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CAR-T Deal Review

A Nelsen Biomedical Report

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In 2012, the striking clinical success of CAR-T therapy in treating acute lymphoblastic leukemia (ALL) in the case of Emily Whitehead was a real game changer for the industry. Since then, there has been an explosion of commercial activity.

In this CAR-T Deal Review we have captured the number and diversity of deals done in this space over the past four years. Included are strategic partnerships, acquisition and licensing deals done between CAR-T companies, Big Pharma, smaller organizations, and academic institutions from 2012 through August 2016. These deals cover intellectual property, new approaches for creating CARs using gene-editing technologies, expansion to allogeneic approaches, manufacturing, combination therapies, and more.

Collectively these deals are worth at least \$2 billion in disclosed upfront payments and \$4 billion in additional milestone, royalty and other payments. Notably, the number of deals in this space has grown every year, from just three deals in 2012 to 35 in 2015. With already 26 deals as of September 1, 2016, the full-year 2016 numbers will likely reach at least the 2015 total.

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Cooperative research and development agreement

CAR clinical trial, eACT™; NCI develops and tests, including in Phase 2 and 1-2a clinical trials, multiple CAR- and TCR based product candidates

Deal Value

Kite will make quarterly payments to the NCI \$250,000 through 2017

Year	2012
Company	Kite Pharma
Partner	NCI
Focus	Autologous clinical trials
Approach	Autologous
Indication	Hematological Cancers

Exclusive global research and licensing agreement

Exclusive worldwide license to Penn technologies used in an ongoing trial of patients with CLL as well as future CAR-based therapies developed through the collaboration. Novartis will invest in the establishment of the Center for Advanced Cellular Therapies (CACT) on the Penn campus and future research

Year	2012
Company	Novartis
Partner	University of Pennsylvania
Focus	Autologous CAR-T development
Approach	Autologous
Indication	Hematological Cancers

License agreement

Two exclusive license agreements granting Collectis the worldwide right to use inventions related to TAL effector-nucleases (TALENs™) and monomeric TALENs™.

Year	2012
Company	Collectis
Partner	Iowa state
Focus	Gene editing IP

Strategic collaboration

Advance and develop existing and new products and programs in the CAR T-cell field

Year	2013
Company	Celgene
Partner	Baylor College of Medicine
Focus	Autologous CAR-T development
Approach	Autologous

Exclusive multiyear research and collaboration agreement and a platform technology license agreement

Global strategic collaboration to discover, develop and commercialize novel disease altering gene therapies in oncology, CAR-T

Year	2013
Company	Bluebird bio
Partner	Celgene & Baylor College of Medicine
Focus	Autologous CAR-T development
Approach	Autologous

Exclusive worldwide license agreement

License I.P. related to a CAR-based product candidate that targets the EGFRvIII antigen for the treatment of brain cancer, head and neck cancer and melanoma, and a TCR-based product candidate that targets the SSX2 CTA for the treatment of head and neck cancer, hepatocellular carcinoma, melanoma, prostate cancer, and sarcoma.

Deal Value

Kite paid to the NIH a cash payment in the aggregate amount of \$200,000 plus \$58,000 in patent expenses, plus minimum annual royalties in the amount of \$20,000, plus clinical and regulatory milestones of aggregate potential benchmark payments are \$8.1 million

Year	2013
Company	Kite Pharma
Partner	NIH
Focus	Autologous CAR-T development for blood cancer and solid tumor
Approach	Autologous
Indication	Solid Tumors

Exclusive worldwide license agreement

Exclusive, worldwide license agreement, including the right to grant sublicenses, with Cabaret and Dr. Zelig Eshhar relating to certain intellectual property and know-how owned by Cabaret, which includes rights associated with KTE-C19, for use in the treatment of oncology and such other fields

Deal Value

Kite paid Cabaret \$25,000 and reimbursed Dr. Eshhar for past patent expenses totaling \$350,000. milestones first two licensed products are \$3.9 million and \$2.7M per product after.

Year	2013
Company	Kite Pharma
Partner	Cabaret
Focus	Autologous CAR-T IP
Approach	Autologous
Indication	Hematological Cancers

Research agreement

Deal Value

Juno to provide aggregate research funding to MSK of \$2.2 million over a period of five years.

Year	2013
Company	Juno
Partner	Memorial Sloan Kettering

License agreement and collaboration

Deal Value

Juno will make an upfront payment of \$250,000 and annual maintenance fee of \$50,000 for the first four years of the agreement's term plus annual royalties of \$100,000 per year, up to a maximum of \$6.75 million per licensed product, which includes JCAR014 and JCAR017. Juno to provide FHCRC aggregate research funding of \$8.0 million over a period of six years relating to the research and development of cellular immunotherapy products

Year	2013
Company	Juno
Partner	Fred Hutchinson
Focus	Autologous CAR-T IP and development
Approach	Autologous
Indication	Hematological Cancers

License agreement

Chimeric Receptors with 4-1BB Stimulatory Signaling Domain; acquired a license to specific patent rights owned by, and a sponsored research agreement

Deal Value

Juno will make initial payment to St. Jude of \$25 million and low single-digit royalties on net sales of licensed products and services. Juno will pay a \$100,000 minimum annual royalty for the first two years of the agreement, and a \$500,000 minimum royalty thereafter through the term of the agreement. Additional milestone payments of up to an aggregate of \$62.5 million

Year	2013
Company	Juno
Partner	St. Jude Children's Hospital
Focus	Autologous CAR-T development
Approach	Autologous

Acquisition

All of the assets of ZetaRx BioSciences, including patent license agreements with FHCRC and the City of Hope

Year	2013
Company	Juno
Partner	ZetaRx Biosciences
Focus	Autologous CAR-T IP
Approach	Autologous

License agreement

This third patent follows the issuance on May, 14 2013 of two previous patents (US 8,440,431 and US 8,440,432) directed to TAL-effector nuclease technology. This third issued patent is more particularly drawn to the polynucleotides encoding the TAL-effector nuclease, per se. i.e. the reagent molecules that are used to specifically cut the DNA at desired locations in the genome of living cells

Year	2013
Company	Collectis
Partner	University of Minnesota and Iowa State
Focus	Gene editing IP

License agreement restructuring

Gives Bellicum a worldwide exclusive license to ARIAD's cell-signaling technology (small-molecule drug, such as AP1903, to activate cell signaling and other cellular events) for broad use in human cell therapies for all diseases on a royalty- and milestone-free basis.

Deal Value

ARIAD will receive \$50 million in exchange for a fully paid up license to this technology and return of its equity stake

Year	2014
Company	Bellicum
Partner	ARAID Pharmaceutical
Focus	Small molecule IP
Approach	Combination

Acquisition

Acquisition brings Homing Endonuclease and MegaTAL gene-editing and novel cell signaling technologies with a broad range of potential therapeutic applications in gene therapy and cancer immunotherapies

Deal Value

Bluebird to issue over 400,000 shares of common stock, \$4.9 million of current liabilities and up to an additional \$15.0 million in preclinical milestones, \$20.1 million in clinical milestones, up to \$99.9 million in commercial milestones

Year	2014
Company	Bluebird bio
Partner	Precision Genome Engineering (Prengen)
Focus	Acquire gene editing technology

Exclusive global license and collaboration agreement

Pfizer has exclusive rights to pursue development and commercialization of CAR-T therapies, in the field of oncology, directed at a total of fifteen targets selected by Pfizer.

Deal Value

Pfizer to pay Cellectis \$80 million upfront plus up to \$185 million per product and royalties

Year	2014
Company	Cellectis
Partner	Pfizer
Focus	Allogeneic CAR-T development
Approach	Allogeneic

Collaboration

Partnership covers the development and potentially the commercialization of Collectis' lead product candidate, UCART19. Engineered allogeneic CD19 T-cells currently stand out as a real therapeutic innovation for treating various types of leukemias and lymphomas, and 5 other targets for solid tumors

Deal Value

Servier to pay Collectis an upfront payment of \$10 million and up to \$140 million for each of the six product candidates potentially developed, spread over various milestones in the development and commercialization phases. Collectis will receive royalties on the sales of commercialized products.

Year	2014
Company	Collectis
Partner	Servier
Focus	Allogeneic CAR-T development for blood cancer and solid tumor
Approach	Allogeneic
Indication	Hematological Cancers and Solid Tumors

License agreement

For patent US 8,697,853 is more particularly drawn to the genomic sequences encoding TAL-effector nucleases. These proteins developed jointly by researchers at the University of Minnesota and Iowa State University can 'read' DNA and make pinpoint cuts in targeted genes.

Year	2014
Company	Collectis
Partner	University of Minnesota and Iowa State
Focus	Gene editing IP

Agreement

CELLforCURE will be responsible for the manufacturing of cGMP clinical batches for candidates from Collectis' UCART product family

Year	2014
Company	Collectis
Partner	CELLforCURE
Focus	Allogeneic CAR-T manufacturing

Agreement

Accelera will perform in vivo preclinical studies to finalize the IND (Investigational New Drug) / IMPD (Investigational Medicinal Product Dossier) package for UCART19.

Year	2014
Company	Collectis
Partner	Accelera CRO of Nerviano Medical Sciences Group
Focus	Allogeneic CAR-T preclinical development
Approach	Allogeneic
Indication	Hematological Cancers

License agreement

Thermo Fisher is granted a worldwide license under Collectis' rights to the TAL nucleases outside the therapeutic field, with exclusive rights to grant sublicenses in research and development, bioproduction and certain applied markets. Thermo Fisher currently markets TALEN™ for these applications under its Life Technologies brand.

Year	2014
Company	Collectis
Partner	ThermoFisher Scientific
Focus	Gene editing IP

License agreement

For US patent 8,921,332 covering chimeric endonucleases for chromosomal gene editing by homologous recombination in cells. This new patent complements Collectis' large portfolio of gene editing technologies implemented in its CAR T-cells and gene therapy programs to treat unmet medical needs, as well as within its Minnesota-based agricultural biotechnology subsidiary, Collectis plant sciences, developing food products with healthier characteristics.

Year	2014
Company	Collectis
Partner	Institut Pasteur and the Boston Children's Hospital
Focus	Gene editing IP for allogeneic CA-T

Collaboration and license agreement

Transposagen will use its proprietary genome editing technologies to create allogeneic CAR-T therapies. Under the agreement, Janssen has exclusive rights to any allogeneic CAR-T therapy that is jointly developed by the companies. Janssen has also received a non-exclusive research license to use Transposagen's proprietary gene editing technologies for gene and cell therapy solutions for treating diseases with significant unmet medical need. Transposagen will retain the rights to develop autologous CAR-T therapies and CAR-T therapies using Natural Killer (NK) cells or NK-like cells.

Deal Value

Unspecified upfront; J&J to pay Transposagen \$292 million per treatment in milestones

Year	2014
Company	Johnson&Johnson
Partner	Transposagen
Focus	Gene editing technology for allogeneic CAR-T

License agreement and collaboration

Deal Value

Juno paid SCRI an upfront payment of \$200,000 and are required to pay to SCRI annual license maintenance fees, creditable against royalties and milestone payments due to SCH, of \$50,000 per year for the first five years and \$200,000 per year thereafter plus up to \$15M per licensed product. \$1.5 million over a period of five years for collaboration

Year	2014
Company	Juno
Partner	Seattle Children's Hospital

License agreement

CAR-T cell product candidate targeting CD22 developed by Opus and NCI

Deal Value

Juno made an upfront payment to Opus Bio of \$20.0 million, plus \$52.5 million in the aggregate for the three milestones plus potential milestone payments total \$215.0 M

Year	2014
Company	Juno
Partner	Opus Bio
Focus	Autologous CAR-T development
Approach	Autologous
Indication	Hematological Cancers

Grant agreement

Next generation of CAR-based product candidates over the next three years

Year	2014
Company	Kite Pharma
Partner	Tel Aviv Sourasky Medical Center
Focus	Autologous CAR-T development

Global license agreement

Bellicum gains rights to develop and commercialize adoptive cell therapies, including CAR-T cells, for tumors expressing Prostate Stem Cell Antigen (PSCA) using PSCA technology, both in-licensed and developed at Agensys.

Year	2015
Company	Bellicum
Partner	Agensys of Astellas
Focus	CAR-T for solid tumor IP
Indication	Solid Tumors

Exclusive license agreement

Exclusive license agreement to research, develop and commercialize chimeric antigen receptor (CAR) T cell therapies using Five Prime's proprietary human antibodies to an undisclosed cancer target for hematologic malignancies and solid tumors.

Deal Value

Bluebird bio to pay Five Prime \$1.5 million upfront and up to \$130 million per licensed product

Year	2015
Company	Bluebird bio
Partner	Five Prime Therapeutics
Focus	Antibodies for CAR-T for cancer and solid tumor
Approach	Autologous
Indication	Hematological Cancers and Solid Tumors

Collaboration

Develop and commercialize chimeric antigen receptor (CAR) T cell therapies using ViroMed's proprietary humanized antibody to an undisclosed cancer target for solid tumors.

Deal Value

Bluebird to pay \$1 million upfront payment and subsequent milestone payments to ViroMed, which together could total over \$48 million per licensed product if certain development and regulatory milestones are achieved.

Year	2015
Company	Bluebird bio
Partner	ViroMed
Focus	Antibodies for CAR-T for solid tumors
Approach	Autologous
Indication	Solid Tumors

Collaboration

Amendment of existing global collaboration agreement restated to focus on developing product candidates targeting B-cell maturation antigen (BCMA) during a three-year collaboration term; Regains Rights to CAR T Programs Outside of BCMA

Deal Value

Celgene to pay Bluebird \$25 million in new research funding

Year	2015
Company	Bluebird bio
Partner	Celgene
Approach	Autologous
Indication	Hematological Cancers

Collaboration

CAR-T clinical trials

Year	2015
Company	CARsgene Therapeutics
Partner	Renji Hospital
Focus	CAR-T clinical trials

Research and development agreement

Identify and develop novel CAR-T candidates as well as next-generation CAR-T technologies. Under terms of the agreement, CARsgen will own commercial rights of any intellectual assets generated from the collaboration

Deal Value

not disclosed

Year	2015
Company	CARsgene Therapeutics
Partner	Shanghai Jiatong Cancer Institute

Collaboration

The alliance is aimed at developing novel cancer immunotherapies based on Cellectis' allogeneic chimeric antigen receptor (CAR) platform. MD Anderson Cancer Center's leukemia and myeloma teams will work with Cellectis to bring better treatments to patients suffering from cancers with high unmet needs, particularly multiple myeloma (MM), acute lymphocytic leukemia (ALL), T-cell acute lymphocytic leukemia (ALL) and blastic plasmacytoid dendritic cell neoplasm (BPDCN).

Year	2015
Company	Cellectis
Partner	MD Anderson Cancer Center
Focus	Allogeneic CAR-T development
Approach	Allogeneic
Indication	Hematological Cancers

Exclusive global license and collaboration agreement

Amendment to their existing collaboration agreement from February 2014 especially for UCART19, a TALEN™ gene-edited allogeneic Chimeric Antigen Receptor T-cell (CAR-T) immunotherapy. Under this amendment, Servier early exercises its option to acquire the exclusive worldwide rights to further develop and commercialize UCART19, which is about to enter Phase 1 development for chronic lymphocytic leukemia (CLL) and acute lymphoblastic leukemia (ALL).

Deal Value

Cellectis will receive from Servier a payment of \$38.2 million upon signature. In addition, Cellectis is eligible for over \$300 million of milestone payments, R&D financing, and royalties on sales from Servier, based on annual net sales of commercialized products.

Year	2015
Company	Cellectis
Partner	Servier
Focus	Allogeneic CAR-T clinical development
Approach	Allogeneic
Indication	Hematological Cancers

Exclusive global license and collaboration agreement

Pfizer Inc. (NYSE: PFE) and Servier have entered into an exclusive global license and collaboration agreement to co-develop and commercialize UCART19. Under the terms of the agreement, Pfizer and Servier will work together on a joint clinical development program for UCART19 and share development costs. Pfizer will be responsible for potential commercialization of UCART19 in the United States, and Servier will retain marketing rights in countries outside the United States. Pfizer's collaboration with Servier on UCART19 is distinct from the collaboration with Cellectis that Pfizer announced in June 2014, which did not include UCART19.

Deal Value

not disclosed

Year	2015
Company	Pfizer
Partner	Servier
Approach	Allogeneic
Indication	Hematological Cancers

License agreement

Develop and commercialize chimeric antigen receptor (CAR) technology targeting multiple myeloma cells.

Year	2015
Company	Collectis
Partner	Ohio State Innovation Foundation
Focus	Allogeneic CAR-T development
Approach	Allogeneic
Indication	Hematological Cancers

Collaboration

The alliance will foster the development of Collectis' lead product candidate in AML, called UCART123.

Year	2015
Company	Collectis
Partner	Weill Cornell Medical College
Focus	Allogeneic CAR-T development
Approach	Allogeneic
Indication	Hematological Cancers

Acquisition

Acquisition of Chinese PLA General Hospital's ('PLAGH', Beijing, also known as '301 Hospital') Chimeric Antigen Receptor T cell (CAR-T) therapy, its recombinant expression vector CD19, CD20, CD30 and Human Epidermal Growth Factor Receptor's (EGFR or HER1) Immuno-Oncology patents (all pending), and Phase I/II clinical data of the aforementioned therapies and manufacturing knowledge.

Year	2015
Company	Cellular Biomedicine Group
Partner	Chinese PLA General Hospital
Focus	Acquire CAR-T programs
Indication	Hematological Cancers

Acquisition

Acquisition of oncyte CAR T-CELL portfolio from Celdara Medical.

Deal Value

Celyad will pay Celedra Medical \$50 million in development and regulatory milestones with additional payments up to 21 million per product.

Year	2015
Company	Celyad
Partner	Celedra Medical
Focus	Acquire CAR-T programs

New company: Mustang Therapeutics

Preclinical and clinical development of proprietary Chimeric Antigen Receptor (CAR-T) technology.

Deal Value

The deal is worth \$40 million in upfront and milestone payments

Year	2015
Company	Coronado Biosciences
Partner	City of Hope
Focus	CAR-T development

Collaboration

Global collaboration for the development and commercialization of immunotherapies. The two companies will leverage T cell therapeutic strategies to develop treatments for patients with cancer and autoimmune diseases with an initial focus on Chimeric Antigen Receptor Technology (CAR-T) and T Cell Receptor (TCR) technologies.

Deal Value

Celgene will make an initial payment of approximately \$1 billion, composed of an approximately \$150 million upfront payment and approximately \$849.8 million to purchase 9,137,672 shares of Juno's common stock at \$93.00 per share.

Year	2015
Company	Juno
Partner	Celgene
Focus	CAR-T for autoimmune diseases
Approach	Autologous

Collaboration

Pursue three research programs together utilizing Editas' genome editing technologies, including CRISPR/Cas9, with Juno's CAR and TCR technologies

Deal Value

Juno will pay Editas an upfront payment of \$25 million and up to \$22 million in research support over the next five years across the three programs in the alliance. Editas is also eligible to receive future research, regulatory, and commercial sales milestones in excess of \$230 million for each program

Year	2015
Company	Juno
Partner	Editas Medicine
Focus	Gene editing technology
Approach	Autologous

Collaboration

Strategic research collaboration and license agreement to identify and utilize small molecules to modulate Juno's genetically-engineered T cell product candidates to improve their therapeutic potential for cancer patients; small molecules to reprogram immune cells for the "off the shelf engineered immunotherapy revolution

Deal Value

Juno to make an upfront payment to Fate of \$5 million, purchase 1 million shares, \$50 million per product

Year	2015
Company	Juno
Partner	Fate Therapeutics
Focus	Small molecule + CAR-T, for allogeneic
Approach	allogenic combination

License agreement and research agreement

Deal Value

Juno paid SCRI an upfront payment of \$200,000 and are required to pay to SCRI annual license maintenance fees, creditable against royalties and milestone payments due to SCH, of \$50,000 per year for the first five years and \$200,000 per year thereafter plus up to \$15M per licensed product. \$1.5 million over a period of five years research agreement

Year	2015
Company	Juno
Partner	Seattle Children's Hospital

Acquisition

The acquisition provides Juno access to transformative cell selection and activation capabilities, next generation manufacturing automation technologies, enhanced control of its supply chain, and lower expected long-term cost of goods. Juno plans to operate the acquired company, which employs 23 scientists, engineers, and other personnel, as a wholly-owned German subsidiary under the name Juno Therapeutics GmbH.

Deal Value

Juno to pay Stage Cell Therapeutics \$59 million upfront and \$140 million in potential milestone payments

Year	2015
Company	Juno
Partner	Stage Cell Therapeutics
Focus	Acquisition of cell selection and automated manufacturing technologies

Collaboration

New collaboration to conduct combination clinical trials in immuno-oncology with one of Juno's investigational CD19-directed chimeric antigen receptor (CAR) T cell candidates and MedImmune's investigational programmed cell death ligand 1 (PD-L1) immune checkpoint inhibitor, MEDI4736. Under the initial development plan, both companies will explore the safety, tolerability and preliminary efficacy of the combination therapy as a potential treatment for patients with non-Hodgkin lymphoma (NHL)

Deal Value

not disclosed

Year	2015
Company	Juno
Partner	MedImmune
Focus	CAR-T + checkpoint inhibitor for NHL
Approach	Autologous combination
Indication	Hematological Cancers

Acquisition

Protein engineering capabilities to Juno for improved ability to generate novel CAR T and TCR product candidates.

Deal Value

Juno agreed to acquire X-Body for an initial \$21 million cash plus 439,265 shares valued at more than \$23 million plus \$35M per product in milestones

Year	2015
Company	Juno
Partner	X body
Focus	Acquire protein engineering technologies

Expand collaboration

Expanded agreement with Tel Aviv Sourasky Medical Center to research and develop novel approaches to CAR T cell therapy.

Year	2015
Company	Kite Pharma
Partner	Tel Aviv Sourasky Medical Center
Focus	Autologous CAR-T development
Approach	Autologous

Collaboration

Develop and commercialize CAR-based product candidates directed against a number of Amgen cancer targets; preclinical development plans through IND.

Deal Value

Amgen to pay Kite \$60 million upfront and up to \$525 million per product in milestone payments, plus royalties on sales and IP licensing

Year	2015
Company	Kite Pharma
Partner	Amgen
Focus	Autologous CAR-T development
Approach	Autologous

Collaboration

Enhance the development of Kite's lead product candidate, KTE-C19, for the treatment of patients with refractory aggressive non-Hodgkin lymphoma (NHL)

Year	2015
Company	Kite Pharma
Partner	Leukemia Lymphoma Society
Focus	Autologous CAR-T development for NHL
Approach	Autologous
Indication	Hematological Cancers

Acquisition; stock purchase agreement

TCR-GENERator technology platform, TCF can rapidly and systematically discover tumor-specific TCRs.

Deal Value

Kite paid T-Cell Factory approximately \$12.0 million , and issued \$3.5 million in shares of our common stock and up to \$240 million in milestones

Year	2015
Company	Kite Pharma
Partner	T-Cell Factory, B.V
Focus	Acquire TCR discovery technology
Approach	Autologous
Indication	Solid Tumors

Expand collaboration

Develop a Next Generation of Cancer Immunotherapy Products for Solid Tumors for CAR and TCR.

Deal Value

Kite to make quarterly payments to the NCI increased from \$250,000 to \$750,000.

Year	2015
Company	Kite Pharma
Partner	NCI
Focus	Autologous CAR-T development for solid tumors
Approach	Autologous
Indication	Solid Tumors

Expand collaboration

Kite will receive from the NCI the exclusive option to license multiple T cell receptor (TCR) gene sequences for the development and commercialization of cancer immunotherapy candidates targeting solid tumors.

Year	2015
Company	Kite Pharma
Partner	Netherlands Cancer Institute (NCI)
Focus	Autologous CAR-T development for solid tumors
Approach	Autologous
Indication	Solid Tumors

Collaboration and license agreement

Discover and develop protein-based immunotherapies targeting the immune synapse to treat cancer. AIS will grant Kite an exclusive license to two programs from its transmembrane immunomodulatory protein (TIP™) technology, which Kite plans to further engineer into chimeric antigen receptor (CAR) and T cell receptor (TCR) product candidates. This collaboration will accelerate Kite's efforts to establish the next generation of engineered T cell therapies specifically designed to overcome the inhibitory mechanisms present in the tumor microenvironment.

Deal Value

Kite will make an upfront payment to AIS of \$5 million and additional payments to support AIS' research. AIS will be eligible to receive milestone payments based upon the successful achievement of pre-specified research, clinical, and regulatory milestones totaling \$530 million

Year	2015
Company	Kite Pharma
Partner	Alpine Immune Sciences
Focus	Development of CAR-T to overcome tumor microenvironment
Approach	Autologous
Indication	Solid Tumors

Collaboration

Automate Manufacturing of Engineered T Cell Therapies

Year	2015
Company	Kite Pharma
Partner	GE Healthcare
Focus	Automate manufacturing of CAR-T

Strategic research collaboration

Year	2015
Company	Maxcyte
Partner	John's Hopkins
Focus	Transient CAR expression for solid tumors
Indication	Solid Tumors

Strategic collaboration and exclusive license agreement

The agreement provides Merck Serono exclusive access to Intrexon's proprietary and complementary suite of technologies to engineer T-cells with optimized and inducible gene expression, as recently strengthened by a license agreement with the University of Texas MD Anderson Cancer Center.

Deal Value

Merck will make a \$115 million up-front payment to be split equally between Intrexon and partner Ziopharm Oncology along with a commitment of up to \$826 million more in milestones for the first two programs

Year	2015
Company	Intrexon and Ziopharm
Partner	Merck
Focus	Development of CAR-T

Collaboration

Multiyear alliance with Aduro Biotech for discovery and development of next generation cancer immunotherapies targeting the STING (Stimulator of Interferon Genes) pathway. Launch of a new immunoncology research group led by renowned cancer vaccine expert Glenn Dranoff, MD.

Deal Value

Novartis will make an upfront payment of \$200 million to Aduro and will make an initial equity investment in the company for \$25 million, with a commitment for another \$25 million equity investment at a future date.

Year	2015
Company	Novartis
Partner	Aduro Biotech
Focus	Small molecule + CAR-T for solid tumors
Approach	Autologous combination
Indication	Solid Tumors

Collaboration

Intellia Therapeutics collaboration to explore therapeutic options for using CRISPR to engineer chimeric antigen receptor T-cells and hematopoietic stem cells.

Year	2015
Company	Novartis
Partner	Intellia Therapeutics
Focus	Gene editing technology

Collaboration

Caribou Biosciences collaboration focused on using CRISPR as a research tool for drug discovery.

Year	2015
Company	Novartis
Partner	Caribou Biosciences
Focus	Gene editing technology

Collaboration

European manufacturing of its cell therapy products including CART.

Year	2015
Company	TxCell
Partner	MaSTherCell
Focus	manufacturing of CAR-T

Exclusive Licensing Agreement

Exclusive licensing agreement with The University of Texas MD Anderson Cancer Center, including an exclusive sublicensing agreement through MD Anderson for intellectual property developed at the University of Minnesota (sleeping beauty) for the development of non-viral adoptive cellular cancer immunotherapies.

Year	2015
Company	Ziopharm
Partner	MD Andersen and Intrexon
Focus	Gene editing IP

Exclusive license agreement

U.S. patent 9,393,292 for a method of cell therapy that enables the selective elimination of administered cells that have been modified to express an inducible caspase-9 protein (iCasp9). Bellicum, which exclusively licensed the worldwide rights to the invention from BCM, has incorporated this method into its CaspaCIDE® platform.

Year	2016
Company	Bellicum
Partner	Baylor College of Medicine
Focus	Gene editing IP

Agreement

cGMP manufacturing of UCART123 clinical batches, Cellectis' lead product candidate, with CELLforCURE, an LFB group company and the largest industrial facility for clinical and commercial production of innovative cell therapies in Europe.

Year	2016
Company	Cellectis
Partner	Takara Bio Inc
Focus	manufacturing of allogeneic CAR-T

Supply and License Agreement

For recombinant human fibronectin fragment RetroNectin®; secure Cellectis' manufacturing processes and expand the Company's UCART production capabilities

Deal Value

Financial terms not disclosed.

Year	2016
Company	Cellectis
Partner	CELLforCURE
Focus	manufacturing of allogeneic CAR-T

Research collaboration and license agreement

Development of a new class of monoclonal antibodies targeting PD-1. The action of these PD-1 antibodies is to promote the recovery of T-cells from exhaustion through a new mechanism of action.

Year	2016
Company	Collectis
Partner	MabQuest
Focus	CAR-T + monoclonal antibodies
Approach	allogenic combination

Collaboration

The project is based on a new generation chimeric antigen receptor T-Cell (CAR-T) immuno-oncology therapy for solid tumours. This involves directing the CAR-T cell towards a new, highly specific marker of tumour angiogenesis, CLEC14a. This therapy will act as a vasculature disruptive agent compromising oxygen supply to the tumours and inhibiting tumour growth.

Year	2016
Company	CellTherapy Catapult
Partner	University of Birmingham and Cancer Research Technology
Focus	Develop CAR-T for solid tumors
Indication	Solid Tumors

Collaboration

Further develop its NKR-T (CAR-T) pipeline in cellular immunotherapies for cancer.

Year	2016
Company	Celyad
Partner	Cancer and Immunity Unit of Institut Curie in Paris, France
Focus	Development of allogeneic CAR-T
Approach	Allogenic

Collaboration

Optimise the manufacture and delivery of these (CAR-T) personalised therapies using increased automation and leading edge processing technology.

Year	2016
Company	GlaxoSmithKline
Partner	Miltenyi Biotec
Focus	manufacturing of autologous CAR-T

Acquisition

Technology for sequencing single T-cells and B-cells of the immune system. Through the AbVitro immune sequencing method, a fully human, natural T-cell receptor that's designed to combat a specific cancer cell marker can be found in a matter of 2-3 weeks

Deal Value

Juno acquired Abvitro for about \$125 million in cash and stock. Specifically, Juno is offering \$78 million in cash and 1,289,193 shares of its stock (valued at \$36.39 a share).

Year	2016
Company	Juno
Partner	Abvitro
Focus	Acquire sequencing technology

Exercised Option

Celgene exercised its option to develop and commercialize the Juno CD19 program outside North America and China.

Deal Value

Celgene will pay Juno a fee of \$50 million and the companies will now share global development expenses for products in the CD19 program

Year	2016
Company	Juno
Partner	Celgene
Focus	Development of autologous CAR-T
Approach	Autologous
Indication	Hematological Cancers

New company; collaboartion

JW Biotechnology (Shanghai) Co., Ltd' to build China's leading cell therapy company by leveraging Juno's world-class chimeric antigen receptor (CAR) and T cell receptor (TCR) technologies together with WuXi AppTec's R&D and manufacturing platform.

Year	2016
Company	Juno
Partner	Wuxi Apptec
Focus	Develop CAR-T for blood cancer and solid tumors
Approach	Autologous
Indication	Hematological Cancers and Solid Tumors

Exclusive license agreement

Agreement with Memorial Sloan Kettering Cancer Center (MSK) and Eureka Therapeutics, Inc. for a novel, fully-human binding domain targeting B-cell maturation antigen (BCMA), along with binding domains against two additional undisclosed multiple myeloma targets to be used for the potential development and commercialization of chimeric antigen receptor (CAR) cell therapies for patients with multiple myeloma.

Year	2016
Company	Juno
Partner	Memorial Sloan Kettering and Eureka Therapeutics
Approach	Autologous
Indication	Hematological Cancers

Acquisition

Acquisition provides Juno with vipadenant, a small molecule adenosine A2a (A2a) receptor antagonist that has the potential to disrupt important immunosuppressive pathways in the tumor microenvironment in certain cancers. Juno intends to explore this molecule in combination with its engineered T cell platform and may over time explore it in other areas as well.

Deal Value

Juno will make an upfront payment to Redox Therapies of \$10 Million in cash with clinical and commercial milestones

Year	2016
Company	Juno
Partner	RedoxTherapies
Focus	Small molecule + CAR-T to overcome microenvironment for solid tumor
Approach	Autologous combination
Indication	Solid Tumors

Cooperative Research and Development Agreement (CRADA)

Research and clinical development of a fully human anti-CD19 chimeric antigen receptor (CAR) product candidate for the treatment of B-cell lymphomas and leukemias.

Year	2016
Company	Kite pharma
Partner	NCI
Focus	Develop fully human autologous CAR-T for blood cancer
Approach	Autologous combination
Indication	Hematological Cancers

Collaboration

Evaluate the safety and efficacy of KTE-C19, in combination with atezolizumab (also known as MPDL3280A), in patients with refractory, aggressive non-Hodgkin lymphoma (NHL).

Year	2016
Company	Kite Pharma
Partner	Genentech
Focus	Antibody + CAR-T for NHL
Approach	Autologous combination
Indication	Hematological Cancers

Collaboration

Test new PD-L1 (programmed death ligand-1) drug atezolizumab with Kite's immunotherapy CAR-T (chimeric antigen-receptor T-cell) treatment KTE-C19 in patients with refractory, aggressive non-Hodgkin lymphoma (NHL).

Year	2016
Company	Kite Pharma
Partner	Roche
Focus	Antibody + CAR-T for NHL
Approach	Autologous combination
Indication	Hematological Cancers

Collaboration and license agreement

Develop next generation, precision-controlled chimeric antigen receptor (CAR) product candidates that incorporate Cell Design Labs' molecular "on/off switch" technology.

Year	2016
Company	Kite Pharma
Partner	Cell Design Labs
Focus	Develop autologous CAR-T with on/off switch
Approach	Autologous

Exclusive, worldwide license agreement

Technology to advance the development of off-the-shelf allogeneic T-cell therapies from renewable pluripotent stem cells.

Year	2016
Company	Kite Pharma
Partner	UCLA
Focus	IP for development of allogeneic CAR-T
Approach	Allogeneic

Exclusive, worldwide license

For intellectual property related to a fully human anti-CD19 chimeric antigen receptor-based product candidate directed against B-cell malignancies.

Year	2016
Company	Kite Pharma
Partner	NIH
Focus	IP for fully human autologous CAR-T for blood cancer
Approach	Autologous
Indication	Hematological Cancers

10 year supply agreement

Year	2016
Company	Kite Pharma
Partner	Biolife solutions
Focus	cryopreservation and storage of autologous CAR-T

License agreement

Four pre-clinical programs that target regulatory T cell populations, inhibitory cytokines, and immunosuppressive metabolites in the tumor microenvironment. These programs will be explored as monotherapies and in combination with other complementary therapies in Novartis' immuno-oncology and targeted therapy portfolios.

Year	2016
Company	Novartis
Partner	Surface Oncology
Focus	overcome microenvironment for solid tumors
Approach	Autologous combination
Indication	Solid Tumors

Joint venture

Develop and commercialize proprietary immunotherapies, including those developed from, including or using TNK's chimeric antigen receptor T cell ("CAR-T")™ technology targeting carcinoembryonic antigen ("CEA") positive cancers.

Year	2016
Company	Sorrento Therapeutics
Partner	3SBio
Focus	Develop CAR-T
Indication	Solid Tumors

Joint venture

Develop and commercialize proprietary Chimeric Antigen Receptor ("CAR") modified cellular therapies based on CBT's Activated Killer Cell ("AKC") technology and five of Sorrento's CARs for all disease conditions, including oncology and infectious diseases.

Deal Value

Both CBT and Sorrento will make contributions of \$2 million to the JV. In addition, Sorrento will grant the JV an exclusive license to five CARs solely for combination with the AKC technology, while CBT will contribute its AKC technology. CBT will initially own 51% of the JV while Sorrento will initially hold the remaining 49%. Sorrento, under a royalty bearing license, will also gain access to the AKC technology for use outside the JV alone or with any other Sorrento products.

Year	2016
Company	Sorrento Therapeutics
Partner	CHA Biotech
Focus	Develop CAR-T

Collaboration

US partner manufacturing of cell therapies including Car-T.

Year	2016
Company	TxCell
Partner	PCT
Focus	manufacturing of CAR-T

Collaboration

The development part of the collaboration will focus on the non-clinical development of Chimeric-Antigen-Receptor engineered regulatory T (CAR-Treg) cells for the treatment of Lupus Nephritis.

Year	2016
Company	TxCell
Partner	Ospedale San Raffaele
Focus	preclinical development of CAR-Treg

Collaboration

CAR-Tregs for bullous pemphigoid.

Year	2016
Company	TxCell
Partner	Lübeck Institute of Experimental Dermatology
Focus	preclinical development of CAR-Treg

You need a partner with an understanding deeply rooted in experience. To develop, but also to implement a strategic plan. To identify, but also execute strategic partnering. To move from opportunity to results.

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