EDISON

CASI Pharmaceuticals

Company outlook

Aiming to be China's hematology company

Pharma & biotech

The year 2019 was transformational for CASI Pharmaceuticals. The company shifted its focus from in-licensing mature assets to investing in early-stage programs such as its CD19 CAR-T program CNCT19 and its anti-CD38 mAb CID-103. The company is focused on becoming a major provider of hematologic drugs for China. To this end, it plans to initiate four clinical trials in 2020 and two more in 2021. In this note we provide a comprehensive clinical and business outlook on the company.

Year end	Revenue ($m)	PBT* ($m)	EPS* ($)	DPS ($)	P/E (x)	Yield (%)
12/18	0.0	(20.0)	(0.24)	0.00	N/A	N/A
12/19	4.1	(36.5)	(0.39)	0.00	N/A	N/A
12/20e	7.9	(29.5)	(0.29)	0.00	N/A	N/A
12/21e	17.0	(34.9)	(0.33)	0.00	N/A	N/A

Note: *PBT and EPS are normalised, excluding amortization of acquired intangibles, exceptional items and share-based payments.

Phase I for CNCT19 initiated, first patients dosed

CASI initiated a Phase I study of CNCT19 for B-cell non-Hodgkin lymphoma in early 2020 and recently enrolled the first patients in spite of the COVID-19 pandemic. The company expects to also initiate the Phase I program for B-cell acute lymphocytic leukemia (B-ALL) in H120. The product would be the first Chinese domestically developed CD19 CAR-T, which we expect to provide it with beneficial formulary status.

CID-103 Phase I study to initiate in the UK

The company also plans to initiate a clinical study for CID-103 in late 2020 or H121 in the UK. CASI is currently preparing a clinical trial authorization (CTA) application, which it expects to submit in H120. The product is a mAb targeting CD38, for the treatment of multiple myeloma, similar to the approved drug Darzalex (daratumumab, Janssen), but the hope is to improve on its tolerability profile.

COVID-19 impact

We expect the ongoing COVID-19 pandemic to have an impact on the company and its business, but it is currently difficult to predict how these will manifest. CASI was able to enroll patients in the Phase I clinical study of CNCT19, but the pandemic may affect future recruitment. Initiation of the CID-103 study was delayed on account of the virus. We expect Evomela to underperform in 2020 at $7.8m sales, which would be down on an annualized basis from 2019, due to the risks of performing a stem cell transplant in an environment with COVID-19.

Valuation: Lowered to $333.6m or $3.37 per share

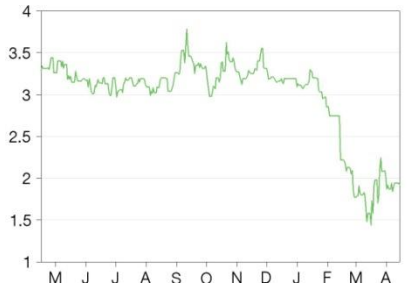
We have lowered our valuation to $333.6m or $3.37 per basic share, from $720m or $7.47 per basic share. We have added a risk adjustment to account for unforeseen risks due to COVID-19 (20% lower valuations across the board). Also, we have adjusted our assumptions for the ANDA portfolio, which has lowered its valuation to $151m from $495m.

16 April 2020

Price	**US$1.75**
Market cap	**US$173m**

Net cash ($m) as at 31 December 2019	54.2
Shares in issue	99.0m
Free float	44.5%
Code	CASI
Primary exchange	NASDAQ
Secondary exchange	N/A

Share price performance



%	1m	3m	12m
Abs	10.8	(46.6)	(46.3)
Rel (local)	7.9	(36.9)	(44.0)
52-week high/low	US$3.78	US$1.44	

Business description

CASI Pharmaceuticals is a pharmaceutical company that has acquired or licensed a series of drugs that it intends to market in China. These include proprietary drugs licensed from Spectrum Pharmaceuticals and a portfolio of ANDAs. The goal is to seek approval through new pathways that have been opened in the quickly changing Chinese regulatory environment.

Next events

First patients in CNCT19 trials	H120
CID-103 CTA application	H120
CID-103 trial start	Late 2020/H121

Analyst

Nathaniel Calloway +1 646 653 7036

healthcare@edisongroup.com

Edison profile page

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Investment summary

Company description: Acquisitions for the Chinese market

CASI is a pharmaceutical company focused on acquiring assets for commercialization in China. It has taken multiple approaches including acquiring the rights to drugs already approved outside of China (such as Evomela, which was approved in China in August 2019) as well as the licensing and acquisition of development stage candidates (such as CID-103, its anti-CD38 antibody, and CNCT19, its anti-CD19 CAR-T therapy). The company has a particular focus on building a portfolio of drugs for hematological disorders, but also has a portfolio of generics it intends to manufacture in China.

Valuation: Lowered to $333.6m or $3.37 per share

We have lowered our valuation to $333.6m or $3.37 per basic share, from $720m or $7.47 per basic share. This downward revision is driven by two primary factors. First, we have included a risk adjustment (20% reduction) to all of the company's programs to encompass the non-specific risks associated with COVID-19. This is meant to encompass disruptions to clinical trial timelines, labor disruptions and other factors. Additionally, we have reduced the value of the ANDA portfolio to $151m from $495m. We believe that this portfolio has been significantly deprioritized compared to the hematology assets, and there has been a lack of progress on breaking ground for the Wuxi production facility.

Financials: Evomela sales of $4.1m

The company reported Evomela sales of $4.1m for 2019 since its launch in August. However, we forecast lower sales in 2020 on an annualized basis ($7.8m) due to the disruption caused by COVID-19. The company ended the year with $54.2m in cash and marketable securities, the majority of which we expect to be deployed on the buildout of the Wuxi facility. The company has committed to deploying $50m in cash before December 2021 on the project, of which approximately $7m has been spent. We have increased our financing requirement for the company to $120m ($50m in 2020, $70m in 2022, recorded as illustrative debt) from $50m to cover operational shortfalls we expect before profitability in 2026.

Sensitivities: Strategy centered on limiting risk

Although CASI faces many of the same risks as other pharmaceutical companies, it has taken strategic measures to limit these risks. Many of the products it has acquired the rights to are already approved medications, some within China and some in other geographies. This dramatically simplifies the approval process for these molecules in China. However, the Chinese regulatory system has historically been associated with delays, so although the company has to date navigated the process adeptly, there can be no guarantees for future applications. Additionally, for its early stage assets, the company has specifically chosen programs with limited clinical risk. For instance, there are already a number of approved CD19 CAR-T therapies similar to CNCT19, so there is little risk associated with the target choice. However, this does not completely reduce the clinical risk because it still remains to be seen if CNCT19 is a well-designed and active CAR-T therapy. The same analysis applies to CID-108, which has the same target as the approved Darzalex. However, in addition to these normal business risks, CASI, along with many other companies across the world, faces certain special risks due to the ongoing COVID-19 pandemic, which we predict may have negative near-term impacts on sales for Evomela as well as potentially delay the company's clinical studies and capital development plans.

Building a premiere Chinese hematology company

CASI was formed in its current manifestation in 2014, when it changed its name from EntreMed and shifted its focus towards its current China-focused strategy. The company's products are a mixture of early stage assets with no prior approvals and products that have been approved outside of China. The overarching strategy of the company is to acquire assets that it believes address a high unmet need in China and are likely to gain approval. The assets that have been previously approved overseas allow a quicker pathway to the market through new pathways that have been established by the Chinese National Medical Products Administration (NMPA). The company then expects to further build out these markets with its early stage assets. And its earlier stage assets have specifically been chosen to limit clinical risk by using well vetted targets.

The company is prioritizing its portfolio of products for hematologic cancers. The company's hematology portfolio was founded around three assets it licensed from Spectrum (which were subsequently sold to Acrotech Biopharma) including Evomela (melphalan), which was launched in China in August 2019 as the company's first commercial product. The company also licensed Zevalin (ibritumomab tiuxetan) and Marqibo (vincristine sulphate liposome) from Spectrum, and has built out the hematology portfolio with the addition of the early stage assets CID-103 (an anti-CD38 mAb) and CNCT19 (an anti-CD19 CAR-T), both of which it acquired in 2019. Finally, the company has announced that it has acquired the Chinese rights to a novel formulation of thiotepa, a treatment for multiple myeloma (conditioning agent) similar to Evomela, but few details of the agreement or the development plan have been announced.

The company also has a package of ANDAs (25 approved and four pending, although seven subsequently delisted) that it acquired from Sandoz in 2018. The company intends to build out a GMP production facility in Wuxi (to break ground before August 2020, unless delayed by the parties involved), originally to support these ANDAs but now also as part of a broader goal to become more vertically integrated across its portfolio of products. Finally, in November 2019, the company announced that it has acquired the Chinese rights to a long-acting injectable (LAI) formulation of Octreotide (Octreotide LAI), for which it will need to perform confirmatory registrational trials, planned to start in 2020.

Exhibit 1: CASI drug portfolios

Portfolio	Drug	Indication	Notes
Hematology portfolio			
	Evomela (melphalan)	Multiple myeloma	China rights licensed from Spectrum, launched in China August 2019
	Zevalin (ibritumomab tiuxetan)	Non-Hodgkin's lymphoma	China rights licensed from Spectrum, CTA approved, trials to start early 2021
	Marqibo (vincristine sulphate liposome)	Acute lymphoblastic leukemia	China rights licensed from Spectrum, CTA approved
	CID-103 (anti-CD38 mAb)	Multiple myeloma	WW rights licensed from Blackbelt (developed by Tusk), CTA filing planned for H120, trial planned for late 2020 or H121
	CNCT19 (anti-CD19 CAR-T)	B-NHL, B-ALL	Joint venture with Juventas Cell Therapy, CTA approved, B-NHL Phase I initiated
	Thiotepa	Multiple myeloma	Little information released, registration study planned for 2021
Other products			
	18 approved and 4 pending ANDAs	Various	Acquired from Sandoz
	Tenofovir disoproxil fumarate (TDF)	HIV, HBV	ANDA acquired from Laurus Labs
	Octreotide LAI	Acromegaly	Chinese rights licensed from Pharmathen, trials planned for 2020

Source: CASI Pharmaceuticals

The Chinese market

China is the largest pharmaceutical market in the world by volume with a population of 1.4 billion, but attempts to penetrate its pharmaceutical market from western companies have historically been limited. In 2015 the total US drug exports to China were only $2bn.[1] However, the situation is rapidly changing with the adoption of new policies across all healthcare market segments to promote improved care, greater innovation and international collaboration. These include initiatives to improve the quality of pharmaceutical products and reduce regulatory bottlenecks.

Reimbursement in China

China's reimbursement system is almost entirely public, with 97% of individuals covered. Chinese citizens are covered under one of three schemes: Urban Employee Basic Medical Insurance (UEBMI), Urban Resident Basic Medical Insurance (URBMI), or New Rural Cooperative Medical Scheme (NRCMS). To complicate matters further, each of these schemes varies based on local government, with wide variations in benefits. UEBMI is by far the best-funded program and the predominant payer in terms of volume, despite only covering 19% of the population. Reimbursement is 75% for inpatient procedures and drugs, and outpatient costs are typically handled via a medical savings account (MSA), which is mandatory for payees and is financed primarily by payroll taxes.

Exhibit 2: Chinese insurance schemes

Program	Acronym	Fraction of population	Target population	Inpatient/outpatient reimbursement	Coverage ceiling
Urban Employee Basic Medical Insurance	UEBMI	19%	Urban employees	55%/50%	6x average local worker's wage
Urban Resident Basic Medical Insurance	URBMI	16%	Urban children, unemployed, disabled	75%/use of MSA*	6x average local disposable income
New Rural Cooperative Medical Scheme	NRCMS	62%	Rural residents	55%/50%	8x average local farmer's income

Source: Yu,[2] Hu and Mossialos.[3] Note: *MSA = medical savings account.

Despite the high number of insured individuals, there are still significant hurdles to receiving care in China. Generally, patients pay for medical procedures upfront then apply for reimbursement, which puts patients with low amounts of disposable income at a significant disadvantage. Additionally, although the NRCMS has had significant success in extending coverage to vulnerable people in China's countryside, this population continues to have issues with access to quality care.

Historically, deficiencies in the public health insurance infrastructure have been met through out-of-pocket spending. The total out-of-pocket contribution for healthcare costs was 33% in 2011 and the government previously stated the goal of reducing this to 30% by 2018.[2] These expenses have been implicated as contributing to the exceptionally high rate of household saving in China at 38% in 2014, the highest in the world.[4] This savings rate has consistently increased since the early 2000s with the ageing population of China. In a given year, approximately 13% of Chinese households experience a catastrophic medical expense, defined as spending of more than 40% of their disposable income,[5] so the need to address significant out-of-pocket medical costs is a common occurrence.

1 International Trade Administration

2 Yu H (2015) Universal health insurance coverage for 1.3 billion people: What accounts for China's success? *Health Pol.* 119, 1145-1152.

3 Hu J and Mossialos E (2016) Pharmaceutical pricing and reimbursement in China: When the whole is less than the sum of its parts. *Health Pol.* 120, 519-534.

4 Organisation for Economic Co-operation and Development

5 Ouyang Y (2013) China tackles illness-led poverty as financing gap grows. *Lancet Onco.* 14, 19.

There are several national regulatory schemes in China that determine drug pricing and reimbursement, although they only cover a portion of the drugs that are commercially available in China. The Essential Drug List (EDL) names widely used, low-cost generics that are intended as drugs required for basic care. The National Reimbursement Drug List (NRDL) is a separately administered list of drugs, divided into two parts: Class A for essential generics, which heavily overlaps with the EDL, and Class B, which includes more expensive and non-generic drugs. In theory, drugs on the EDL and NRDL Class A are fully reimbursed, although in practice this is limited by the resources of the individual insurance schemes and local jurisdiction. The NRDL Class B list is reimbursed on a provincial level with copays of between 10% and 90%. The prices of the drugs included on all these lists also have a high degree of variability compared to their western counterparts, ranging from 30% or less of the US list price for innovative cancer drugs to par for low-cost generics and subsidized programs. A limitation of the NRDL historically has been the frequency at which it was updated: the list received its first revision in eight years in early 2017. The government is also developing the so-called major disease schemes system, which provides reimbursement at a minimum of 50% for patients with certain high-cost conditions such as cancer or autoimmune disorders. These programs are still in the pilot stages.

Exhibit 3: Chinese drug reimbursement schemes

Program	Reimbursement	Notes
Essential Drug List	100%	Basic, low-cost generics
National Reimbursement Drug List: Class A	100%	Overlaps with EDL
National Reimbursement Drug List: Class B	10–90% copay provincially determined	Higher priced, innovative drugs
Major disease schemes	Minimum 50%	In development

Source: Various

Recent regulatory changes

One of the biggest focuses of regulatory reform in the Chinese healthcare system has been improving the availability of innovative medicines. A major limiting factor in the approval of new drugs in China has been the regulatory backlog. Historically, a new drug application was filed each time a manufacturer launched a competing generic and there was no apparatus to effectively identify which applications should receive priority review. As of 2014 there were approximately 19,000 open drug applications, and fewer than 100 employees involved in their review at the Chinese FDA (the agency that historically precedes the NMPA). In efforts to reduce the backlog, the agency increased the number of reviewers to 600 by the end of 2017 and reduced the number of outstanding applications to approximately 4,000.[6]

The agency has also instituted a series of pathways to market to expedite the approval of innovative drugs. In particular, these new policies open up the process to drugs that have been approved by foreign regulatory agencies. In June 2017, the CFDA joined the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use, the organization tasked with standardizing drug approval standards across regulatory agencies. To facilitate the approval of foreign medicines and align its process with foreign agencies, the CFDA created a series of new drug classifications, which take into consideration the approval status of a drug overseas and reduce the clinical requirements for drugs that have been approved elsewhere (Exhibit 4). Further, in October 2018, the State Council announced a draft proposal that would further reduce the clinical burden for imported drugs by allowing the CFDA to accept overseas clinical trial data as part of Chinese application packages. The proposal included the requirement that application include clinical data on 'the existence of ethnic differences,' presumably to ensure similar activity in Chinese populations. This requirement is in accordance with the historical motivation for requiring additional Chinese clinical trials. We should note that this requirement was not a barrier for the approval of Evomela in 2018.

[6] CFDA 2017 Drug Review Report

Exhibit 4: New drug classifications

Class	Definition	Regulatory status	Local clinical development	Application process
1	New drug	Not marketed globally	Phase I, II, III	New drug
2	Modified or improved drug	Not marketed globally	Phase I, II, III	New drug
3	China-manufactured generic	Approved outside of China	PK and Phase III	Generic drug
4	China-manufactured generic	Approved in China	BE	Generic drug
5.1	Imported innovative drug	Approved outside of China	PK and Phase III	Import drug
5.2	Imported generic drug	Approved outside of China	BE	Import drug

Source: Wang et al.[7] Note: PK=pharmacokinetics, BE=bioequivalence.

The agency has set up a series of criteria for priority review to shorten the time to approval for new drugs. Priority review is awarded to:

- innovative drugs not approved elsewhere
- innovative drugs that will be manufactured in China
- innovative drugs for HIV, hepatitis, rare diseases, malignant tumors and pediatric diseases, among others
- the first generic of a drug.

China is also reforming its approach to intellectual property with regard to pharmaceuticals. It is moving to a patent-linkage system similar to that present in the US, where a generic applicant must reference the originator patent and inform the holder, thus initiating an appeals process. The CFDA also proposed a series of data exclusivity periods for different classes of drug: six years for an innovative small molecule and 12 for a biologic. We expect this data exclusivity to be the primary method by which CASI protects the drugs in the Spectrum portfolio.

Spectrum portfolio

In September 2014, CASI was granted the Chinese rights (including Taiwan, Hong Kong and Macau) to three drugs, Zevalin, Marqibo and Evomela, from Spectrum Pharmaceuticals in exchange for approximately 17% of CASI stock and a $1.5m promissory note. The agreement does not include any milestones or royalties to Spectrum, but CASI is obligated to pay the China portion of royalties and milestones owed to Spectrum's upstream licensors. Spectrum subsequently sold these products to Acrotech Biopharma, which now holds the supply agreement. In general, these products are modified versions of other approved medications: novel formulations in the case of Evomela and Marqibo, and a radio-labelled derivative in the case of Zevalin. The patent terms for these products are limited (estimated at 2029, 2020 and expired for the three products, respectively), but additional protection may be provided in China via data exclusivity. In accordance with the most recent guidance, Evomela and Marqibo should be eligible for data protection of six years as innovative drugs, whereas Zevalin should be eligible for 12 years as a biologic.

Evomela

CASI's first commercial product is Evomela, a proprietary formulation of melphalan, a nitrogen mustard chemotherapy agent. Melphalan has a low solubility in water and the generic drug is commonly prepared with propylene glycol as an excipient to improve solubility, although this is associated with certain toxicities such as lactic acidosis, renal dysfunction and hemolysis. Evomela instead uses the proprietary cyclodextrin Captisol (developed by Ligand Pharmaceuticals) as a solubilization agent to avoid these effects and provides the additional

[7] Wang B, et al. (2017) An overview of major reforms in China's regulatory environment. *Reg Rapporteur* 14(7/8), 5-9.

benefit of increased stability after preparation. A 20% royalty on sales is owed to Ligand for the product.

Evomela is approved in the US for use as a conditioning agent before undergoing hematopoietic stem cell transplantation in patients with multiple myeloma. The drug is essentially used to kill the body's malignant bone marrow before it is replaced in the transplant. In the 61-person, open-label, single-arm pivotal trial, the drug combined with stem cell transplant improved response rates (partial response or better) from 79% to 95% following transplant. The safety profile was consistent with high-dose melphalan, without any toxicities typically associated with propylene glycol. The drug is also approved for the minor indication of patients with multiple myeloma who cannot take oral medications. The drug was launched in 2016 and Spectrum reported sales of $35.2m in 2017. We estimate pricing of around $14,000 for a conditioning regimen in the US.

As with other hematologic malignancies, multiple myeloma is significantly rarer in China than in the west. The age-adjusted incidence rate is 0.8 per 100,000 person years,[8] compared to 3.3 in the US.[9] Prior to its approval, there were no other forms of melphalan available in China, and the drug was granted a priority review process to speed its entry to the market. The drug was approved in December 2018 and launched August 2019, and had $4.1m in sales through the end of the year.

Zevalin

Zevalin is an antibody targeting CD20 with an yttrium-90 radio-label. CD20 is the same protein on B-cells that is target by the blockbuster Rituxan (rituximab). Zevalin is used in combination therapy with Rituxan for the treatment of follicular non-Hodgkin lymphoma (NHL) in the second and higher lines and for consolidation in the first line. The therapy is designed to improve standard anti-CD20 therapy by providing a dose of radiation to accumulations of B-cells in the lymph nodes. The drug was shown to improve progression-free survival compared to Rituxan alone, albeit at the risk of inducing radiation-associated malignancies such as myelodysplastic syndrome. In the pivotal study (open-label, randomized), the Zevalin arm had a complete response rate of 38% vs 18% for Rituxan alone. The drug has been on the market since 2002 and Spectrum reported sales of $11.8m of it in 2017. We estimate that Zevalin costs approximately $66,000 per treatment.

Based on the underlying rate of 6.4 per 100,000 cases of non-Hodgkin's lymphoma in China,[11] we estimate a rate of follicular lymphoma of approximately 1.3.[10] The CTA for the drug was approved in February 2019, and the company is planning to initiate pivotal studies in China in early 2021.

Marqibo

Marqibo is a liposomal formulation of vincristine, a chemotherapy used in the treatment of hematologic and solid tumors. The goal of the development of the liposomal formulation was to improve the pharmacokinetic profile of the drug by increasing circulation time and reducing off-target tissue exposure. The drug is approved in the US for Philadelphia chromosome negative (Ph-) acute lymphoblastic leukemia (ALL) in the third line. The drug was approved with an open-label, single-arm registration trial of 65 relapsed and refractory patients. Three patients had a complete response (CR, 4.6%) and an additional seven patients had a complete response with incomplete blood cell recovery (CRi, 10.8%). Marqibo was launched in 2013 and generated $6.6m in sales (US only) in 2017, with an estimated list price of $112,000 per course.

8 Globocan

9 SEER

10 American Cancer Society.

The estimated incidence of all forms of leukemia in China is approximately 5.5 per 100,000 person years.[11] Based on statistics from western countries, we estimate the rate of adult ALL in China at 1.0 per 100,000, 80% of which are expected to be Ph-.[12] The CTA for the product was approved in March 2019, but the company has indicated that it is evaluating its options for the drug.

A domestic Chinese CAR-T therapy

CASI announced on 17 June 2019 that it had signed an agreement with Chinese company Juventas Cell Therapy to license the worldwide rights to the latter's anti-CD19 CAR-T therapy, CNCT19. The therapy was developed at the Institute of Hematology and Blood Diseases Hospital in Tianjin, one of the premier hematological cancer centers in the country.

A joint venture was established (80% owned by CASI) that will invest ¥80m (US$11.6m) in Juventas as well as provide for undisclosed future development milestones and royalties. The new CEO of CASI, Weiwu He (appointed in April 2019), is also the chairman and a founder of Juventas (although he recused himself from the deal process).

The announcement stated that Juventas would be responsible for the future development of the treatment (although CASI would be on a steering committee). Juventas submitted two IND applications with the NMPA for the treatment of non-Hodgkin lymphoma and acute lymphoblastic leukemia, which have been approved. Juventas previously announced in December 2018 that it received ¥163m in a series A to support CAR-T development.

We have made several assumptions regarding the program. First, we expect initial indications for these programs to be diffuse large B-cell lymphoma and adult ALL, respectively, as these are the target indications that already have approved CD19 CAR-T therapies. Additionally, although CASI has stated that it intends to market the therapy worldwide, we expect the initial market to be China. Autologous cell therapies require a substantial manufacturing footprint to process patients' cells and establishing this manufacturing and the associated supply chains are a greater barrier to market entry than traditional intellectual property protections. Moreover, it is currently illegal for cell therapies (or other products containing genetic material) manufactured in China to leave the country. Juventas has a 1,400 square foot lab in Tianjin and has announced that it is building a 7,000 square foot production facility in Tianjin and plans to build a facility in Wuxi. We therefore expect the company to establish initial operations in China, but may amend this assumption in the future.

CD19 CAR-T therapy

CD19 is the most prominent target for CAR-T therapy in the oncology industry. The protein is a marker for immature B-cells (those that are not terminally differentiated into plasma cells), and is present on the abnormal cells of B-cell cancers. There has been significant interest in developing CD19 CAR-T therapies both in China and worldwide. The two CAR-T therapies currently approved in the US Kymriah (tisagenlecleucel, Novartis) and Yescarta (Axicabtagene ciloleucel, Kite/Gilead), as well as prominent development-stage candidates JCAR017 and JCAR014 from Juno/Celgene/Bristol Meyers all also target CD19. All of these programs have footprints in China (albeit structured differently) with the goal of entering this market.

[11] Chen W, et al. (2016) Cancer statistics in China, 2015. *CA: Can. J. Clin.* 66, 115-132.

[12] Kurzrock R, et al. (1988) The Molecular Genetics of Philadelphia Chromosome–Positive Leukemias. *N Eng J Med* 319, 990-998.

We expect these companies to seek approval in China, where applicable, through the priority review pathway for foreign approved drugs, which allows for speedy approval using foreign clinical trial data for drugs already approved overseas. A potential limitation of this strategy is that these companies must replicate an identical product in China. Because of restrictions on the export of human tissue in China, these companies cannot use overseas manufacturing to support Chinese sales, and therefore must reconstitute their manufacturing and controls domestically, which may be expensive. Moreover, trade disputes may affect the ability of these companies to import components of their CAR-T products, such as viruses.

We expect that a fully domestic CD19 CAR-T like that being developed by CASI will be able to better realize efficiencies in China and provide a lower-cost product, which may provide a competitive edge with patients and payers. There are a large number of such domestic CD19 CAR-T development programs in China, with ongoing clinical studies. According to clinicaltrials.gov, there are current 49 ongoing industry sponsored CD19 CAR-T clinical studies in China, although the status of many of these studies is largely unconfirmed.

We expect the first domestic CD19 CAR-T that is included on state insurance formularies to command significant market share. In the case of CASI, we have previously been impressed at the company's ability to quickly navigate the new regulatory framework in China in order to get Evomela approved quickly, but there can be no concrete assurances that it will be able to bring CNCT19 to market first.

The NMPA has approved CTAs to start clinical studies for both B-cell non-Hodgkin lymphoma (B-NHL), which initiated Phase I studies and enrolled its first patients in Q120, and B-cell adult lymphocytic leukemia (B-ALL), which is expected to initiate in H120.

Diffuse large B-cell lymphoma

Diffuse large B-cell lymphoma (DLBCL) is the primary B-NHL indication currently being treated with CAR-T. DLBCL is the most common variety of non-Hodgkin lymphoma, making up approximately 30% of all new cases of the disease. We expect this to be the primary market for CNCT19, like other CD19 CAR-Ts. Like other B-cell lymphomas, it is characterized by the proliferation of abnormal B-cells that accumulate in the lymph nodes and destroy their underlying structure. The genetic causes of the disease are diverse and truly it represents an underlying cluster of diseases based on the precise defect and histology. Because of this, the disease can be complex to treat, with widely varying prognoses depending on subtype. For instance, the five-year survival is only 10% when the disease affects bone marrow, compared to over 60% in the disease as a whole.[13] DLBCL is one of the most common hematologic cancers in the western world, with approximately seven cases per 100,000 in the US. By comparison, the rate in China is much lower: the underlying rate of lymphoma in China is 6.4 people per 100,000 (including all NHL subtypes, Hodgkin's lymphoma, and others),[14] so we estimate a rate of DLBCL of approximately 1.3 per 100,000.

Adult acute lymphocytic leukemia

Acute lymphocytic leukemia (ALL) is similar to DLBCL in that it is caused by the over proliferation of lymphocytes, although unlike DLBCL, these dysfunctional cells accumulate primarily in the bone marrow. In the majority of ALL cases, B-cells or B-cell progenitors over proliferate (B-ALL, approximately 75% of cases), although T-cells can be affected in a minority,[15] and therapies such as CD19 CAR-Ts would not be appropriate for these patients. Unlike the vast majority of cancers,

[13] NIH SEER database.

[14] Chen W, et al. (2016) Cancer statistics in China, 2015. *CA: Can. J. Clin.* 66, 115-132.

[15] American Cancer Society

ALL afflicts children as well as adults and 30% of ALL cases occur before the age of 15. It is the most common childhood cancer and leading cause of cancer deaths among children despite the fact that the five-year survival rate among children is high at 90%. By comparison the survival for adult patients is significantly lower at 40% for those aged 25 to 64 and 15% for those 65 and older. The disease is most common in Caucasian populations, but tends to be more aggressive in non-Caucasians. We estimate the incidence of ALL in China at 1.4 per 100,000[16] compared to 1.7 per 100,000 in the US.[17]

CID-103: Expanding the hematology portfolio

CASI announced that it had in-licensed the rights to anti-CD38 antibody CID-103 (formerly TSK011010) from Black Belt Therapeutics. Black Belt was recently spun off from Tusk Therapeutics when the latter merged with Roche in September 2018 (for €70m upfront and €585m in milestones) to acquire an unrelated asset (an anti-CD25 antibody). Tusk/Black Belt previously completed preclinical studies of the drug and CASI plans to submit CTA and Investigational Medicinal Product Dossier (IMPD) applications in H120 and for clinical trials to start in late 2020 or H121 (following delays due to COVID-19). CASI will assume all development responsibility for the asset.

CD38 is a cell-surface protein expressed on a range of white blood cells, including the malignant B-cells present in multiple myeloma. The strategy of targeting CD38 has already been vetted clinically. The drug Darzalex (daratumumab, Janssen) is an anti-CD38 antibody that was approved in 2015 in the US for the treatment of multiple myeloma and had sales of $2.0bn in 2018. Inclusion of the drug in a regimen of lenalidomide and dexamethasone significantly improved progression-free survival (HR=0.37, p<0.0001, median not reached at 21 months). However, despite its success Darzalex has been limited in part by its tolerability profile. The drug is associated with high rates of infusion reactions (48% as a monotherapy), fatigue (39%), back pain (23%), nausea (27%), vomiting (17%) and infections (20% upper respiratory, 15% nasopharyngitis, 11% pneumonia). There is ample room to improve on these results, particularly in the area of safety and tolerability.

There are a small number of other CD38 antibodies in clinical development (Exhibit 5), the most advanced of which is isatuximab (Sanofi), which reported positive results for its pivotal Phase III study in February 2019 (although the company has not reported detailed data).

Exhibit 5: Other anti-CD38 programs

Drug	Stage	Sponsor
Darzalex	Approved	Janssen
Isatuximab	Phase III complete	Sanofi
MOR202	Phase II	MorphoSys, I-Mab
TAK-079	Phase I	Takeda
CID-103	Preclinical	CASI

Source: Evaluate Pharma

In addition to the obvious indication of multiple myeloma, CID-103 has been investigated in preclinical studies for activity in solid tumors. CD38 is expressed in certain solid tumor cells and is believed to play a role in avoiding an anti-tumor immune response. Janssen also explored this possibility in the clinic combining the PD-L1 inhibitor Tecentriq (atezolizumab) with Darzalex for the treatment of non-small cell lung cancer (NSCLC). However, the study was terminated in May

[16] Yang C and Zhang X (1991) Incidence survey of leukemia in China. *Chin. Med. Sci. J.* 6, 65-70.

[17] NIH SEER database.

2018 after finding higher mortality in the treatment arm, but there are other combination studies in solid tumors that remain ongoing.

The acquisition of this drug is different from the company's previous strategy to acquire or in-license mature drugs and seek approval in China via new regulatory regimes in that country. However, it is consistent with the company's previous acquisition of hematology drugs from Spectrum. The development and approval of CID-103 will follow a more traditional route and will require Phase I through III trials. While we expect the company to seek approval for the drug in China, the major markets will be the US and Europe. However, the company will be able to add the drug to its portfolio of other hematologic malignancy assets for marketing in China.

Thiotepa

CASI also recently announced that it has licensed the Chinese rights to a novel formulation of thiotepa. Very little has been said about the deal, including no details on the partner or any payments, but we do know that it will be manufactured by Riemser Pharma. The company has stated that it expects the product to enter registrational trials in early 2021. The drug is an alkylating chemotherapeutic agent, similar to melphalan, and also used as part of a conditioning regimen for hematopoietic stem cell transplant. However, it is generally considered a more aggressive conditioning regimen. It is also used as an intravesical chemotherapy for bladder cancer. Also similar to Evomela, there currently is no commercially available form of thiotepa in China. We expect the company to add it to its hematology portfolio to provide a more complete catalogue of conditioning treatments.

Octreotide LAI in China

CASI announced on 7 November 2019 that it entered into an agreement with Pharmathen to develop and distribute octreotide LAI in China. The agreement included a €1m upfront payment and €2m in future milestone payments. CASI will be responsible for securing approval for the drug in China and intends to file for a CTA and initial clinical studies in 2020.

Octreotide is a synthetic form of the hormone somatostatin. Somatostatin's role in the body is to inhibit the effect of growth hormone and it is used medically to counteract the effect of high levels of growth hormone in patients with acromegaly (also known as gigantism). Acromegaly is generally caused by the presence of a growth hormone-secreting tumor present on the pituitary. Patients must maintain a constant level of somatostatin for it to be effective, which has led to the development of LAI forms of the drug. The first long-acting formulation developed was Sandostatin LAR (long acting release) from Novartis, which had sales of $1.6bn in 2018. The expiration of the patent for Sandostatin LAR in 2017 has opened up the field to competitors, such as the formulation available from Pharmathen, which is approved in Germany and the Czech Republic and is under review in the UK and France.

In addition to acromegaly, octreotide has been approved in the US to treat carcinoid syndrome. Carcinoid syndrome is a set of symptoms such as diarrhea and flushing secondary to carcinoid tumors caused by the overproduction of a range of hormones. Carcinoids are only diagnosed at 3.8 per 100,000, and carcinoid syndrome only occurs in approximately 10% of these cases.[18] We do not expect carcinoids to be the primary value driver for the product.

We expect acromegaly to be the primary market for the drug. The prevalence of acromegaly in China has not been studied to our knowledge, but it has an estimated prevalence of between 2.8

[18] Maggard MA (2004) Updated Population-Based Review of Carcinoid Tumors. *Ann Surg* 240, 117-122.

and 13.7 per 100,000 depending on geography.[19] In South Korea, the prevalence was estimated at 3.9 per 100,000.[20]

Sandostatin is already approved in China in both LAR and standard formulations and was recently the target of recent pricing negotiations between the Chinese government and drug makers. In October 2018, it was announced that the government had negotiated price reductions for Sandostatin and 16 other drugs for inclusion on in the National Reimbursement Drug List. The agreed price for the product was ¥5,800 for a 20mg vial, which corresponds to ¥75,400 per year for an acromegaly patient.

The generics portfolio

CASI has a portfolio of generic drugs it intends to commercialize in China. The majority of drugs in this portfolio were acquired in January 2018 when the company announced it had acquired 25 approved and four pending ANDAs from Sandoz for $18m CASI added the ANDAs for tenofovir disoproxil fumarate (TDF) in October 2018 from Laurus Labs ($700,000 upfront and $2.3m in milestones), and subsequently delisted seven ANDA for non-core products. Most of these drugs are already included on the NRDL in one form or another, and CASI intends to select certain products from the list that it believes have significant market potential in the US and China.

Plans for GMP manufacturing

The company is planning to establish a GMP manufacturing facility for these products in China. In late 2018 it established a joint venture (CASI Wuxi) with Wuxi Jintou Huicun Investment Enterprise, a Wuxi based development corporation to build a production facility in the Wuxi Huishan Economic Development Zone in Jiangsu Province. CASI owns 80% of CASI Wuxi following a $21m initial investment, the transfer of select ANDAs valued at $30m and a commitment to invest an additional $29m by the three-year anniversary of the agreement (December 2021). To our knowledge, CASI Wuxi has not broken ground on the new facility yet, but has committed to making 'specified fixed asset investments on the land with initial construction to begin before 26 August 2020,' unless it is extended by the parties involved.

If the country were to manufacture ANDA products locally in China, it would receive priority review for its ANDA applications to the CFDA. CASI will then perform the bioequivalence studies needed for approval, allowing these products to rapidly enter the market. This is an avenue that was previously unavailable to non-Chinese generics companies such as Sandoz and has the potential to dramatically increase the market for these products and the value of this portfolio. Moreover, in the future the company may file ANDA amendments (CBE-30 or PAS) to allow manufacturing in China for the US market.

The generic drug market in China

Despite the recent regulatory shift toward more branded and innovative pharmaceuticals, the drug market in China has been, and still is, dominated by generics. The market is highly competitive and fragmented with as many as 5,000 generics companies, with the top 100 companies only comprising a third of total sales.[1] The situation is further complicated by a highly complex, multi-level distribution network of over 13,500 companies.

The Chinese government recently initiated a pilot drug purchasing program aimed at reducing the price of generic drugs. The program consists of a pact between major cities (including Beijing,

[19] Lavrentaki A, et al. (2017) Epidemiology of acromegaly: review of population studies. *Pituitary* 20, 4–9.

[20] Kwon O, et al. (2013) Nationwide survey of acromegaly in South Korea. *Clin Endocrinol (Oxf)* 78, 577–585.

Shanghai and Guangzhou) to purchase certain generic drugs in bulk, forcing companies to compete for contracts, but also making the winning companies the sole distributors to hospitals in these regions. This resulted in an average price reduction of 52%. Importantly for CASI, the program cut the price of entecavir by 90% when the contract was won by Chia-tai Tianqing Pharma. Historically entecavir has received high reimbursement rates through programs to address the hepatitis B virus (HBV) epidemic in China. Additionally, the company's other HBV treatment TDF was also included in the scheme.

Impact of COVID-19

The global COVID-19 pandemic will undoubtedly affect the operations of CASI. It is difficult to fully estimate the impact of the disease at this time, but we believe it is safe to assume that even if the impact on human health is contained, there will be widespread and long-lasting economic consequences. These risks are not specific to China, but as the country already has a major caseload, we do not expect it to be able to avoid future disruption.

Firstly, we expect COVID-19 to negatively impact sales of Evomela. We expect a large fraction of healthcare infrastructure will be redirected toward treating the virus and that many stem cell transplant procedures will be delayed until after the threat from the virus has diminished. We model the drug taking a 20% haircut from the run rate established in the first five months of sales (from August to December 2019), which corresponds to sales of $7.8m in 2020.

Additionally, COVID-19 may negatively impact the ability of the company to enroll clinical studies. It has studies planned in 2020 for CID-103, CNCT19 and Octreotide LAI, and trials for thiotepa and Zevalin in 2021. The company has some flexibility over these studies and we expect few resources have been allocated to them yet, but prolonged delays could negatively impact the ability of the company to get these products approved in a timely manner and delay the profitability of the company. It is encouraging that the company was able to enroll some patients in the CNCT19 NHL study in Q120, and the company stated that it believes it can meet its timeline for the program at this time. However, it guided to delays in the initiation of the CID-103 study in the UK, and has guided that it will enter Phase I in late 2020 or H121.

Finally, COVID-19 may negatively impact the ability of the company to deliver its capital development plans. It is committed to building two facilities: the Wuxi manufacturing facility (to support the generics portfolio) and the Tianjin cell therapy production facility (for CNCT19, in collaboration with Juventas). Completion of these facilities may be delayed due to labor disruptions and a shift in priorities among local authorities. Again, relatively little cash has been deployed on these projects, so the company may have some latitude although it has a deadline of August 2020 to break ground on the Wuxi facility.

Valuation

We have lowered our valuation to $333.6m or $3.37 per basic share from $720m or $7.47 per basic share. This is due to multiple adjustments on our part. First, we have added a 20% discount across the board discount based on the risks associated with the COVID-19 pandemic. The goal is for this to encompass all the non-specific risks to development and commercialization for these projects from the pandemic. We expect to update this value with further information on the pandemic, but our current outlook is for there to be widespread disruption throughout 2020, especially in China, which may impact the ability of the company to perform normal business. We have also directly lowered our revenue estimates for Evomela for 2020 to $7.8m from $13.2m as

a result of the impact of COVID-19. We believe the risk of performing a stem cell transplant with active COVID-19 will temper use during the outbreak.

We have also significantly lowered our valuation for the ANDA generics to $151m from $495m. This is to align the value of the project with the company's current priorities. We believe this portfolio has been significantly deprioritized in favor of the hematology portfolio. The company originally planned on bringing these products to market quickly, using contract manufacturing if needed, but this shifted to internal manufacturing at the Wuxi facility, which has not broken ground yet. Moreover, the company has indicated that this facility will not exclusively be used for generics production. The lower valuation is driven by delaying initial commercialization of these products to 2023 (from 2020), the removal of the seven delisted drugs and the aforementioned COVID-19 risk. We have also increased our discount rate to 12.5% from 10%. We use typically use 10% for approved products but given the delays and uncertainties over the company getting these drugs to market, we have reflected this in our discount.

We have increased the probability of success for CNCT19 to 10% from 5% as the product has begun clinical trials. This has increased its value to $30.7m from $23.2m.

We have delayed the clinical program for CID-103 to align with company guidance that it will enter Phase I in late 2020 or H121. We previously forecasted the majority of patient enrolment in 2020.

We have also added Thiotepa to the hematology portfolio. We use the same market estimates as for Evomela (given it is used for the same indication of stem cell transplant for multiple myeloma), but expect lower penetration (10%) given it is generally reserved for more severe cases. We do not know the terms of the license (or the other participant yet) but include a 15% royalty payable in lieu of more detail. Our initial valuation is $4.1m.

Finally, we have removed the legacy asset ENMD-2076 from our model, as we do not expect it to be developed further.

Exhibit 6: Valuation of CASI

Portfolio	Asset	Region	Peak sales ($m)	Margin	Clinical risk adjustment	COVID-19 risk	Value ($m)
Hematology	Evomela	China	35.4	49%	100%	80%	56.20
	Marqibo	China	9.2	56%	90%	80%	5.85
	Zevalin	China	25.5	64%	90%	80%	32.55
	Tiotepa	China	0.0	39%	90%	80%	3.45
	CID-103	China & US & Europe	766.6	59%	5%	80%	10.61
	CNCT19	China	306.2	54%	10%	80%	30.72
Other products	ANDA portfolio	China & US	145.6	48%	100%	80%	151.05
	Octreotide LAI	China	15.7	41%	80%	80%	8.95
Total							299.37
Net cash and equivalents (YE19) ($m)							54.25
Non-controlling interest							(20.02)
Total firm value ($m)							333.60
Total shares (m)							99.02
Value per basic share ($)							3.37
Dilutive warrants and options							29.46
Value per diluted share ($)							3.14

Source: CASI Pharmaceuticals reports, Edison Investment Research

Financials

The company reported revenue of $4.1m from Evomela in 2019. The majority of these sales were in Q319 ($2.7m) following the August launch, presumably because of warehoused patients. As described above, we forecast $7.8m in sales for 2020, which is lower on a full-year basis, due to the impact of COVID-19.

Spending for 2019 was dominated by SG&A expenses of $30.4m, which we expect to remain relatively stable in 2020, but increase thereafter as Evomela sales ramp up and costs associated with the generics business increase ($40.8m in 2021).

The company ended the year with $54.2m in cash. A large portion of this is earmarked for the buildout of the facility in Wuxi. The company has earmarked $50m in cash for the project: $21m payment to CASI Wuxi (although this has not left the CASI balance sheet as CASI Wuxi is consolidated in CASI financials) and an additional $29m to be deployed before December 2021. Of the $21m, approximately $7m has been spent on land use rights. We forecast $15m in capex in 2020 and $29m in 2021. We have increased our expected financing hurdle for the company to $120m ($50m in 2020, $70m in 2022, recorded as illustrative debt) from $50m. This increase is driven primarily by the delay in the expected commercialization timeline for the ANDAs. We forecast profitability in 2026.

Exhibit 7: Financial summary

$'000s	2018	2019	2020e	2021e
Year end 31 December	US GAAP	US GAAP	US GAAP	US GAAP
INCOME STATEMENT				
Revenue	0.0	4,131.0	7,869.0	17,011.0
Cost of Sales	0.0	(3,935.0)	(1,950.2)	(4,235.8)
Gross Profit	0.0	196.0	5,918.7	12,775.3
EBITDA	(19,402.4)	(37,495.0)	(29,352.4)	(33,962.3)
Normalised operating profit	(19,767.9)	(38,098.0)	(29,549.4)	(34,996.2)
Amortisation of acquired intangibles	(1,305.4)	(1,550.0)	(1,550.0)	(1,550.0)
Exceptionals	0.0	0.0	0.0	0.0
Share-based payments	(6,118.1)	(7,310.0)	(7,310.0)	(7,310.0)
Reported operating profit	(27,191.4)	(46,958.0)	(38,409.4)	(43,856.2)
Net Interest	(280.1)	1,062.0	48.6	48.6
Joint ventures & associates (post tax)	0.0	0.0	0.0	0.0
Exceptionals	0.0	534.0	0.0	0.0
Profit Before Tax (norm)	(20,048.1)	(36,502.0)	(29,500.9)	(34,947.6)
Profit Before Tax (reported)	(27,471.6)	(45,362.0)	(38,360.9)	(43,807.6)
Reported tax	0.0	0.0	0.0	8,761.5
Profit After Tax (norm)	(20,048.1)	(36,502.0)	(29,500.9)	(34,947.6)
Profit After Tax (reported)	(27,471.6)	(45,362.0)	(38,360.9)	(35,046.1)
Minority interests	0.0	(670.0)	0.0	0.0
Discontinued operations	0.0	0.0	0.0	0.0
Net income (normalised)	(20,048.1)	(37,172.0)	(29,500.9)	(34,947.6)
Net income (reported)	(27,471.6)	(46,032.0)	(38,360.9)	(35,046.1)
Basic average number of shares outstanding (m)	85	96	101	106
EPS - basic normalised (c)	(23.65)	(38.74)	(29.28)	(33.04)
EPS - diluted normalised (c)	(23.65)	(38.74)	(29.28)	(33.04)
EPS - basic reported (c)	(32.41)	(47.98)	(38.08)	(33.13)
Dividend (c)	0.00	0.00	0.00	0.00
BALANCE SHEET				
Fixed Assets	20,845.4	41,130.0	54,103.8	80,903.7
Intangible Assets	18,784.7	16,895.0	15,345.0	13,795.0
Tangible Assets	1,750.6	985.0	15,508.8	43,858.7
Investments & other	310.0	23,250.0	23,250.0	23,250.0
Current Assets	92,564.6	61,501.0	68,481.7	16,206.3
Stocks	0.0	4,542.0	641.2	1,392.6
Debtors	0.0	1,293.0	1,293.5	2,796.3
Cash & cash equivalents	85,117.0	54,246.0	65,127.0	10,597.4
Other	7,447.6	1,420.0	1,420.0	1,420.0
Current Liabilities	(3,873.9)	(7,947.0)	(8,952.6)	(11,213.2)
Creditors	(968.0)	(5,113.0)	(6,118.6)	(8,379.2)
Tax and social security	0.0	0.0	0.0	0.0
Short term borrowings	(1,499.5)	0.0	0.0	0.0
Other	(1,406.4)	(2,834.0)	(2,834.0)	(2,834.0)
Long Term Liabilities	(73.6)	(1,019.0)	(51,019.0)	(51,019.0)
Long term borrowings	0.0	0.0	(50,000.0)	(50,000.0)
Other long term liabilities	(73.6)	(1,019.0)	(1,019.0)	(1,019.0)
Net Assets	109,462.5	93,665.0	62,614.0	34,877.8
Minority interests	0.0	20,670.0	20,670.0	20,670.0
Shareholders' equity	109,462.5	72,995.0	41,944.0	14,207.8
CASH FLOW				
Op Cash Flow before WC and tax	(19,402.4)	(37,495.0)	(29,352.4)	(33,962.3)
Working capital	(9,780.4)	4,452.0	4,905.9	6.4
Exceptional & other	598.9	9,800.0	0.0	8,761.5
Tax	0.0	0.0	0.0	0.0
Net operating cash flow	(28,583.9)	(23,243.0)	(24,446.6)	(25,194.4)
Capex	(1,131.1)	(7,053.0)	(14,720.8)	(29,383.8)
Acquisitions/disposals	(20,642.4)	(21,005.0)	0.0	0.0
Net interest	0.0	0.0	48.6	48.6
Equity financing	92,269.8	3,545.0	0.0	0.0
Dividends	912.0	0.0	0.0	0.0
Other	0.0	20,000.0	0.0	0.0
Net Cash Flow	42,824.4	(27,756.0)	(39,118.8)	(54,529.6)
Opening net debt/(cash)	(41,991.7)	(83,617.5)	(54,245.5)	(15,126.7)
FX	(1,197.5)	(1,328.0)	0.0	0.0
Other non-cash movements	(1.0)	(288.0)	0.0	0.0
Closing net debt/(cash)	(83,617.5)	(54,245.5)	(15,126.7)	39,402.9

Source: CASI Pharmaceuticals reports, Edison Investment Research

Contact details	Revenue by geography
9620 Medical Center Drive Suite 300 Rockville, MD 20850 USA (240) 864-2600 www.casipharmaceuticals.com	N/A

Management team

Chairman and CEO: Weiwu He

Dr He has been chairman of the company since February 2012, executive chairman since February 2018 and chief executive officer since 2019. Prior to joining CASI, Dr He was the CEO of OriGene Technologies and remains chairman of the board of directors. He also is the founder and general partner of Emerging Technology Partners, a life sciences focused venture fund established since 2000. Dr He has been involved in founding or funding over 60 biotech companies throughout his career, some of which went on to be acquired by significantly larger firms. In the earlier part of his career, Dr He was one of the first few scientists at Human Genome Sciences, and prior to that, was a research fellow at Massachusetts General Hospital and Mayo Clinic. Dr He is an author to more than 30 research publications and inventor of over 32 issued patents.

President: Larry Zhang

Mr Zhang joined CASI Pharmaceuticals in September 2018 as President of CASI Pharmaceuticals (Beijing), which is a subsidiary of CASI Pharmaceuticals, and became President of CASI Pharmaceuticals in September 2019. Prior to joining CASI's Beijing office, Mr Zhang was vice president, head of public affairs and corporate responsibility at Novartis Group (China), where he focused on the public affairs/public relations strategy, including initiating Novartis's China policy focusing on China FDA (NMPA) new drug approval reform, intellectual property protection, generic quality consistency evaluation and new regulations on biosimilars. From 2011 to 2016, he was chief executive officer of Sandoz Pharmaceutical (China), a Novartis Company. Mr Zhang has also held executive leadership roles with Bayer Healthcare and Baxter International Corporation in the US and Asia Pacific.

CMO: Alexander A Zukiwski

Dr Zukiwski joined CASI Pharmaceuticals in April 2017 as chief medical officer. Prior to that Dr Zukiwski was chief executive officer and chief medical officer of Arno Therapeutics and has been a director of Arno Therapeutics since 2014. At Arno his responsibilities included leading the clinical development and regulatory affairs teams to support the company's pipeline. Before joining Arno in 2007, Dr Zukiwski served as chief medical officer and executive vice president of clinical research at MedImmune. Dr Zukiwski previously held several roles of increasing responsibility at Johnson & Johnson's medical affairs and clinical development functions at Johnson & Johnson Pharmaceutical Research & Development; Centocor R&D and Ortho Biotech. Before joining Johnson & Johnson, he served in clinical oncology positions at pharmaceutical companies such as Hoffmann-LaRoche, Glaxo Wellcome and Rhone-Poulenc Rorer. He previously served as a member of the medical advisory board at Gem Pharmaceuticals and served as a director of Ambit Biosciences Corporation.

COO (US), General Counsel and Secretary: Cynthia W Hu

Ms Hu joined CASI Pharmaceuticals in June 2006 as vice president, general counsel and secretary, and in December 2008 was appointed Chief Operating Officer. Prior to joining CASI Pharmaceuticals, from January 2000 to May 2006, Ms Hu served as senior attorney for the corporate and finance practice group at Powell Goldstein in Washington, DC, where she advised clients on all corporate and financing matters, including complex public and private financings, mergers and acquisitions, SEC and regulatory compliance, and corporate governance and compliance. Before that, Ms Hu served as corporate and securities counsel for a NYSE-listed financial institution and prior to that was in private practice with increasing levels of responsibilities, including at Klehr, Harrison, Harvey & Branzburg and Littman & Krooks focusing on corporate transactions and compliance with corporate and securities laws.

Principal shareholders	(%)
IDG-Accel China Growth Fund III Associates	8.28
Blackrock	3.41
Vanguard Group	2.42
Wellington Shields Capital Management	1.37
Wellington Shields & Co	1.33

Companies named in this report

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Frankfurt +49 (0)69 78 8076 960
Schumannstrasse 34b
60325 Frankfurt
Germany

London +44 (0)20 3077 5700
280 High Holborn
London, WC1V 7EE
United Kingdom

New York +1 646 653 7026
1,185 Avenue of the Americas
3rd Floor, New York, NY 10036
United States of America

Sydney +61 (0)2 8249 8342
Level 4, Office 1205
95 Pitt Street, Sydney
NSW 2000, Australia