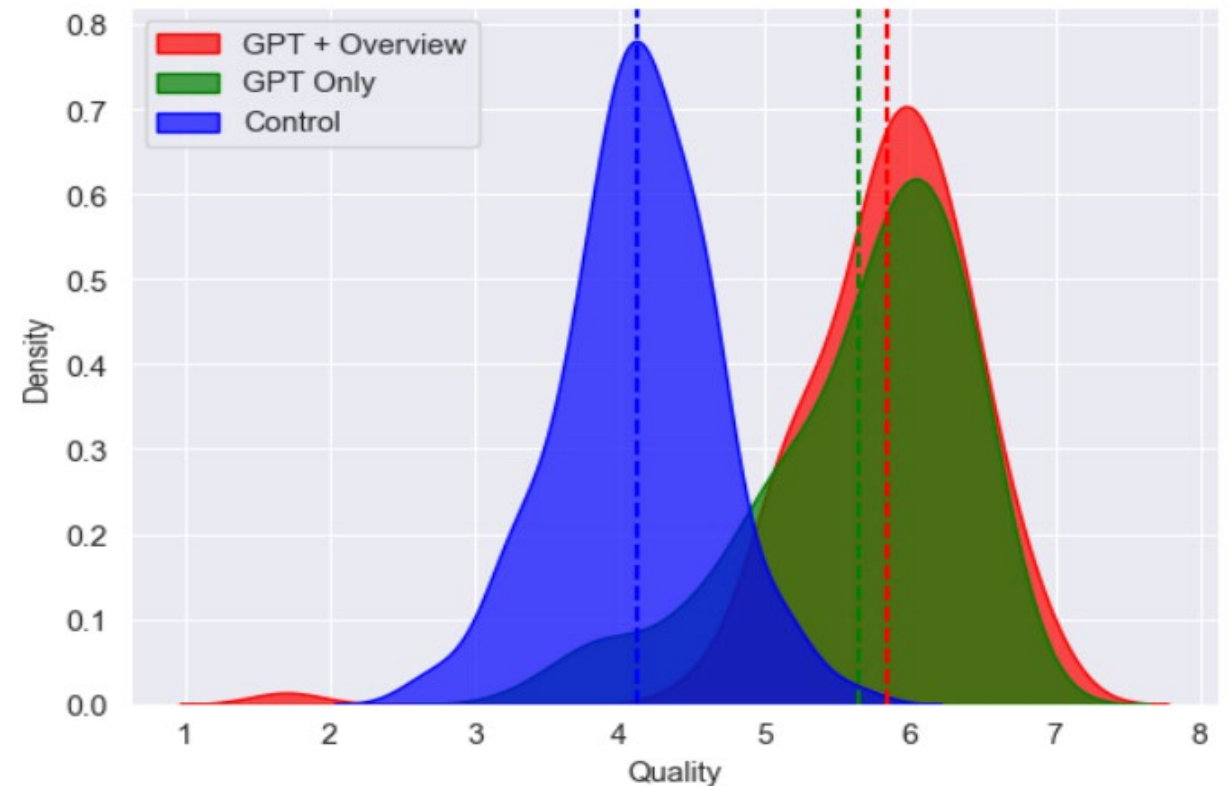
**Productize AI with self-service business driven platforms**

**Generate early success symbols in every business line**

**Empower all users and leaders with action learning and events**

**Grow the AI culture from a core of Champions and Enthusiasts**

## Instruction accelerates transformation



1: <https://hbr.org/podcast/2023/05/how-generative-ai-changes-productivity>

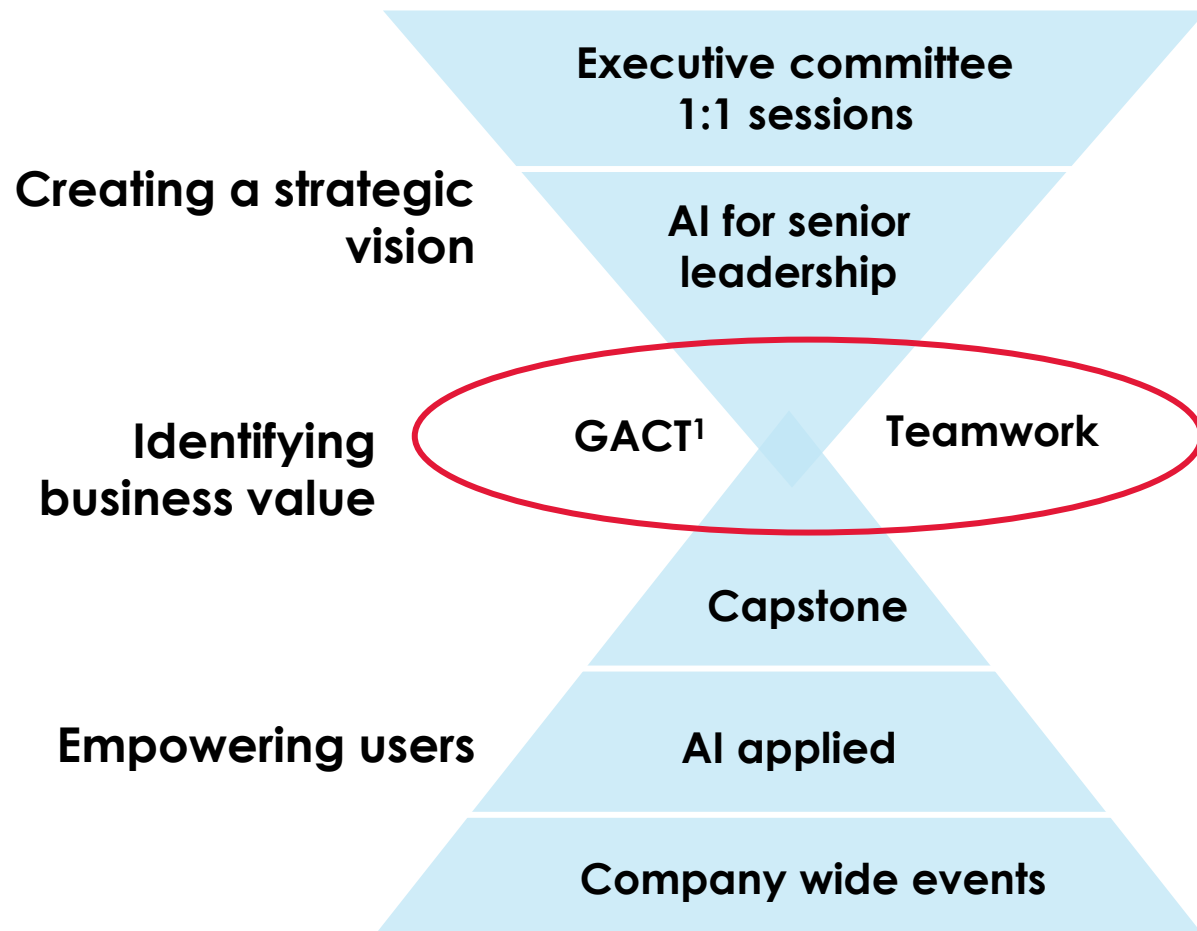
2: <http://dx.doi.org/10.2139/ssrn.4573321>



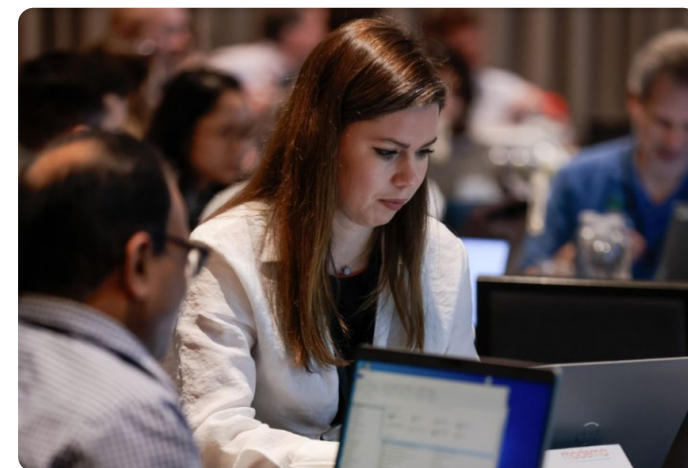


# Empower users and managers with our AI academy

Our AI academy is designed to transform Moderna into a real-time AI organization



<sup>1</sup>Generative AI Champions Team – top 5% mChat users



# Creating customized technology tools

mChat introduces Moderna employees to Gen AI

Progressive **data policy**, from a safer data ecosystem

Ensures responsible AI use cases

Expanded mChat Capabilities with **Document Upload**

X100 larger amounts of information can be shared

Introducing a Simplified Interface for Easier Use

Empowers broad employee uptake

Data Analytics and **Proficiency Tracking**

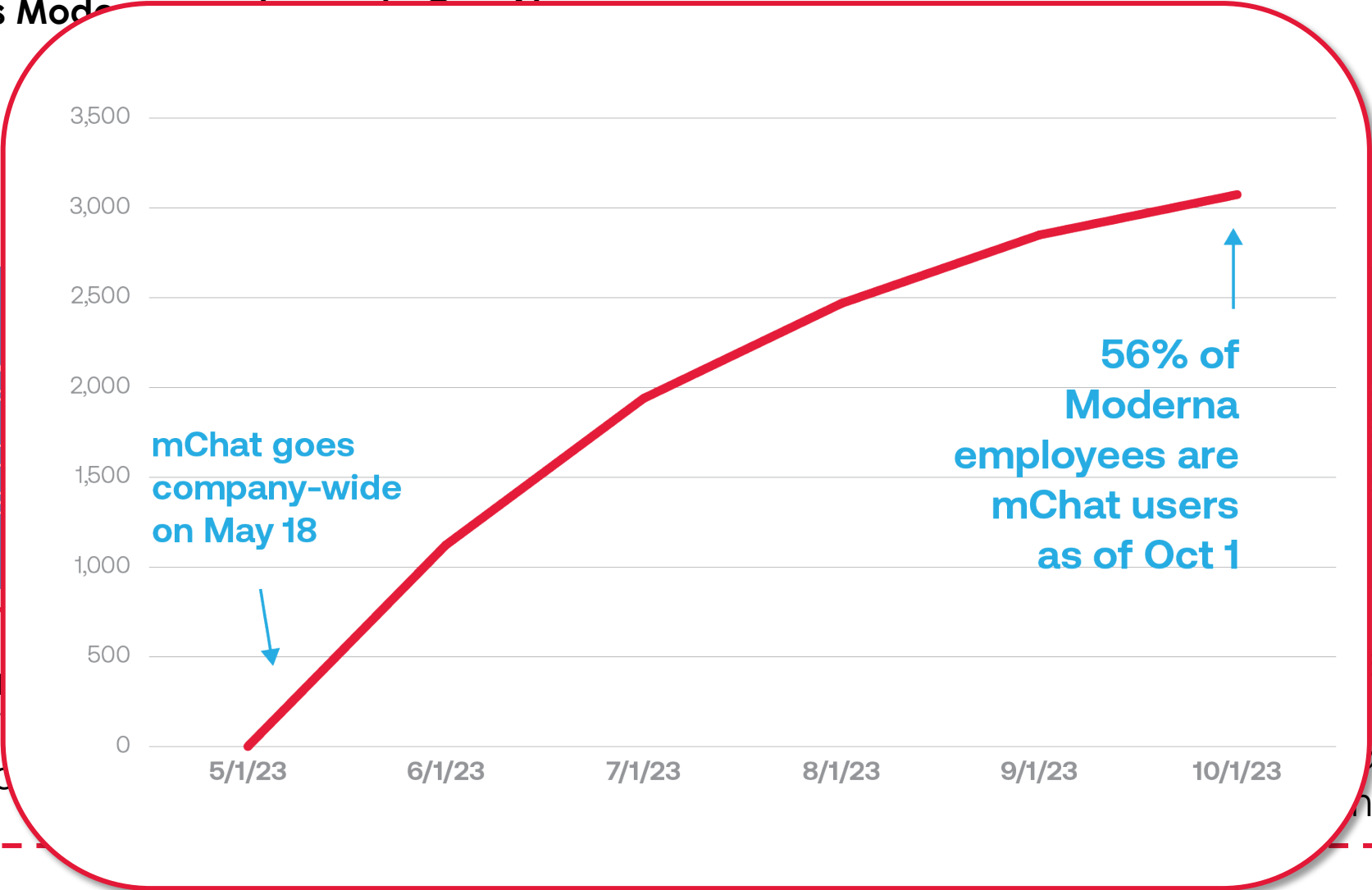
Enables continuous learning and improvement

# Creating customized technology tools

mChat introduces Moderna

Progressive  
policy, for  
safer and  
ecosystem

Ensure  
responsibility  
use cases



Analytics  
agency

Support  
us  
and  
ment

# Leveraging AI to create easy-to-implement, personalized products

Built by Everyone as a self-service capability.

## 1- Superprompts

Extensive instruction, often including multiple prompts for specific, fine-tuned, & controlled outcomes.

E.g., [Speech Generator Superprompt](#) generates high quality speech based on topic and audience

50% of use cases

Built by **Advanced Users**.

## 2- Custom Workflows

Series of prompts and scripts executed one after the other. The result of the first prompt is used in the following prompt.

E.g., [Stardust Email Update](#) automatically pulls data from our datalake, and generates an email with mChat

30% of use cases

Built by **ML & GenAI Engineering Team**.

## 3- Agents/Plugins

Functions or Integrations that expand mChat capabilities towards taking actions or more advanced objectives

E.g., [Image Generation](#) agent is triggered by #createimage to generate images based on text.

15% of use cases

Built by your assigned **PM & DBR**, with CVM prioritization

## 4- Net New Product

Separate Product & Interface with unique requirements & capabilities for business-critical tasks.

E.g., [Marketing Campaign Local Generation Engine](#)

5% of use cases

# Leveraging AI to create easy-to-implement, personalized products

Built by Ever...  
service cap...

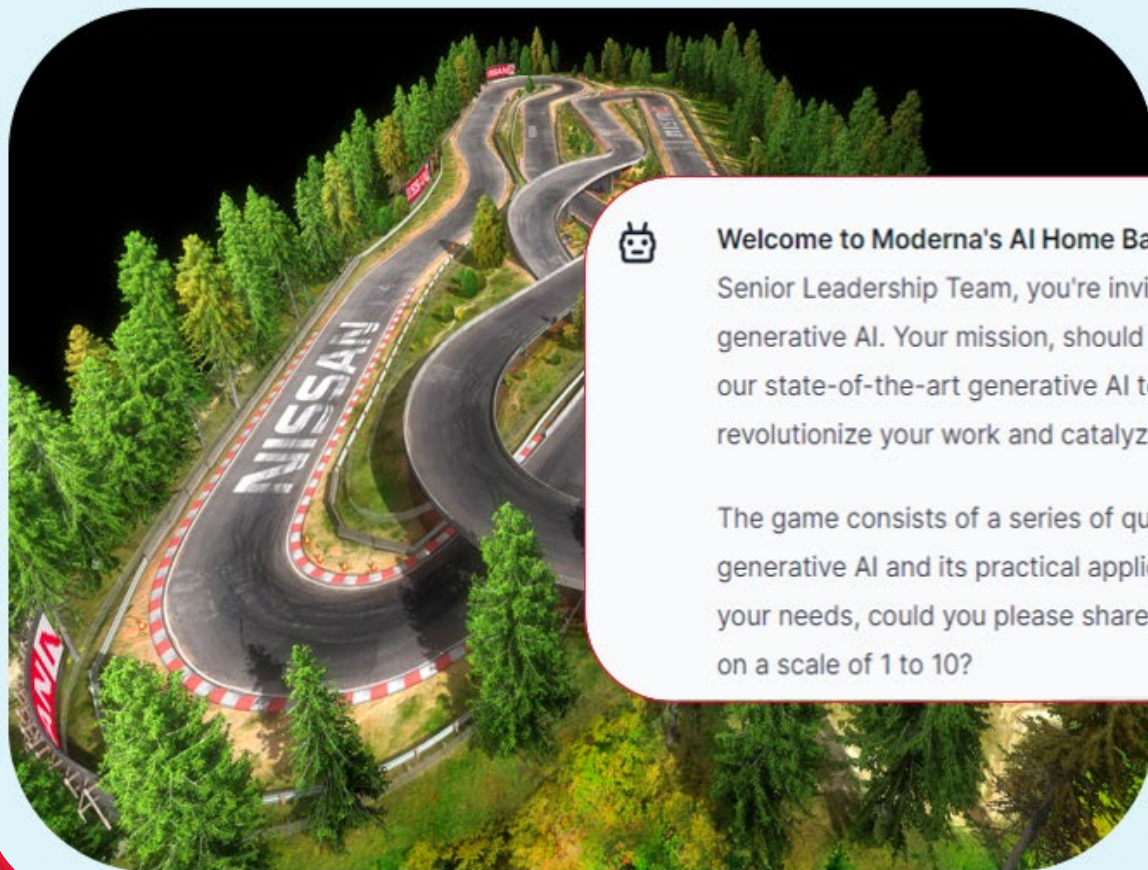
## 1- Superprompts

Extensive...  
often incl...  
prompts f...  
tuned, &...  
outcome

E.g., Speed...  
Superprom...  
high qual...  
based on...  
audience

## Superprompts

Ready to begin your **Gran Turismo** experience?



Welcome to Moderna's AI Home Base Adventure! As a distinguished member of our Senior Leadership Team, you're invited to journey into the fascinating realm of generative AI. Your mission, should you choose to accept it, is to master the use of our state-of-the-art generative AI tool, mChat, and unlock its potential to revolutionize your work and catalyze innovation in your department.

The game consists of a series of quests designed to enhance your understanding of generative AI and its practical applications within your field. To tailor the adventure to your needs, could you please share your name, role, and familiarity with generative AI on a scale of 1 to 10?

W

50% o

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PM &  
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business-

Campaign  
Engine



# Leveraging AI to create easy-to-implement, personalized products

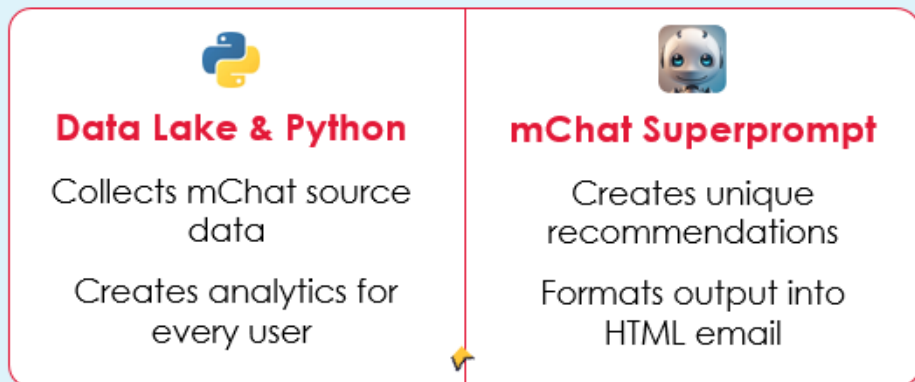
Built by Ever...  
service cap...

## 1- Super

Extensive i...  
often inclu...  
prompts fo...  
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outcomes

E.g., Speed...  
Superprom...  
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## Custom workflow: mChat Stardust

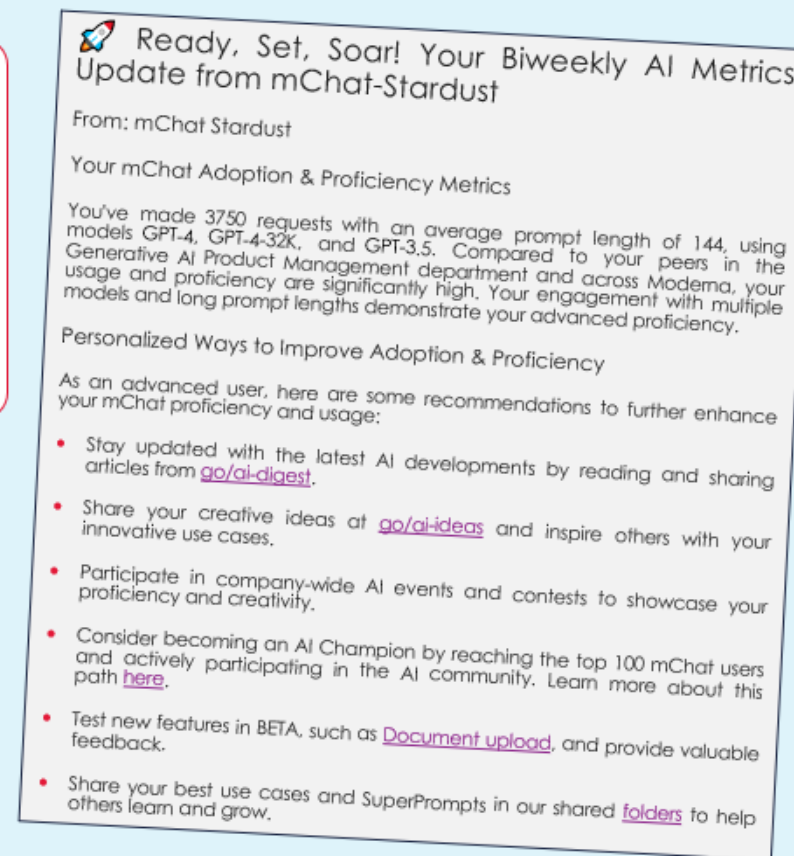


**Email delivered bi-weekly**

Hyper Personalized

Always Different

Automated & Private



PM &  
station

Product

&  
ue

Business-

Campaign  
Engine

ases

50% of

# Leveraging AI to create easy-to-implement, personalized products

Built by Ever...  
service cap...

## 1- Super...

Extensive...  
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tuned, &...  
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E.g., Spee...  
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audience

## Net New Product - Marketing Campaign Local Gen. Engine

The screenshot shows a web editor interface for the 'ImmunoShield US Website'. The top navigation bar includes 'Tasks', 'Library', 'Text Assets', 'Content Modules', 'Reports', 'Dashboards', 'Admin Tools', and 'Portal'. A '+ Create' button and a settings gear icon are on the right. Below the navigation, the page title is 'ImmunoShield US Website'. A progress bar shows the current stage: 'Proofing and compliance' (active), with other stages being 'Pre-Approval', 'In Review and approval', 'Submission to health and safety', and 'Approved'. The main content area displays a Japanese version of the website. It features a header with the 'slalomTherapeutics' logo and a paragraph of Japanese text. Below this, there are three statistics: '99%' (効率), '+1.5mil' (ワクチン接種を受けた米国の成人), and '700k' (予防接種会場). The main headline asks 'ImmunoShield ワクチンをお探しですか?' (Are you looking for ImmunoShield vaccine?). At the bottom, it says 'ワクチンを見つける近くの場所!' (Find the nearest place to get the vaccine!). On the right side of the editor, there are controls for 'Detected language' (English) and 'Target language' (Japanese). A notification box states 'GenAI has 2 recommendations.' with 'View' and 'Dismiss' buttons. Below that is an 'Edit text' section with a placeholder 'Select text to edit manually.'

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## Product

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50% o...

# Leveraging AI to create easy-to-implement, personalized products

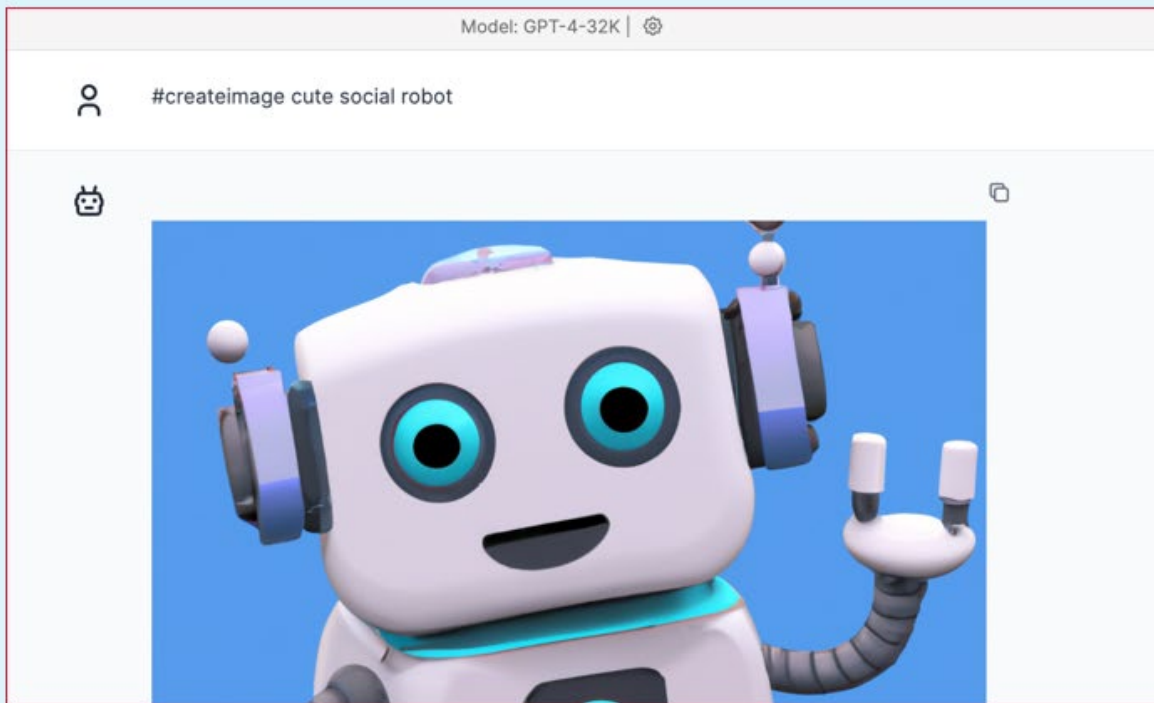
Built by Ever...  
service cap...

## 1- Super

Extensive  
often incl  
prompts f  
tuned, &  
outcome

E.g., Spee  
Superpro  
high qual  
based on  
audience

### Agent / Plugin: Image Generation



#createimage

Requests Action from an  
Image Generation Model

Delivers AI Image in mChat

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## Product

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n Engine

50% of use cases

60% of use cases

70% of use cases

80% of use cases

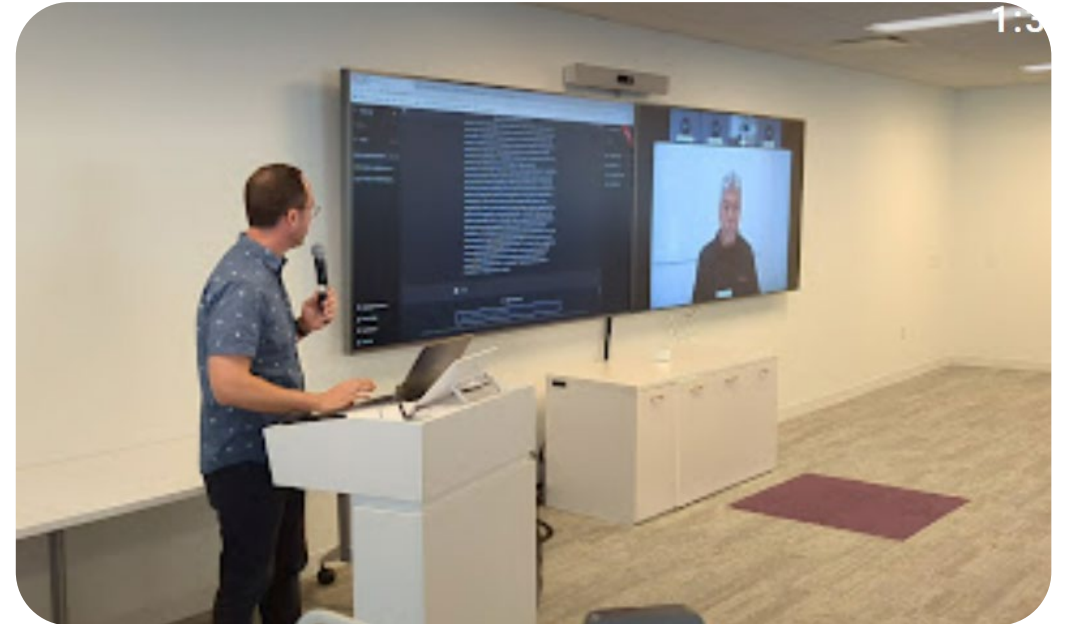


# Building and maintaining an AI culture

## Training sessions for employees

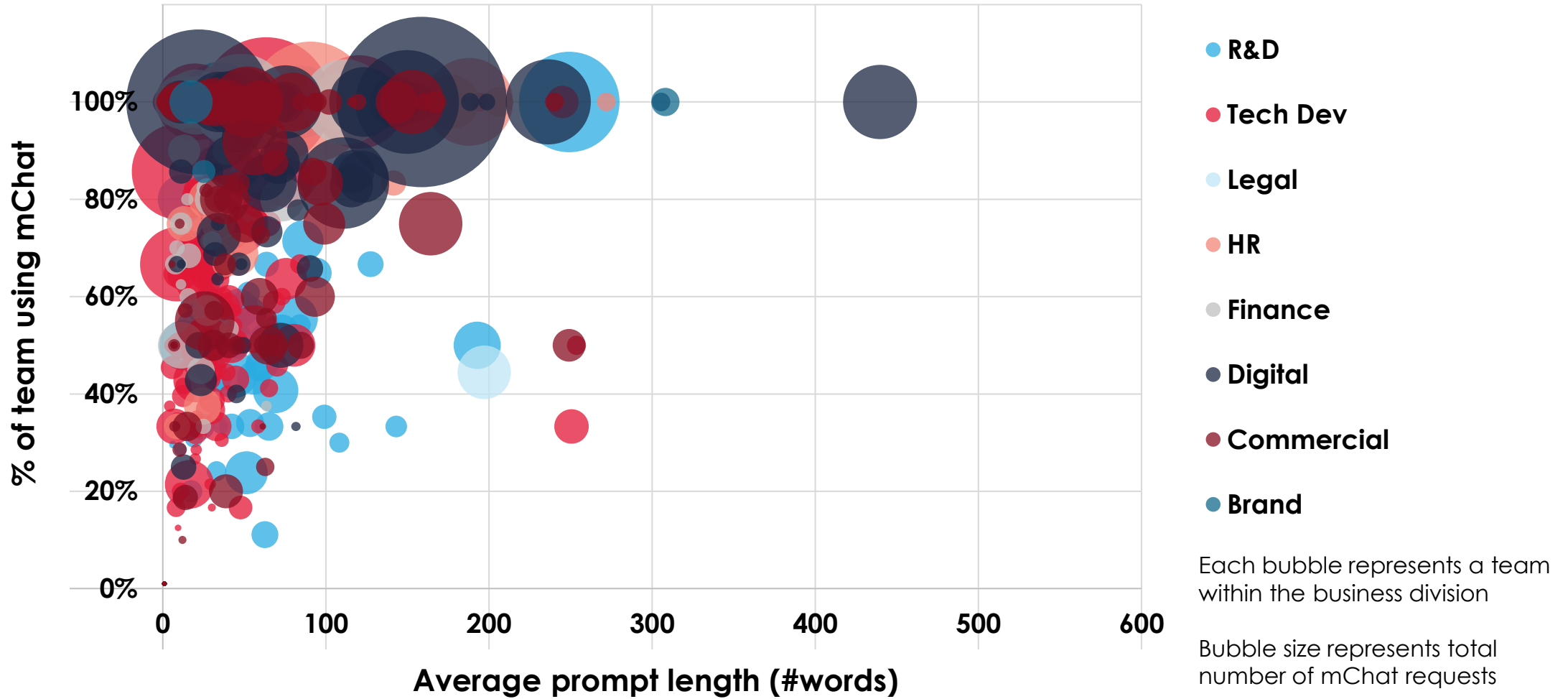


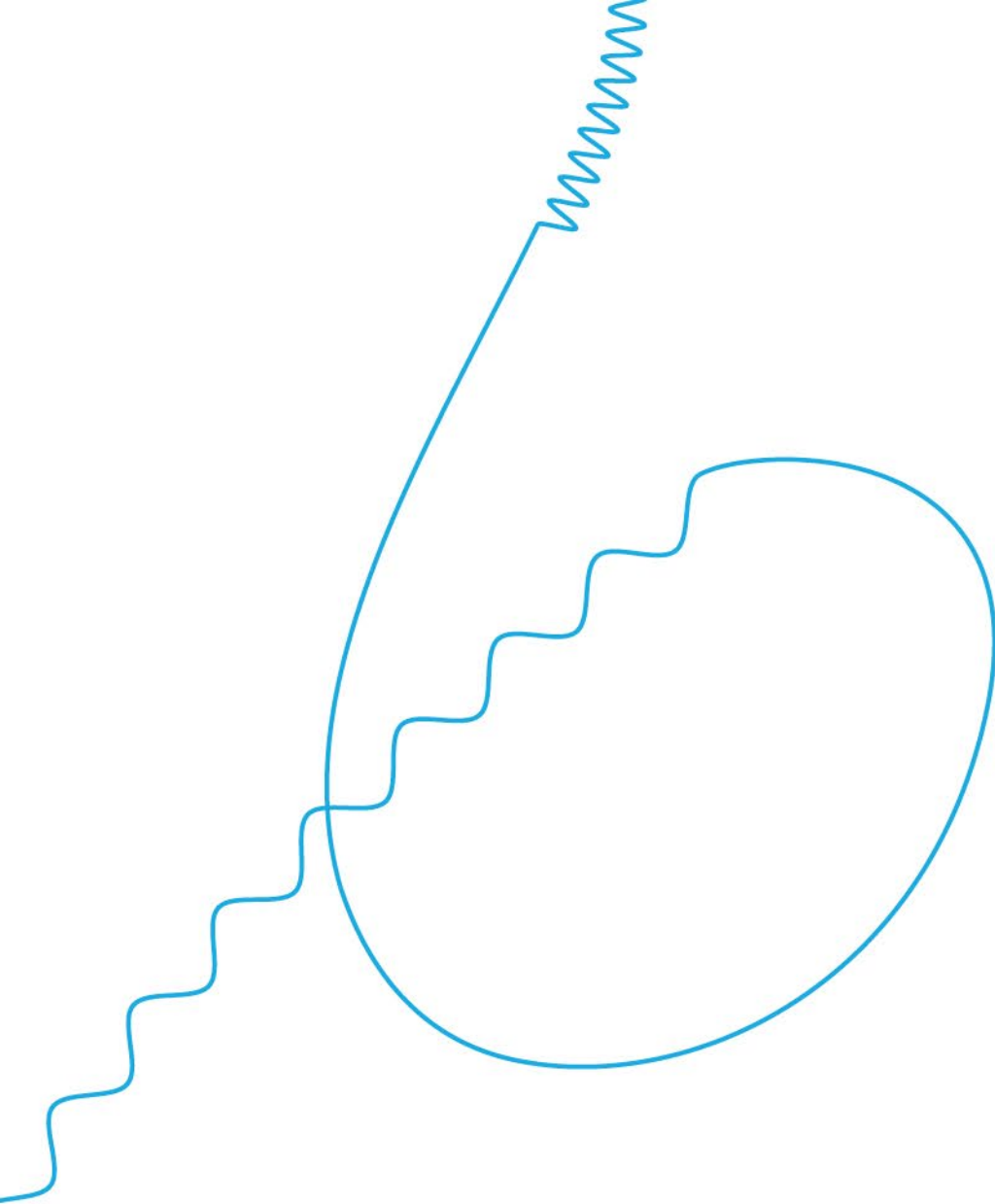
## Functional workshops with expert speakers



Periodic training sessions and workshops facilitate company-wide AI adoption and culture

# AI is being adopted across work functions





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# Conclusion

**Brad Miller**

*Chief Information Officer*

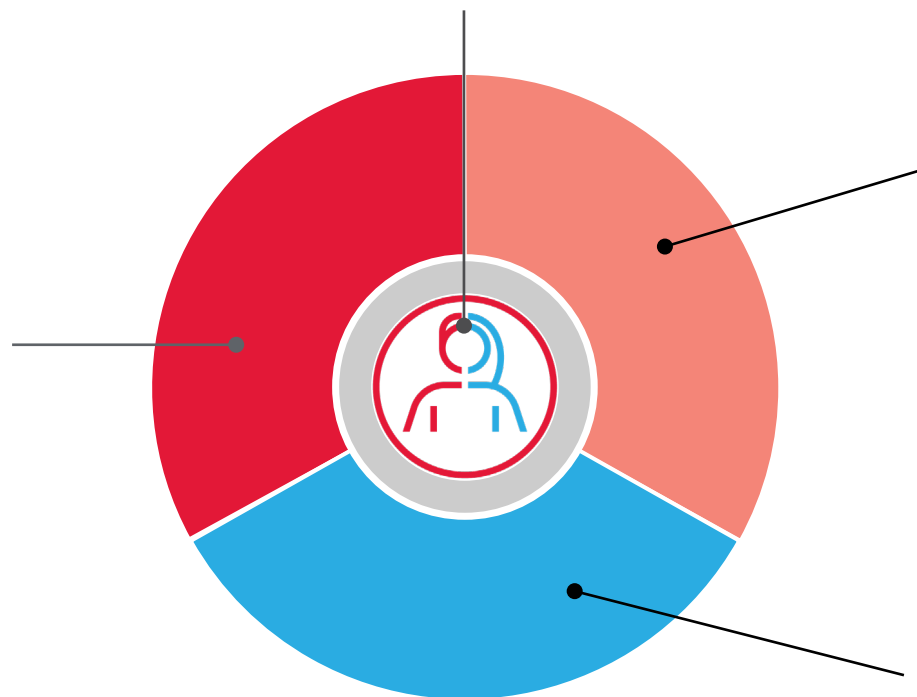
# Democratizing AI transforms how people are working

## AI User

Enabling people to create value measured in **efficacy** (do better) and **efficiency** (do more) at the center of our operating model

## AI Culture

Foster vital behaviors for AI adoption and proficiency with individual, collective and structural motivators



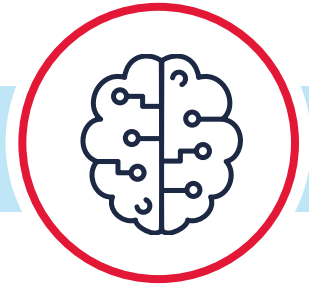
## AI Business

Powered by AI technology, business owners/leaders create AI products to meet business needs

## AI Architecture

- AI Infrastructure
- Platform capabilities that enable scaled AI solutions
- Framework to quickly build AI products

# AI use case portfolio is expanding...



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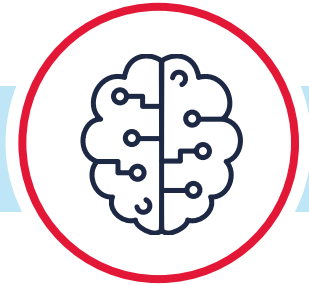
machine learning  
(ML) use cases  
added



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large language model  
(LLM) use  
cases added

# AI use case portfolio is expanding...



999

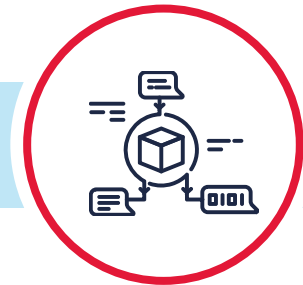
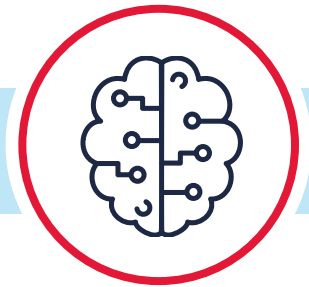
machine learning  
(ML) use cases  
added



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large language model  
(LLM) use  
cases added

# AI use case portfolio is expanding...

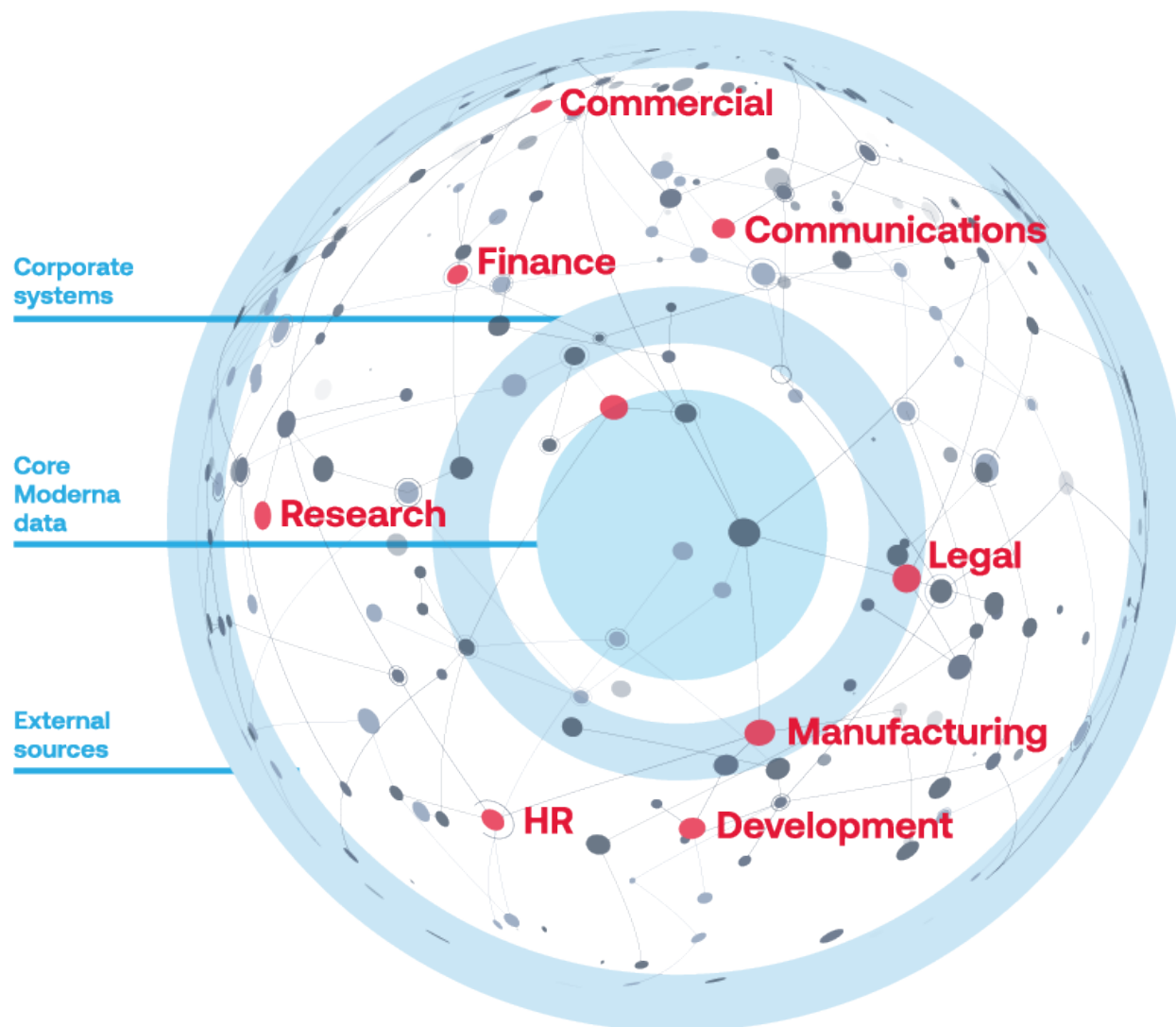


**...and is growing daily**

**machine learning  
(ML) use cases  
added**

**large language model  
(LLM) use  
cases added**

# Moderna's integrated AI ecosystem is generating many use cases daily across functions



## AI-driven impact

### Commercial

Drive '24 sales with smaller sales force

### Manufacturing

Automate operations, reduce COGS, unlock process innovation

### Research & Development

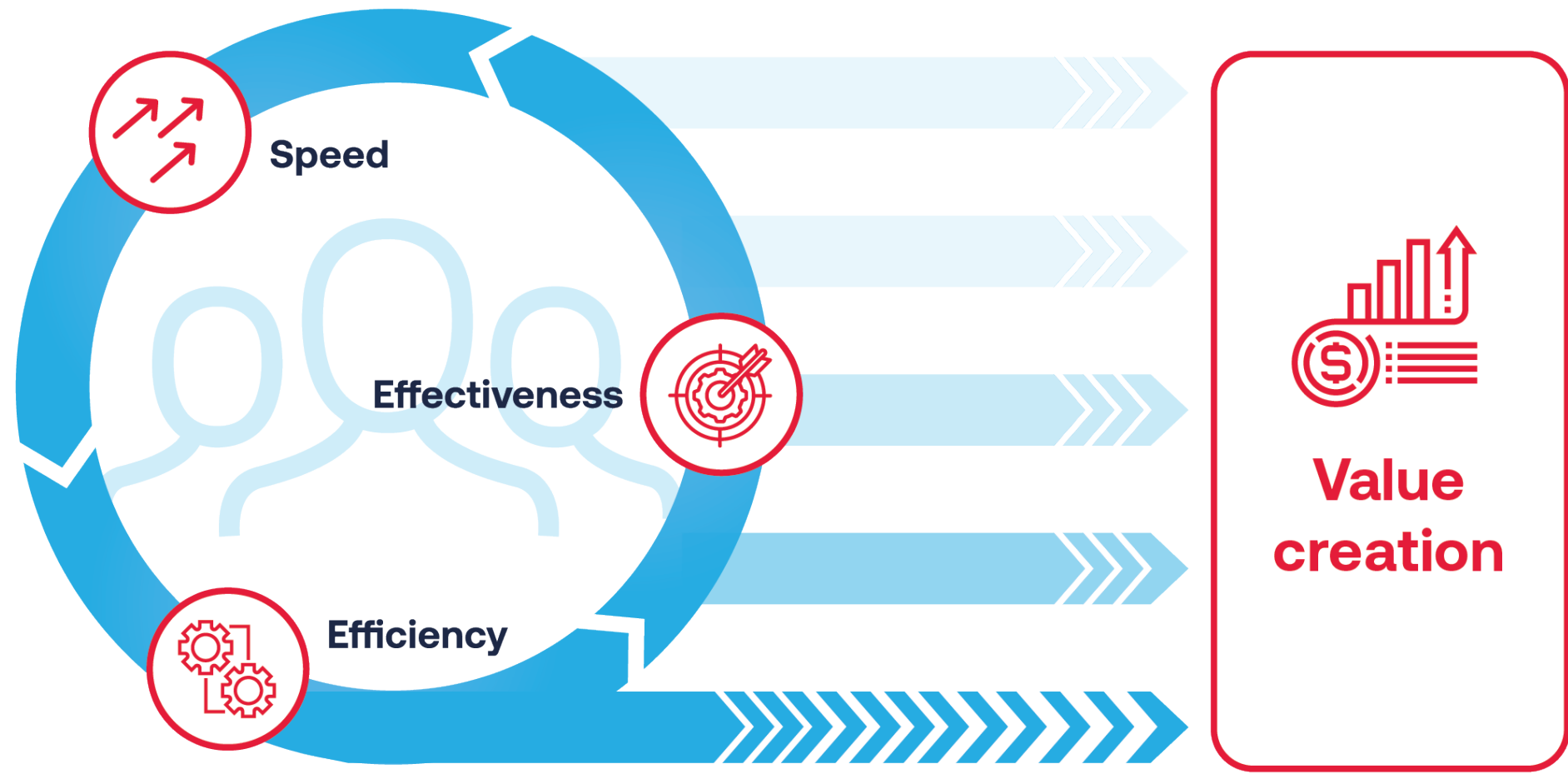
Accelerate research and clinical development

### Corporate Technology

Make SG&A scalable, productivity gains



# The impact of digitalization and AI



## We are building a real-time AI company

To **DELIVER** the greatest possible impact to **PEOPLE** through **mRNA MEDICINES**

# Anticipating up to 15 product launches over the next 5 years

Our mRNA platform is delivering across cancer, rare disease, and infectious diseases

	Respiratory vaccines	Latent/other vaccines	Oncology	Rare disease			
by 2025	<b>RSV (older adults)</b> mRNA-1345	<b>Seasonal Flu</b> mRNA-1010					
	<b>Flu/COVID</b> mRNA-1083	<b>NextGen COVID</b> mRNA-1283					
by 2028	<b>Flu/COVID/RSV</b> NextGen	<b>RSV/hMPV (older adults)</b> mRNA-1365	<b>CMV</b> mRNA-1647	<b>INT (adjuvant melanoma)</b> mRNA-4157	<b>MMA</b> mRNA-3705	<b>PA</b> mRNA-3927	
	<b>RSV (2-18Y)</b> mRNA-1345	<b>Pandemic Flu</b> mRNA-1018	<b>EBV (IM)</b> mRNA-1189	<b>Lyme</b> mRNA-1975/-82	<b>INT (undisclosed indication)</b> mRNA-4157	<b>PKU</b> mRNA-3210	<b>GSD1α</b> mRNA-3745
	<b>NextGen Flu</b> mRNA-1011/-1020	<b>Endemic hCOV</b> mRNA-1287	<b>VZV</b> mRNA-1468	<b>HSV</b> mRNA-1608	<b>INT (adjuvant NSCLC)</b> mRNA-4157		
							<i>Subject to regulatory discussions<sup>1</sup></i>

Note: Subject to positive clinical data and regulatory discussions/approvals  
 1 Subject to future regulatory discussions, there may be potential for accelerated or conditional approvals in some markets  
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# Q&A

