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Pharma R&D Annual Review 2023

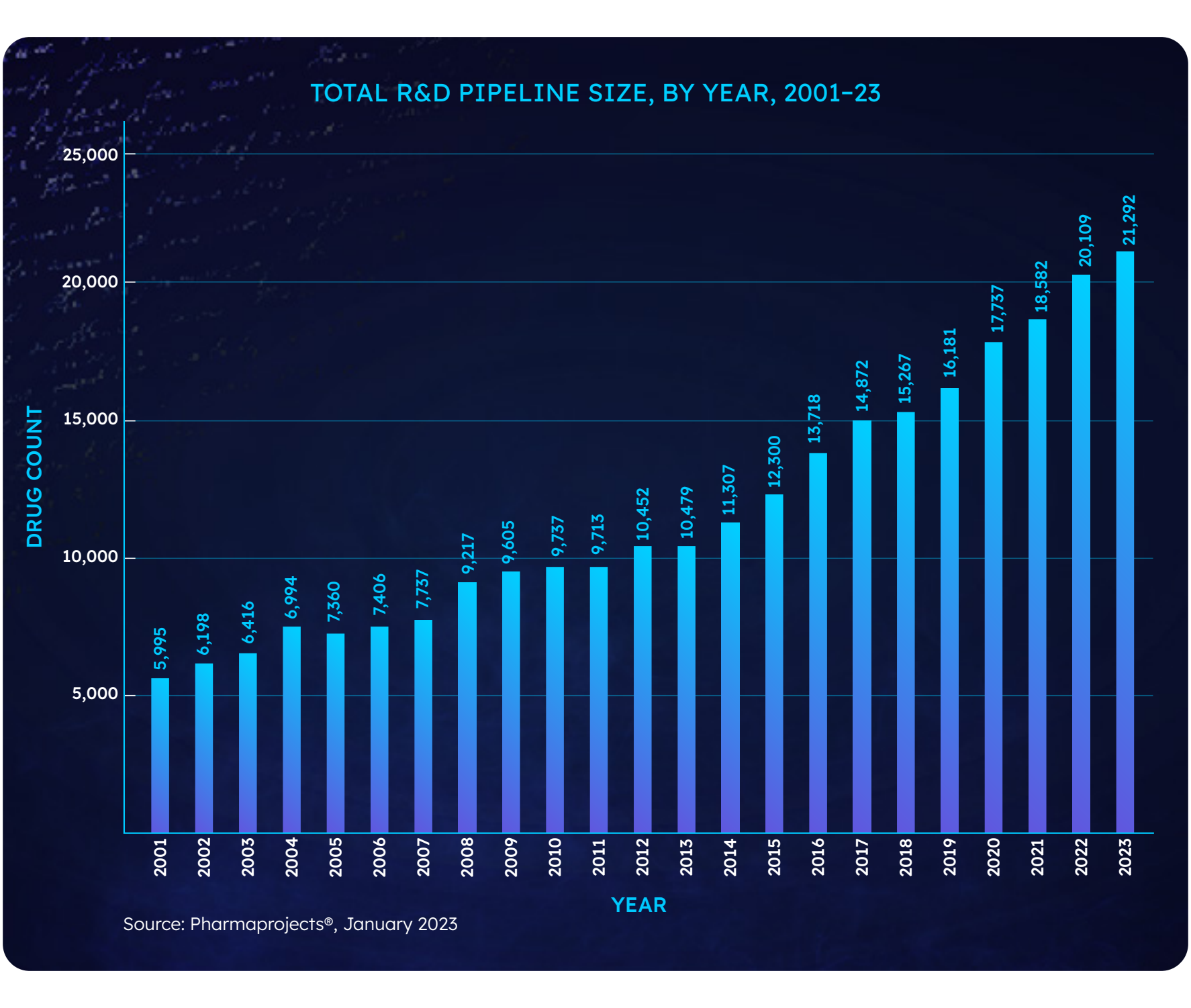
Reimagining the future one chapter at a time

To help illustrate our findings, we've turned to the world of literature. Perhaps one of the most famous opening lines to a novel that best describes the experience of pharma over the past few years is from Charles Dickens' seminal 1859 opus, A Tale of Two Cities: ***"It was the best of times, it was the worst of times…."*** It appears the pharmaceutical industry is emerging from the tumultuous episode of the COVID-19 pandemic stronger and emboldened.

"The beginning is always today"
— Mary Shelley, Short Stories Vol. II (2014)

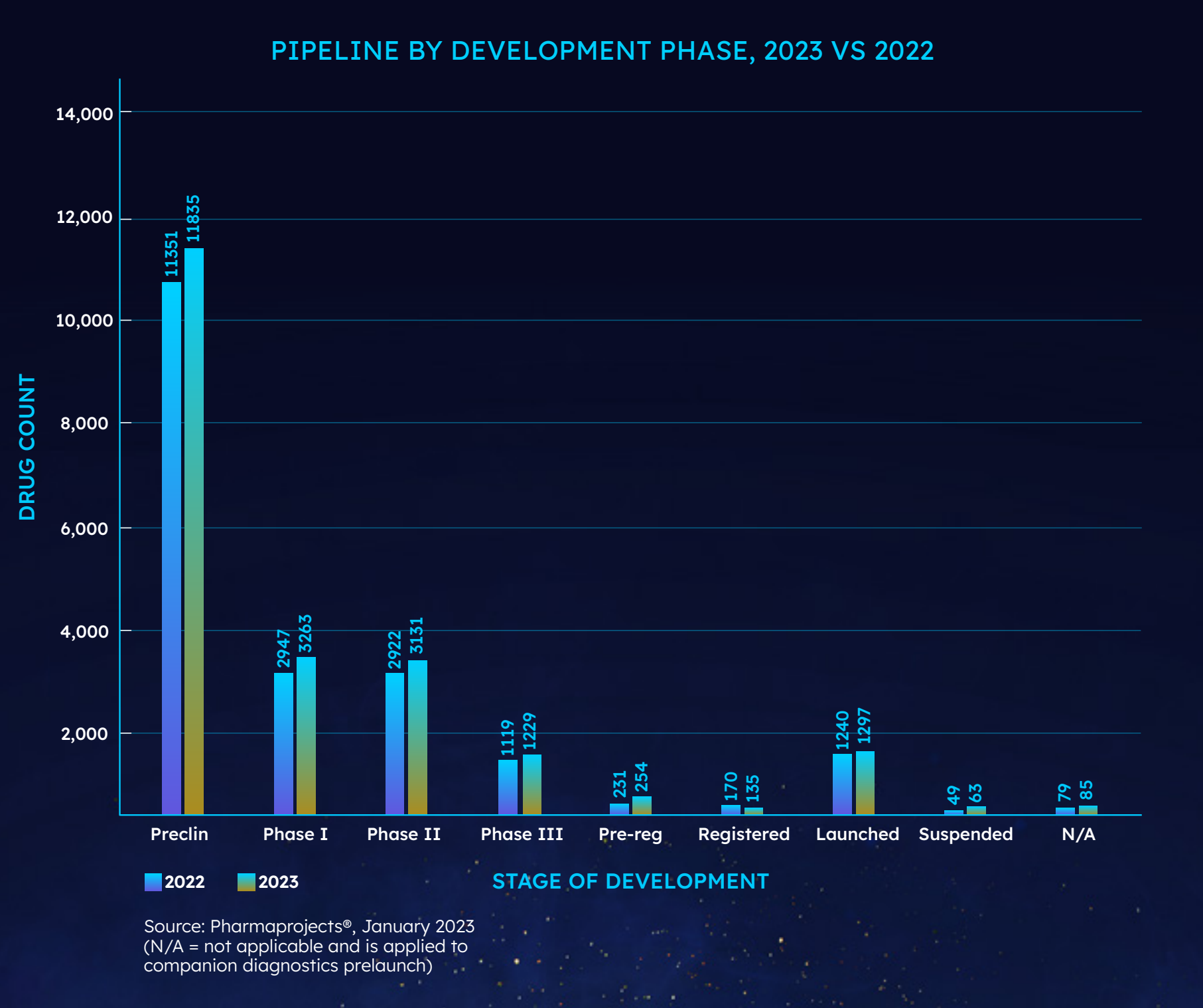
Chapter One
An Introduction: Total Pipeline Size

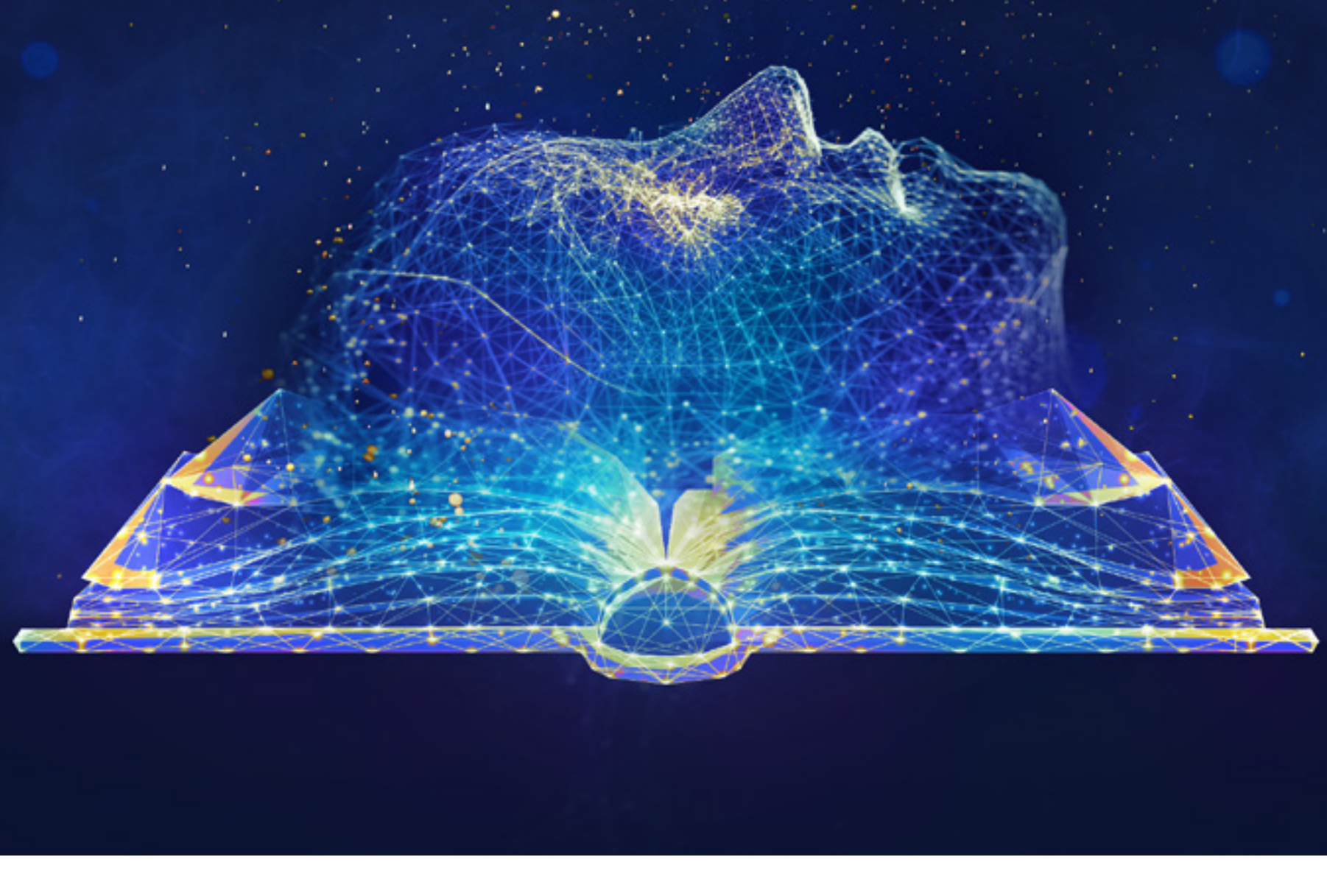
By "pipeline" we refer to all drugs in development by pharmaceutical companies, from those at the preclinical stage, through the various stages of clinical testing and regulatory approval, and up to and including launch. Launched drugs are still counted, but only if they are still in development for additional indications or markets. Drugs whose development has been terminated, or is complete, are not included.



Chapter Two
Setting the Scene: The 2023 Pipeline by Phase

Great literature has a beginning, a middle, and an end. Similarly, drug development has three major "acts": preclinical, clinical, and regulatory. Here we break down the 2023 pipeline by the drugs' current global statuses.





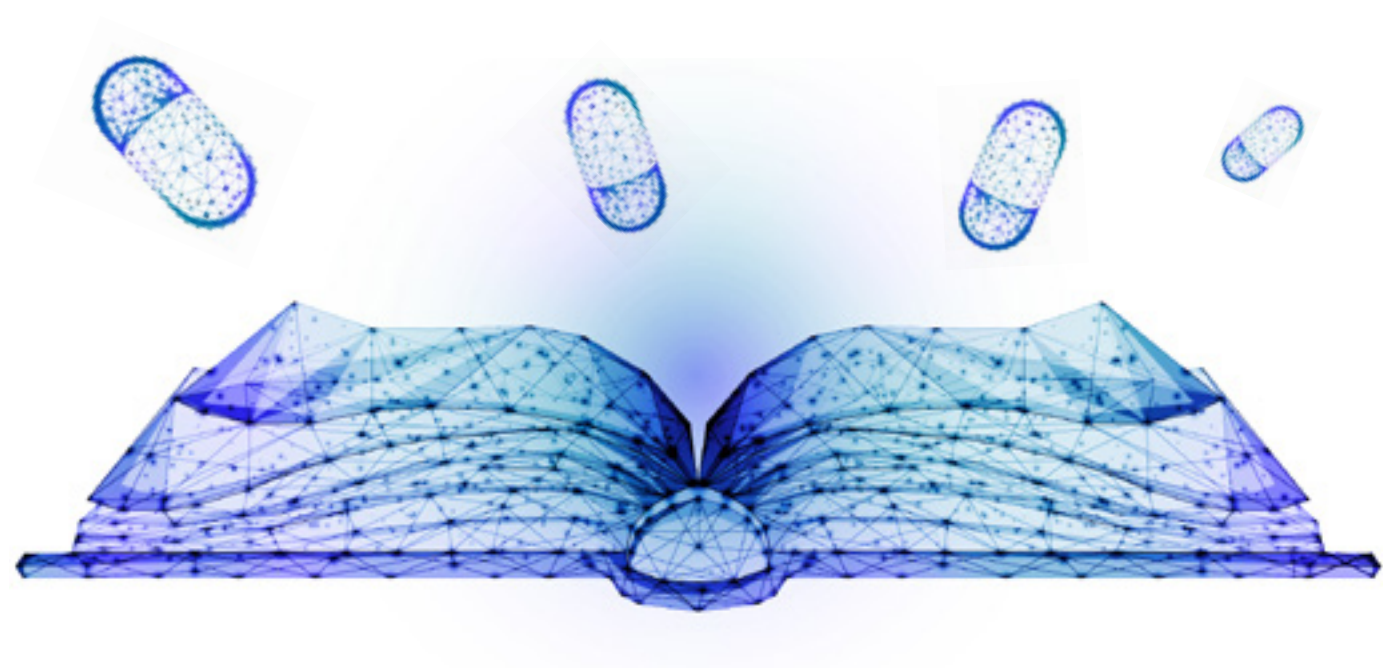
Chapter Three
Dramatis Personae: Top Companies

One attribute that you'll find every novel-writing "expert" includes is a diverse and well-developed set of characters. The characters in our tale of pharma R&D are the pharmaceutical companies themselves. But who are the leads who cast the longest shadows over our story?

TOP 25 PHARMA COMPANIES BY SIZE OF PIPELINE

POSITION 2023 (2022)	COMPANY	NO. OF DRUGS IN PIPELINE 2023 (2022)	NO. OF ORIGINATED DRUGS 2022	TREND
1 (2)	Roche	194 (200)	110	↔
2 (1)	Novartis	191 (213)	112	↓
3 (3)	Takeda	178 (184)	61	↔
4 (4)	Bristol Myers Squibb	175 (168)	96	↔
5 (5)	Pfizer	171 (168)	105	↔
6 (8)	Johnson & Johnson	156 (157)	84	↔
7 (6)	AstraZeneca	155 (161)	85	↔
8 (7)	Merck & Co	151 (158)	72	↔
9 (9)	Sanofi	145 (151)	82	↔
10 (10)	Eli Lilly	135 (142)	64	↔
11 (11)	GSK	123 (131)	60	↔
12 (12)	AbbVie	122 (121)	45	↔
13 (16)	Jiangsu Hengrui Pharmaceuticals	106 (89)	96	↑
14 (13)	Boehringer Ingelheim	99 (108)	75	↔
15 (14)	Bayer	93 (105)	63	↓
16 (21)	Gilead Sciences	86 (72)	59	↑
17 (15)	Otsuka Holdings	85 (93)	42	↔
18 (17)	Amgen	79 (83)	58	↔
19 (36)	Novo Nordisk	77 (51)	52	↑↑
20 (18)	Eisai	74 (80)	39	↔
21 (22)	Regeneron	73 (68)	41	↔
22 (20)	Daiichi Sankyo	70 (75)	37	↔
23 (27)	CSPC Pharmaceutical	68 (62)	53	↔
24 (23)	Shanghai Fosun Pharmaceutical	64 (68)	43	↔
25 (24)	Biogen	63 (66)	18	↔

Source: Pharmaprojects®, January 2023



While the previous table gives us our cast of characters, what is the setting? The next table looks at all drugs in active R&D and where their development is reported to be taking place.

WHERE IS R&D ACTUALLY OCCURRING?

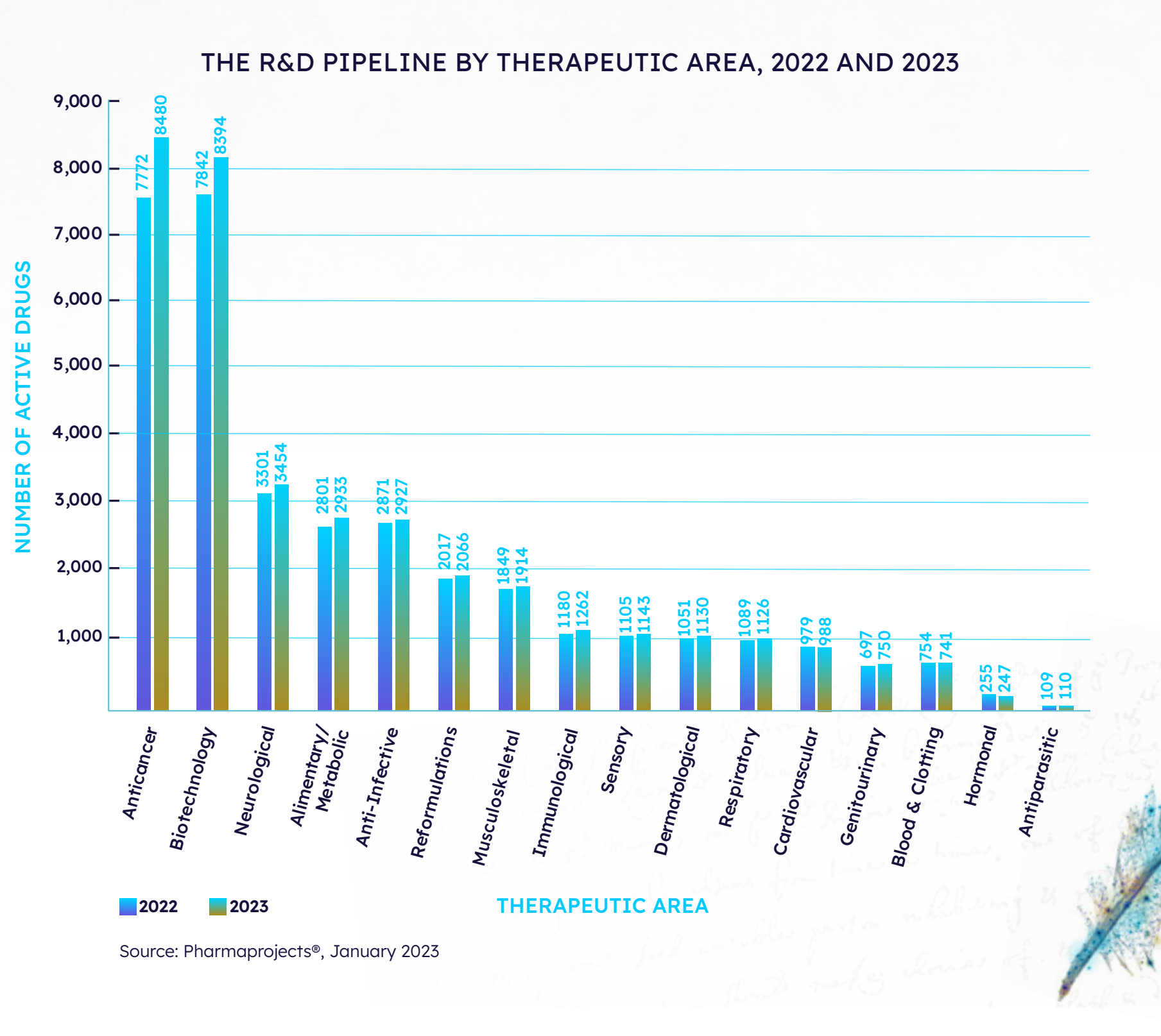
COUNTRY	NO. OF DRUGS	% OF PIPELINE
US	10,876	51.1
China	5,033	23.6
UK	3,048	14.3
South Korea	2,917	13.7
Germany	2,349	11.0
Canada	2,231	10.5
Australia	2,172	10.2
France	2,161	10.1
Spain	2,033	9.5
Japan	1,964	9.2
Netherlands	1,704	8.0
Italy	1,670	7.8
Belgium	1,651	7.8
Poland	1,575	7.4
Sweden	1,437	6.7
Denmark	1,415	6.6
Switzerland	1,403	6.6
Hungary	1,298	6.1
Czech Republic	1,283	6.0
Austria	1,258	5.9
Taiwan, China	1,240	5.8
Bulgaria	1,150	5.4
Finland	1,105	5.2
Ireland	1,085	5.1
Israel	1,062	5.0
Greece	1,055	5.0

Source: Pharmaprojects®, January 2023

- North America
- Asia
- Europe
- Oceania

Chapter Four
The Motivations Propelling Events: Top Therapies

Having established who our lead characters are, for our yarn to resonate with the reader, we need to look at their motivations and what they are hoping to achieve. What diseases is the pharmaceutical industry trying to cure, where is its focus, and what is motivating it to develop the drugs it does?



Chapter Five
Deus Ex Machina: Mechanisms and Targets

In literature, there is a technique known as deus ex machina, whereby, once the story has evolved to a place where the protagonists are seemingly in an impossible position, something unexpected occurs to help resolve the issue and engineer an unlikely happy ending. While medicine generally relies more on slow and steady progress, sometimes there are "happy accidents" or sudden great leaps forward that can change the direction of pharma R&D quite abruptly.

TOP 25 MECHANISMS OF ACTION (PHARMACOLOGIES)

POSITION 2023 (2022)	Drug disease	Number of drugs 2023 (2022)	% at PR, R, or L	TREND
1 (1)	Immuno-oncology therapy	3,393 (3,307)	2.2	↔
2 (2)	Immunostimulant	1,472 (1,494)	9.2	↔
3 (3)	T-cell stimulant	1,091 (1,061)	1.1	↔
4 (4)	Immune checkpoint inhibitor	618 (575)	5.0	↔
5 (6)	Gene expression inhibitor	283 (280)	1.8	↔
6 (5)	Genome editing	274 (280)	0	↔
7 (8)	Protein degrader	221 (197)	0.9	↑
8 (9)	CD3 agonist	198 (196)	2.5	↔
9 (10)	Radiopharmaceutical	192 (183)	9.4	↔
10 (7)	Angiogenesis inhibitor	192 (198)	24	↔
11 (13)	Natural killer cell stimulant	186 (160)	0	↑
12 (12)	PD-L1 antagonist	181 (165)	4.4	↔
13 (11)	Immunosuppressant	179 (173)	36.3	↔
14 (16)	PD-1 antagonist	152 (143)	11.8	↔
15 (15)	Immune checkpoint stimulant	150 (145)	0	↔
16 (14)	Vascular endothelial growth factor (VEGF) receptor antagonist	142 (146)	21.1	↔
17 (17)	Microbiome modulator, live microorganisms	128 (115)	0	↔
18 (18)	Glucagon-like peptide 1 receptor agonist	111 (111)	6.3	↔
19 (19)	Apoptosis stimulant	103 (105)	15.5	↔
20 (20)	ErbB-2 antagonist	97 (91)	15.5	↔
21 (24)	K-Ras inhibitor	87 (73)	2.3	↑
22 (32)	Microbiome modulator	83 (65)	1.2	↑
23 (21)	Surface glycoprotein (SARS-CoV-2) antagonist	83 (84)	10.8	↔
24 (22)	DNA inhibitor	82 (79)	29.3	↔
25 (26)	Cyclooxygenase 2 inhibitor	71 (71)	19.7	↔

Source: Pharmaprojects®, January 2023

ABBREVIATIONS
PR: pre-registration
R: registered
L: launched

Chapter Six
Modus Operandi: Types of Pipeline Drugs

Here we look at the types of drugs in current development and the technologies used to produce them. This might be considered the equivalent of a drug's modus operandi – a term used in literature (and elsewhere) to describe a method or procedure that is commonly employed.

TOP 25 ORIGINS OF PIPELINE DRUGS

POSITION 2023 (2022)	Drug disease	Number of drugs 2023 (2022)	TREND
1 (1)	Chemical, synthetic	10,307 (9,565)	↑
2 (2)	Biological, protein, antibody	2,734 (2,681)	↔
3 (4)	Biological, protein, recombinant	932 (865)	↔
4 (5)	Biological, cellular, autologous	758 (776)	↔
5 (3)	Biological, cellular, heterologous	687 (587)	↑
6 (6)	Biological, nucleic acid, viral vector	677 (680)	↔
7 (9)	Biological, cellular	583 (558)	↔
8 (8)	Chemical, synthetic, nucleic acid	536 (489)	↑
9 (7)	Biological, virus particles	534 (493)	↑
10 (10)	Biological, protein	523 (541)	↔
11 (12)	Biological, nucleic acid	477 (471)	↔
12 (11)	Chemical, synthetic, peptide	461 (453)	↔
13 (19)	Biological, other	358 (237)	↑↑
14 (14)	Biological, bacterial cells	330 (283)	↑
15 (16)	Biological, peptide	254 (272)	↔
16 (13)	Natural product, plant	215 (215)	↔
17 (15)	Biological, nucleic acid, non-viral vector	185 (184)	↔
18 (17)	Biological, peptide, recombinant	171 (171)	↔
19 (18)	Biological	164 (187)	↓
20 (20)	Chemical, semisynthetic	57 (53)	↔
21 (21)	Natural product, fungal	51 (46)	↔
22 (23)	Natural product, bacterial	50 (55)	↔
23 (22)	Natural product	38 (41)	↔
24 (24)	Natural product, animal	22 (23)	↔
25 (25)	Chemical, synthetic, isomeric	21 (24)	↔

Source: Pharmaprojects®, January 2023

Epilogue
What's Next for the Pharma Saga?

Let's turn our attention to what may or may not happen in 2023, as we indulge ourselves in a bout of speculative fiction. Macroeconomic factors threaten to make 2023's story more of a thriller than a work of poetry. With inflation running riot in many countries, and recession under way, additional interest rate rises might further push up pharma's costs.

The pharmaceutical industry enters 2023 admirably unperturbed by the events that have buffeted it. Pharma R&D continues to grow pretty much across the board. There has been comparatively little year-on-year structural change in terms of the composition of the pipeline and its characters, just gentle — and therefore hopefully sustainable — growth.

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