Antibody Drug Conjugates

Therapeutics Market (6th Edition), 2020-2030

Dissertation submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

BIOINFORMATICS

By

AAKANKSHA GAUTAM

171517

UNDER THE GUIDANCE OF

Mr. Gaurav Chaudhary

Mrs. Ishita Nanda

(Roots Analysis Pvt. Ltd.)

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MAY 2021

CERTIFICATE

This is to certify that the work reported in the B.Tech academic report entitled '***Antibody Drug Conjugates- Therapeutics Market (6th Edition), 2020-2030'*** submitted by **Aakanksha Gautam** in partial fulfillment for the award of degree of B.Tech. Bioinformatics from **Jaypee University of Information & Technology, Waknaghat** has been carried out under my supervision. This report was not submitted to any other University or Institute in full or in part for the award of any other degree, certificate or other titles.

Mrs. Ishita Nanda
Senior Associate
Roots Analysis Pvt. Ltd.

Roots Analysis
BUSINESS RESEARCH & CONSULTING

Certificate of Internship

I wish to confirm that Aakanksha Gautam (B. Tech Bioinformatics) did her internship (Feb 2021 – May 2021) at Roots Analysis. During her training, she worked on a business research project focused on pharmaceutical industry. She was sincere, dedicated and displayed a good work ethic. Her work was well appreciated by the team members.

I wish her all the best for her future endeavours.

Regards,

Sunaina Arora
Assistant HR Manager
Roots Analysis

Date: 21 May 2021

Roots Analysis Pvt. Ltd. A-430 Bestech Business Tower Sector 66-A, Mohali

CERTIFICATE

This is to certify **Ms. Aakanksha Gautam**, B.Tech Bioinformatics student of Jaypee University of Information Technology, Solan, bearing a **Roll No. 171517** has worked on the project entitled "**Computational studies to investigate DNA repair mechanism and mutation involved in lung cancer**" at the department of Biotechnology and Bioinformatics, under the guidance from 15-01-2020 to 19-05-2020. She has successfully completed her 7th semester training and her conduct was satisfactory.

I wish her a successful career.

Dr. Tiratha Raj Singh

Associate Professor

Department of Biotechnology and Bioinformatics

Jaypee University of Information Technology, Solan

Date: 20 May, 2021

DECLARATION

I hence state that the work reported in the B.Tech. academic report entitled '***Antibody Conjugates-Therapeutics Market (6th Edition), 2020-2030***' submitted at **Jaypee University of Information Technology, Waknaghat** is an authentic record of my work carried out under the guidance and direction of **Mr. Gaurav Chaudhary** and **Mrs. Ishita Nanda**. I have not presented this work somewhere else for any other degree or qualification.

Aakanksha Gautam (171517)
Department of Biotechnology & Bioinformatics
JUIT, Waknaghat

Certified that the student's statement above is accurate to the best of our knowledge and belief. Roots Analysis holds the copyright of the results reported in this article. In no circumstances will the information be exchanged with third parties without the company's prior consent.

Mrs. Ishita Nanda
Senior Associate
Roots Analysis Pvt. Ltd.

ACKNOWLEDGEMENT

It is my pleasure to be indebted to various people, who are directly or indirectly contributing in the development of this work and who influence my thinking, behavior, and acts during the whole project as any knowledge is incomplete without the right guidance of a mentor.

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I would like to thank my manager, Ishita Nanda, Senior Associate, Roots Analysis who has been a continuous support and provided me appropriate guidance to develop the skill set required for being a good business analyst. I am grateful to Sourav Thakur, who has guided me and helped me throughout and all my team members who not only solved my queries from time to time, but also encouraged me to develop a balanced work-life approach. I think it's a great opportunity that would help me to grow professionally and provide me with invaluable life experience.

Finally, to my caring and supporting parents who leave no stone unturned to push me to give my best shot everytime. Thanks for standing with me through every thick and thin.

Aakanksha Gautam

(171517)

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PREFACE

1.1 COMPANY OVERVIEW

Roots Analysis Pvt, Ltd. which was founded in 2013 is a market research and consulting company that specializes in offering in-depth business analysis and pharma industry consultancy services. Committed to providing an informed and impartial view of the industry's greatest issues, and other important elements the research is driven chiefly by an in-depth analysis attempting to cover the parameters shown in figure 1.1:

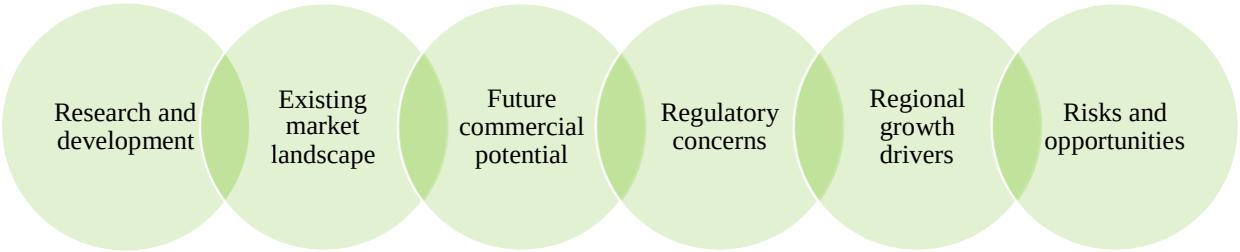


Figure 1.1 Primary Parameters for In-depth Analysis

The company specializes in the study of sectors which has so far been lacking in solid research or that need more centered understanding of the overall industry. The company also offers

bespoke data analysis / consulting services in addition to writing reports on specific areas, dedicated to serving the clients in the best possible way.

The company reports illustrate factors that range from market success / potential, technical advances and future projections centered around opportunities and challenges.

The company majorly focus on areas spanning the following domains:

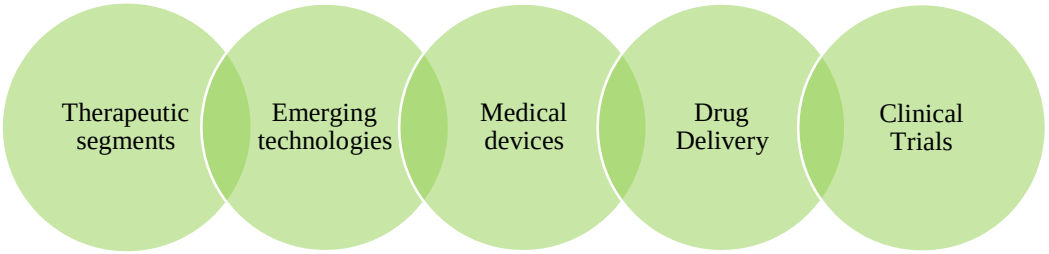


Figure 1.2 Focus Areas for Reports

1.2 Scope of the Report

With ten approved and marketed drugs. As per the recent updates 95 ADCs are in the development stage and there are hundreds of ongoing clinical trials being conducted by various big companies. ADCs have become popular in terms of targeted therapeutic agent They are useful in both oncology and hematological disease candidates. The success of these products is related to their ability to effectively identify and eliminate the pathogen or disease associated cells. Presently, ADCs are a part of mainstream healthcare regimens.

The growing popularity of ADCs and their therapeutic potential can be correlated with the exponential rise in the number of patents filed / granted. The patent count has increased enormously from 2009 till 2021. With more than 288 ADCs.

ADCs can be used in combination with other drugs / therapy classes, this is an emerging concept. Multiple companies are evaluating their proprietary ADC candidates in combination with other established therapeutic companies. With the advancement in the technologies and by the introduction of new combination therapies involving ADCs, new innovative ADC development, conjugation technologies, etc. the new strategies can be expanded to increase the existing market of ADC to the geographies across the world.

1.3 RESEARCH METHODOLOGY

Most of the information contained in this study has been collected through primary and secondary research. We have interviewed field experts to seek their view points on new growth opportunities in the market. It is mainly useful for us to draw our own conclusion about how the competition will develop through the different geographies and segments of technology. Where appropriate, the data available from various sources of information were checked for accuracy. Figure 1.3 displays the secondary information sources:

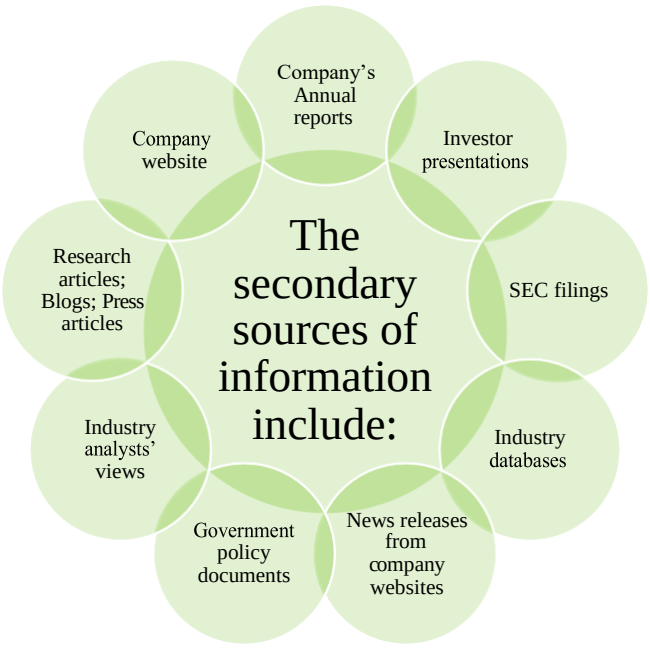


Figure 1.3 Secondary Sources Information

1.4 Project Objectives

The detailed study on the Antibody Drug Conjugates covers key aspects of the industry's evolution and identifies potential future growth opportunities Figure 1.4 lists the analyses that have been explained in this report. However, the detailed information on each and every analysis is available in the master report.

Source: Roots Analysis

Fig 1.4 Project Objectives

2

INTRODUCTION

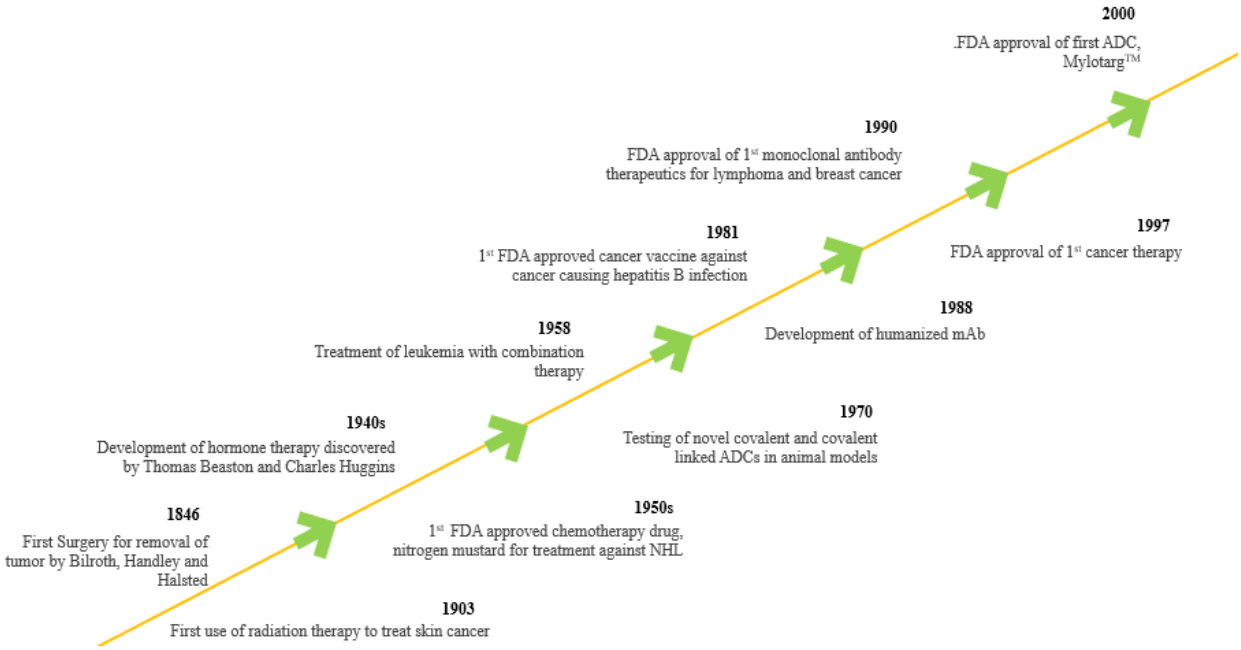
2.1 CHAPTER OVERVIEW

Antibody drug conjugates (ADCs) are an upcoming class of targeted therapeutic agents that have caught the attention of both big / large and small pharmaceutical companies and academic or research institutions from all across the world. ADCs are presently an established therapeutic concept with ten approved products. Despite the challenges associated with the development and manufacturing of such interventions, they are still considered a revolutionary technology. This chapter highlights the important general notions related to cancer treatment and the evolution of ADCs, in order to develop a better understanding of the subsequent chapters

2.2 Evolution of Anti-Cancer Therapy

Cancer is a complex disease that is caused primarily by a number of natural and man-made factors. Worldwide, cancer is the second most common cause of deaths, after cardiovascular diseases. Since ancient times, cancer treatment has involved a combination of a number of different therapeutic modalities. Figure represents the evolution of various treatment strategies against cancer.

Figure 2.1 **Timeline of Cancer Treatments**



Source: Roots Analysis

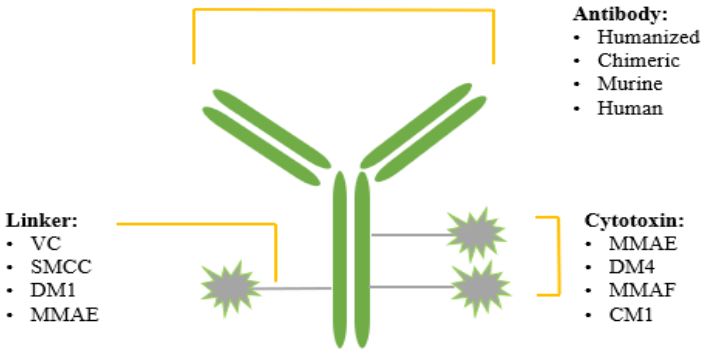
2.3 Components of Antibody Drug Conjugates (ADCs)

As mentioned earlier, ADCs consist of an antibody and a small molecule drug. The molecule that links both the components is called a linker. Although both the molecules can be separately used as viable therapeutics, together, they become a guided therapeutic entity. It is worth highlighting that the mechanism of action of the conjugate is completely different from those of the individual components.

2.3.1 Antibody

The antibody is usually of monoclonal origin, which means that it identifies and binds to a specific receptor on target cells. These can be used to specifically target aberrant cells in cancer and other diseases. Thus, the main function of the antibody component in an ADC is to guide the conjugate to the target cells. It is therefore important to select the accurate antigen, in order to elude targeting the wrong cell population, which may lead to the development of unwanted side effects. Figure 2.2 depicts the different parts of an ADC molecule

Figure **2.2 Components of an ADC**



Source: Roots Analysis

2.3.2 Cytotoxin

The drug, also referred to as a cytotoxin, may be an antibiotic or any other agent that either has the capability to treat or cause the death of a diseased / transformed cell. Research has estimated that less than 0.1% of the injected ADCs is actually taken up by the target cells. This requires the cytotoxin to be highly potent to ensure optimal therapeutic effects. The most common types of cytotoxins that are being investigated are listed below:

- Calicheamicin (ozogamicin) (CM1)
- Maytansinoids (DM1 and DM4)
- Auristatins (monomethyl auristatin E (MMAE) and monomethyl auristatin F (MMAF))

Calicheamicin binds to the minor groove of DNA causing irreparable DNA damage, whereas the other two classes of drugs are modulators of tubulin polymerization. As such, there are two main categories of cytotoxins, namely DNA damaging agents and tubulin polymerization inhibitors. Table 2.1 highlights some of the cytotoxins that are commonly used as payloads on ADCs.

Table 2.1 **Commonly Used Cytotoxins for ADC Therapeutics**

Toxin	Example	Type
Maytansines	DM1, DM4	Tubulin polymerisation inhibitors
Auristatins	MMAE, MMAF	Tubulin polymerisation inhibitors
Calicheamicin	CM1	DNA damaging agents
Duocarmycin	-	DNA damaging agents
Doxorubicin	-	DNA damaging agents

Source: Roots Analysis

SafeBridge Consultants, an independent occupational health and safety consulting firm headquartered in Mountain View, California, has developed a set of guidelines which are currently considered as the global standard for developing / manufacturing highly potent compounds. The firm also assesses and certifies production facilities developed for synthesizing hazardous chemical compounds. The company's rating system classifies cytotoxic compounds into four categories based on their occupational exposure limit (OEL), which is defined as the maximum levels of a hazardous compound to which humans (factory personnel) can be exposed to over an 8-hour day.

Table lists the four SafeBridge bands designed to categorize highly potent / cytotoxic compounds.

Table **2.2 Occupational Exposure Limit Bands, Safebridge Consultants**

Category	1	2	3	4
OEL	>0.5mg/m3	0.5mg/m3 - 10µg/m3	10µg/m3 - 30ng/m3	<30ng/m3
Toxicity	Low	Intermediate	High	High

Source: Roots Analysis

SafeBridge defines HPAPIs as pharmacologically active ingredients with OEL of or below 10 µg/m3 of air over eight hours. For example, the internal OEL for KADCYLA, as listed in the Material Safety Data Sheet (MSDS) from Roche, is 0.0003mg/m3.1

Currently, auristatins are the most popular cytotoxins associated with ADCs.
Other toxins, such as maytansinoids, are also cytotoxic agents that inhibit the assembly of microtubules. Maytansinoids are synthetic derivatives of maytansine, which can be isolated from plants of the genus Maytenus. This particular type of toxin is characteristic of ADCs developed using ImmunoGen's technology. Duocarmycin is an alternative payload type that is being used by various ADC candidate molecules. These are DNA alkylating drugs.

2.3.3 Linker

The antibody and the cytotoxin is conjugated using a synthetic chemical linker, which ensures the integrity of the conjugate during circulation. The stability of the linker affects the efficacy and potency of the overall ADC molecule. It is essential that the linker remains stable in the bloodstream and is cleaved to release the drug, only when the complex is inside the cell. The failure of the first-generation ADCs was attributed to the use of unstable acid-labile linkers, which were broken down in the acidic environment of the cell. Since then, linker technologies have undergone significant advances and improvements. Early linkers, derived from acid cleavable hydrazones, could be cleaved at non target sites and thereby, were known to cause systemic toxicity.

[1]Source: http://www.gene.com/download/pdf/KADCYLA_MSDS.pdf

Therefore, second-generation linkers, with improved stability, were developed. Examples of such molecules are mentioned below:

- **Disulfide linkers**

- **Peptide linkers**

- **Thioether linkers**

More recently, the third generation of ADC linkers were developed; these are essentially designed to target drug-resistant tumor cells. PEG4Mal linker is an example of such as linker.

Linkers are generally manufactured through a synthetic chemistry processes. Therefore, the production of a linker in itself neither requires high containment facilities (as is necessary for cytotoxic drugs) nor clean rooms / aseptic facilities (as required for antibodies). As a result, linkers can be produced by many contract manufacturers worldwide.

3

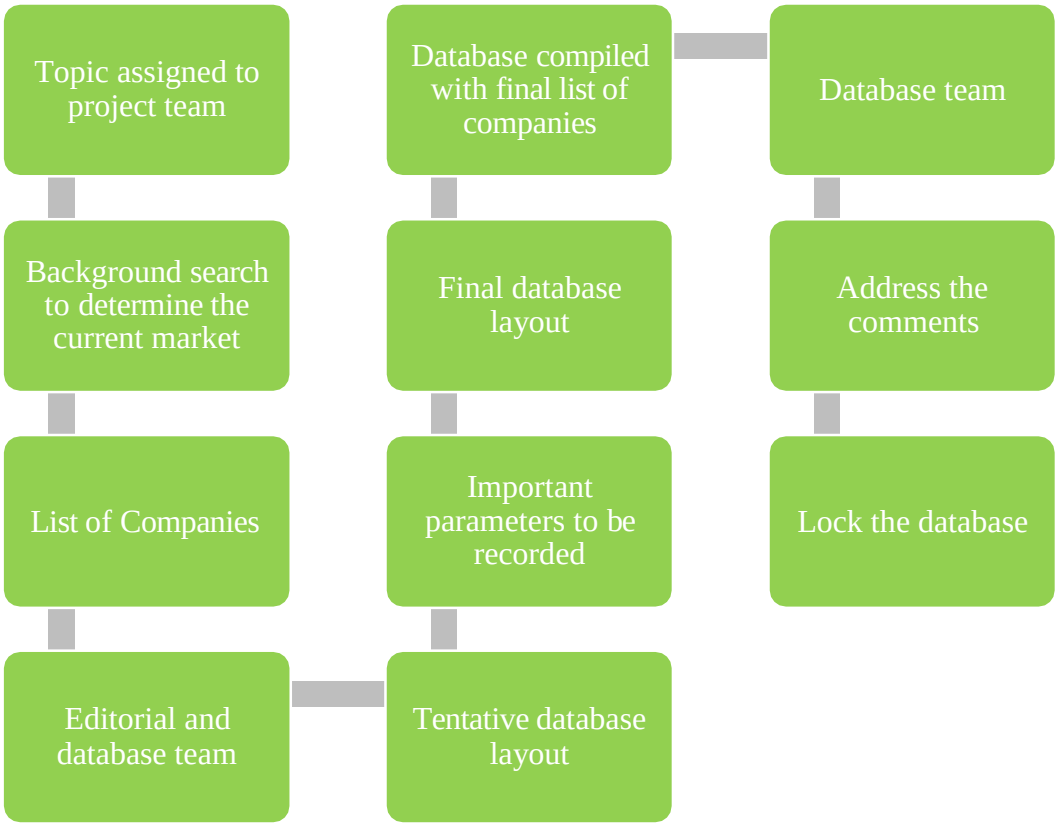
MARKET OVERVIEW

3.1 Chapter Overview

This chapter provides an overview of the current market landscape of ADC therapeutics. During our research, we identified over 230 unique ADCs across various stages of preclinical / clinical development. In this chapter, we have presented a detailed analysis of ADC pipeline based on various constraints, such as phase of development, indication, line of treatment, dosing regimen, type of therapy, target antigen, antibody origin, antibody isotype, linker type and payload type. We have also highlighted the major drug developers and technology providers working in this domain. Moreover, the chapter provides a detailed list of novel drug conjugates that are being developed using various innovative conjugation technology platforms. Further, we have provided a list of the ADCs that have been discontinued due to various reasons.

3.2 DATABASE BUILDING

Database (in this case) is a list of companies and the type of services provided by these companies. The information about these services provided is usually taken from various sources. These include public records, company websites and other secondary sources. It heads the organization of the report and hence acts as the most significant aspect in the course of enlisting the report comprehensions and insights. Hence, it must be vigorous, thorough and finely structured, which is the key to accurate analysis.



Source: Roots Analysis

Figure 3.1 Workflow: Database building

3.3 ADC Therapeutics: Approved / Clinical Pipeline

Table 3.1 provides the list of the various ADCs that are currently approved or are in the clinical stages of development. Amongst 234 molecules identified during our research, below given are some of the molecules which are being evaluated in various clinical trials. It is important to highlight that drugs being developed for multiple indications have been included as separate entries in the subsequent analysis and are referred to as drug candidates, henceforth.

Table 3.1 **ADC Therapeutics: Approved / Clinical Pipeline**[2]

S. No.	Drug	Company Name	Indication Type	Phase	Line of Treatment	Dosage	Type of Therapy
1	Adcetris/ brentuximab vedotin	Seattle Genetics / Takeda Oncology	Hodgkin lymphoma	Approved[104]	≥ 1, ≤ 3	3weeks (1 dose), 2 weeks (1 dose)[105]	Combination therapy (doxorubicin, vinblastine and dacarbazine (AVD)), monotherapy and

							combination therapy (chemotherapy)[106]
			Anaplastic large cell lymphoma	Approved[107]	≤ 2	3 weeks (1 dose)	Monotherapy and combination therapy (cyclophosphamide, doxorubicin, prednisone (chemotherapy))[108]
			Primary cutaneous anaplastic large cell lymphoma	Approved[109]	2	3 weeks (1 dose)	Monotherapy
			Mycosis fungoides	Approved[110]	2	3 weeks (1 dose)	Monotherapy
			Cutaneous T-cell lymphoma	Approved[111]	2	3 weeks (1 dose)	Monotherapy
			Diffuse large B-cell lymphoma	II	≥ 1[112]	3 weeks (1 dose)	Combination therapy (rituximab, cyclophosphamide, doxorubicin, prednisone)
			Diffuse cutaneous systemic sclerosis	II	NA	3 weeks (1 dose)	Monotherapy
			Sezary syndrome, and lymphomatoid papulosis	II	≥ 1	3 weeks (1 dose)	Monotherapy
2	Kadcyla / ado-trastuzumab emtansine	Roche (Genentech)	Breast cancer	Approved[113]	≤ 2	3 weeks (1 dose)	Monotherapy and adjuvant therapy[114]
			Non-small cell lung cancer	II	≥ 2, ≤ 3	3 weeks (1 dose)	Combination therapy (osimertinib)
3	Besponsa / inotuzumab	Pfizer	Acute lymphoblastic leukemia	Approved[115]	2	3 weeks (3 dose) / 4 weeks (3 dose)	Monotherapy
4	Mylotarg / gemtuzumab ozogamicin	Pfizer	Acute myeloid leukemia	Approved[116]	≤ 2	4 weeks (3 dose) / 4 weeks (2 dose) / 4 weeks (1 dose)	Monotherapy, Combination therapy (daunorubicin and cytarabine)
5	Lumoxiti / moxetumomabpasudotox-tdfk	AstraZeneca (MedImmune)	Hairy cell leukemia	Approved[117]	≥ 3	4 weeks (3 dose)	Monotherapy

3.4 DATA ANALYSIS

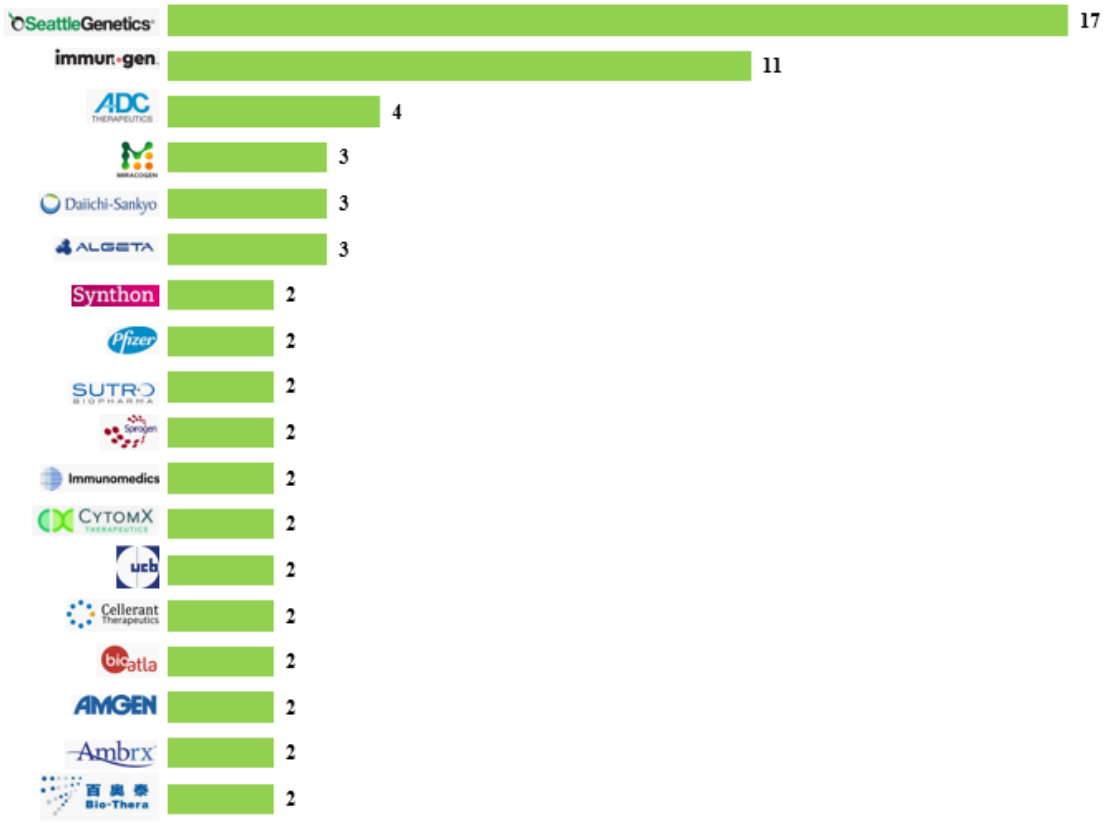
The following analysis were done:

- Analysis by Phase of Development
- Analysis by Indication
- Analysis by Line of Treatment
- Analysis by Dosing Regimen
- Analysis by Type of Therapy
- Analysis by Target Antigen
- Analysis by Antibody Origin
- Analysis by Antibody Isotope
- Analysis by Type of Linker
- Analysis by Type of Payload/Warhead

3.5 Key Technology Providers

Figure 3.2 provides the distribution of the companies that provide technologies for more than one clinical stage ADC molecule. Seattle Genetics and ImmunoGen were observed to be the two most prominent players to provide their technology platforms for the development of 17 and 11 drugs, respectively. Other notable technology providers include ADC Therapeutics (4), Miracogen (3), Daiichi Sankyo (3) and Algeta (3).

Figure 3.2 **ADC Therapeutics Approved / Clinical Pipeline: Distribution by Key Technology Providers**



Source: Roots Analysis

3.6 ADC Therapeutics: Developer Landscape

Table 3.2 presents the list of players that are developing ADC therapeutics, along with information on their year of establishment, location of headquarters (state and country) and company size. The company size is based on the strength of their employee base.

Table 3.2 **ADC Therapeutics: Developer Overview**[3]

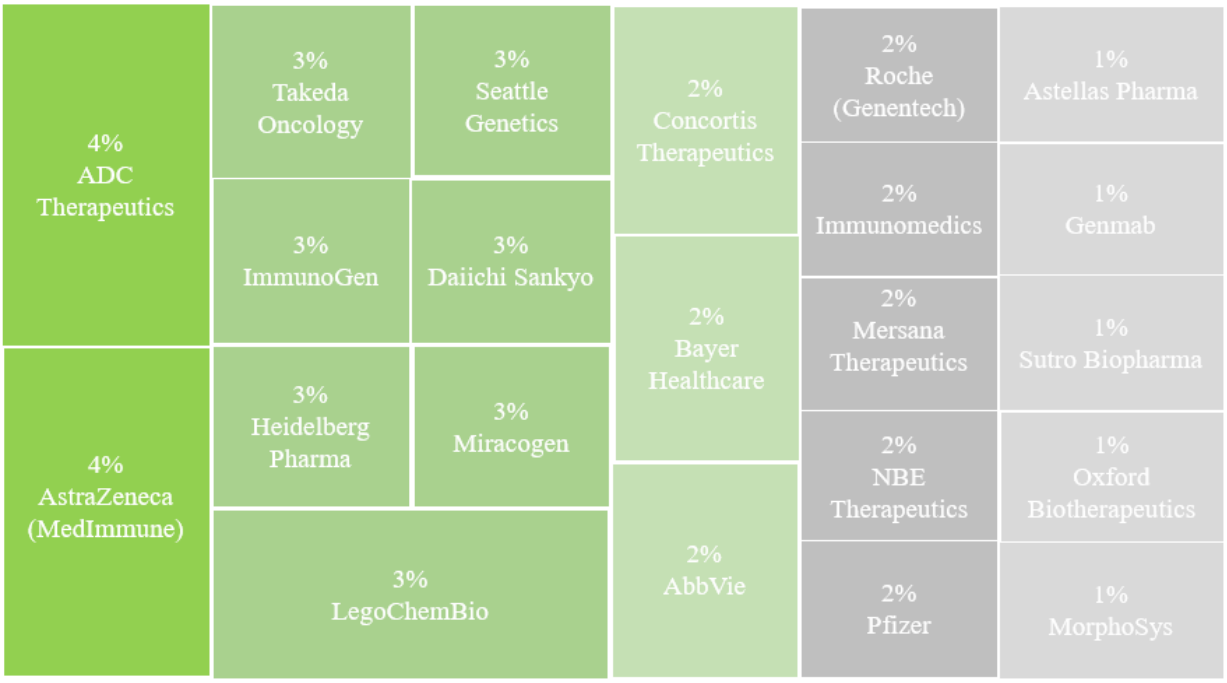
S. No.	Company	Year of establishment	Location	Company size
1	3P Pharmaceuticals	2006	Navarra, Spain	Large
2	AbbVie	2013	Illinois, US	Very large
3	AbGenomics International	2000	California, US	Small-sized
4	ABL Bio	2016	Gyeonggi-do, South Korea	Small-sized
5	ADC Therapeutics	2012	Lausanne, Switzerland	Mid-sized
6	Allergan	1983	Ireland, UK	Very large
7	Alteogen	2008	Daejeon, South Korea	Mid-sized
8	Ambrx	2003	California, US	Mid-sized
9	Amgen	1980	California, US	Very large
10	Angiex	2015	Massachusetts, US	Small-sized

Source: Roots Analysis

The following analysis were done:

- Analysis by Year of Establishment
- Analysis by Company Size
- Analysis by Geographical Location
- Analysis by Distribution of Key Players

Figure 3.3 **ADC Therapeutics Developer Landscape: Distribution by Key Players**



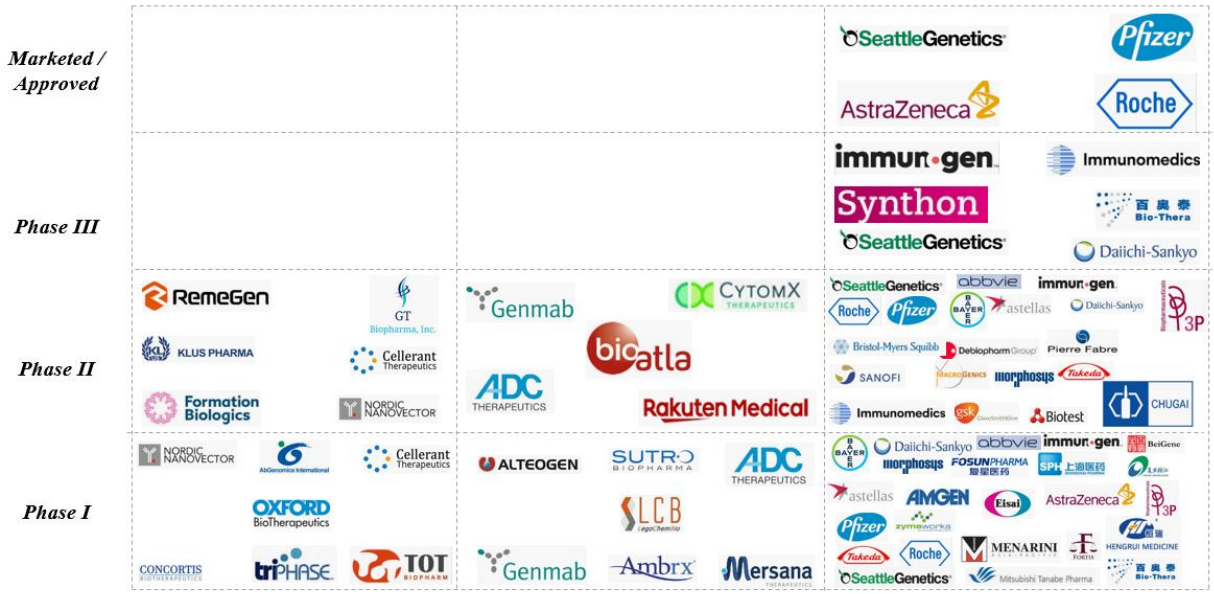
Legend:

Color	*Number of drug candidates*
	>12 drug candidates
	>8 drug candidates
	>6 drug candidates
	>5 drug candidate
	=5 drug candidate

Note: Players with five or more drugs under development, have been represented in the figure

Source: Roots Analysis

Figure 3.4 **ADC Therapeutics Developer Landscape: Logo Landscape**



Note 1: For the purpose of this analysis, molecules in phase I/II have been considered under phase II
Note 2: 56 companies for which information on the company size was available have been included in this analysis

Source: Roots Analysis

4

COMPANY PROFILES

4.1 CHAPTER OVERVIEW

This chapter focuses on leading, large, mid-sized and small companies that that have ADC therapeutic candidates in phase III or higher stages of clinical development. It includes detailed profiles of the key service providers, which, according to our research offer a comprehensive set of related services. Each detailed profile includes information on the following:

- **Company Snapshot:** This provides basic information about the company, including details on the where the headquarters are located, establishment year, number of employee and the executive / management team.
- **We profiled 12 key players in this domain, however, here we have only included profile of Seattle Genetics (now known as Seagen).**

Figure 4.1 & 4.2 represent the sample profile.

5.2. SEATTLE GENETICS

5.2.1. COMPANY OVERVIEW

Seattle Genetics is a biotechnology company focused on the development and commercialization of anticancer therapies. The company claims to have developed a proprietary technology for linking cytotoxic agents to monoclonal antibodies; this technology has also been out-licensed by the company to various other players that are involved the development of ADC drugs.[133]

The company screens and selects antibodies that bind more specifically and with greater affinity to tumor cells (compared to normal cells), have a rapid rate of internalization into the target cells, and can be optimally conjugated to drugs through native or engineered attachment sites. The ADCs developed using the company's proprietary technology use auristatins (anti-microtubulin agents) payloads.

Fig. 4.1 Snapshot of Company Overview

Table 5.1 provides a brief overview of Seattle Genetics.

Table 5.1 **Seattle Genetics: Company Overview**

Key Parameters	Description
Headquarters	Washington, US
Year of Establishment	1997
Number of Employees	~1,300
Executive Team Members	Clay B. Siegall (President, Chief Executive Officer and Chairman of Board) Roger D. Dansey (Chief Medical Officer) Vaughn B. Himes (Chief Technical Officer) Todd E. Simpson (Chief Financial Officer) Robin G. Taylor (Chief Commercial Officer) Jean I. Liu (General Counsel, Executive Vice President of Legal Affairs) Christopher Pawlowicz (Executive Vice President of Human Resources) Rachel Lenington (Senior Vice President of Program and Portfolio Management) Natasha Hemday (Senior Vice President of Corporate Development)

Source: http://www.annualreports.com/HostedData/AnnualReports/PDF/NASDAQ_SGEN_2018.pdf, https://www.seattlegenetics.com/about/leadership, Roots Analysis

Fig. 4.2 Company Snapshot

5

KEY THERAPEUTIC AREAS

5.1 Chapter Overview

In this chapter, we have provided an overview of the key oncological indications being targeted by ADCs. The drugs in phase II and above were shortlisted. The key indications (being targeted by more than 4 drugs) of these drugs have been discussed in detail in this chapter. The chapter features list of approved drugs and the ADCs being developed for each disease indication. The key therapeutic indications discussed in the chapter are mentioned below:

- Hematological Cancers
  - Leukemia / Lymphoma
  - Multiple Myeloma
- Solid Tumors
  - Lung Cancer
  - Breast Cancer
  - Ovarian Cancer
  - Bladder Cancer
  - Colorectal Cancer
  - Prostate Cancer
  - Gastric Cancer

6

PARTNERSHIPS AND COLLABORATIONS

6.1 Chapter Overview

The past decade has witnessed a number of developments in the field of ADC Therapeutics. A significant proportion of the breakthrough research conducted in this domain can be attributed to the collaborative efforts of industry stakeholders. Till date, the ADC Therapeutics market continues to witness substantial partnership activity. We observed that many companies have entered this field by in-licensing technologies from other players to establish the necessary expertise to develop / manufacture ADCs. Further, given the multidisciplinary requirements of this class of biopharmaceuticals, several companies have entered into product co-development and co-commercialization agreements as well. It is also worth highlighting that companies of all sizes and experience levels are engaged in the development of this upcoming class of therapeutics.

We identify the following unique types of partnership models that have been adopted by stakeholders in this industry:

- Merger / Acquisition
- Clinical Trial Agreement
- Manufacturing Agreement
- Licensing Agreement
- Research and Development (R&D) Agreement
- Product Development and Commercialization Agreement
- Others

We profiled 92 key players in this domain, however, here we have only included 4 companies in this snippet.

Table 6.1 Snapshot- ADC Therapeutics: Partnerships and Collaborations, 2016-2021

S. No.	Company Name	Partner	Month -Year	Type of Collaboration	Details
1	Antikor Biopharma	Essex Bio-Technology	Aug 2019	Licensing Agreement	**Agreement Terms:** Antikor licensed its novel technology platform to Essex Biotechnology for the research and development of novel FDCs. **Financial Details:** Antikor Biopharma entered into the agreement for USD 3.1 million.[793]
2	CytomX Therapeutics	Agensys	Jul 2019	Merger / Acquisition	**Agreement Terms:** Agensys' drug conjugate linker-toxin and CD3-based bispecific technologies have been acquired by CytomX. **Financial Details:** CytomX agreed to pay Astellas a one-time, up-front payment.[794]
3	GSK	SpringWorks	Jun 2019	Clinical Trials Collaboration	**Agreement Terms:** GSK signed the agreement to sponsor and conduct a clinical trial focused on evaluating the safety, tolerability and preliminary efficacy of combination of gamma-secretase inhibitor and anti-BCMA ADC belantamab mafodotin. **Financial Details:** Undisclosed[795]
4	Exelixis	Iconic Therapeutics	May 2019	Licensing Agreement	**Agreement Terms:** Under the terms of agreement, Iconic therapeutics licensed its lead ADC program to Exelixis development of novel ADC molecules. **Financial Details:** Exelixis paid an upfront fee of USD 7.5 million and the funding generated during the preclinical development.[796]

7

FUNDING AND INVESTMENT ANALYSIS

7.1 Chapter Overview

Over the years, monetary assistance from angel investors, venture capitalists and funding schemes of various public and private organizations / funds, along with assistance from regulatory authorities, have allowed start-ups / small companies to further their R&D efforts related to the ADC therapeutics. Various capital investments have also been reviewed that have been made into the ADC therapeutics market.

7.2 TYPES OF FUNDING

There are numerous ways in which a company may receive financing. We have considered following types of funding for the purpose of this analysis:

- Grant
- Seed Financing
- Venture Capital Investments
- Initial Public Offering (IPO)
- Secondary Offerings
- Other Equity
- Debt Financing
- Others

Table 7.1 Snapshot of ADC Therapeutics: Funding and Investments, 2011-2021

S. No.	Company	Amount Invested (USD Million)	Month-Year	Type of Funding	Investors
1	Rakuten Medical (Aspyrian Therapeutics)	100	Jul 2019	Other Equity	NA[948]
2	ADC Therapeutics	303	Jul 2019	Venture (Series E)	NA[949]
3	Zymeworks	201	Jun 2019	Secondary Offering	NA[950]
4	Mersana Therapeutics	98	Mar 2019	Secondary Offering	NA[951]
5	GT Biopharma	1.3	Feb 2019	Other Equity	NA[952]

Figure 7.1 **Funding and Investment Summary, 2011-2021 (USD Million)**

	Seed	VC Funding	Debt Financing / Loan	IPO / SOs	Other Equity	Others
Low	2.4	2.0	0.7	9.4	0.8	1.8
High	3.0	303	75	500	200	3
Average	2.7	47	16.4	169.7	59.8	2.5

Source: Roots Analysis

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TRANSCRIPT

8.1 TRANSCRIPT

A transcript is prepared from the on call interview which taken as primary source of information. These interviews are usually organized with multiple investors in the domain.

Following figure represent the step wise workflow for preparing a transcript:

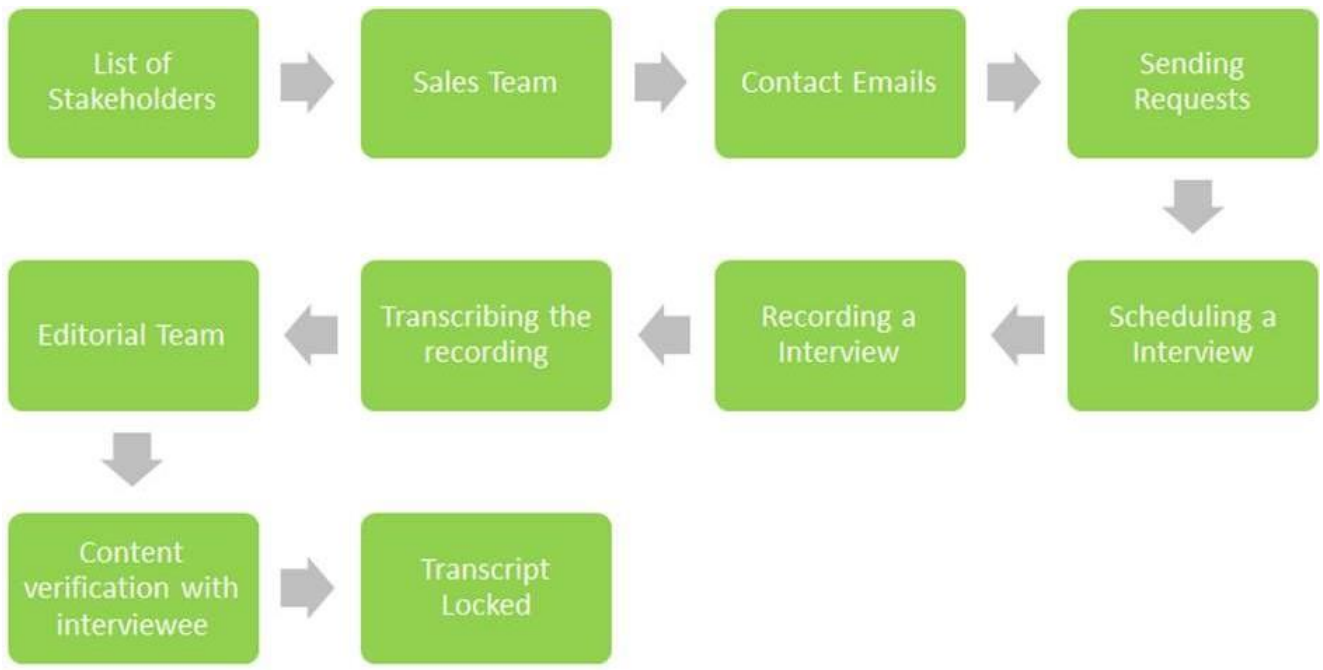

Fig. 8.1 Workflow for a transcript

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CONCLUSION

Antibody drug conjugates or ADCs are a new class of highly potent biopharmaceutical drug. ADCs are highly complex molecular entities composed of an antibody which is linked via a stable chemical linker to a biologically active cytotoxic agent or a drug to target variety of cancer. The cytotoxic drug recognizes the specific tumor-associated antigen, making the antibody to drug conjugation highly specific.

In the past decade, there have been done a lot of advancements in ADC development. There have been clinical failures and some companies even suspended some drugs from company's pipeline. Companies have shown considerable progress in antibody engineering and in development of new classes of cytotoxics.

Hundreds of ongoing clinical trials are being conducted by companies like Seagen, AstraZeneca, GSK, Roche and Daiichi Sankyo with different ADCs which target various cancers.

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PROJECT LEARNING OUTCOME

The report skillfully covers a wide range of analyses on the large volume wearable injectors market and presents it in a uniform and informative way. Besides providing information on the current market landscape, the report provides an estimate of the potential future growth opportunities for the new combination therapies used with the ADCs. This field has recently witnessed a lot of innovation, such as the development of the novel conjugates keeping in mind the demand of the candidates and monitoring their needs. These efforts can help in the growth in this market over the coming years.

However, I would mention the fact that the work done here is a tip of the ice-berg. The detailed report, available at *www.rootsanalysis.com*, has separate chapters for all the analyses. The report makes it a point to cover the length and breadth of the market and its trends, following the “best efforts” approach.

Although each chapter involves a unique data-set, but the basic methodology of framing a chapter is consistent across the entire report. It gives the analyst a chance to collate the information in tables in an excel file, make charts and representations of the collated data-set in the same excel file and finally arrange the charts, along with an appropriate write-up in a word file. However, in my opinion, the first step of data collation is the most crucial as it determines the accuracy of the entire analysis. The report is very useful from business point of view, considering the fact that stakeholders want to make decisions based on factual information and validated data-points.

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