EDISON

Mologen

Global deal

Global lefitolimod partnership close to completion

Pharma & biotech

Mologen announced that it has signed term sheets for a global partnership with Oncologie for its lead asset, lefitolimod. The deal is expected to complete in Q119, and in the near term Mologen expects to receive €23m from the agreement in a combination of R&D funding, cash payment and bond issues. Sensitivity remains around Oncologie who are an early stage biotech with $16m in seed funding. Mologen announced a capital raise in which it could receive gross proceeds of €18m. Focus remains on data from the Phase III IMPALA trial in metastatic colorectal cancer (mCRC), expected in 2020. We value Mologen at €188m (€16.6/share).

Year end	Revenue (€m)	PBT* (€m)	EPS* (c)	DPS (c)	P/E (x)	Yield (%)
12/16	0.0	(20.8)	(4.22)	0.0	N/A	N/A
12/17	0.0	(19.3)	(2.81)	0.0	N/A	N/A
12/18e	6.0	(11.1)	(0.98)	0.0	N/A	N/A
12/19e	7.0	(9.7)	(0.86)	0.0	N/A	N/A

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

Oncologie: Challenges remain with early partner

Oncologie will lead the global development of lefitolimod (TLR9 agonist). Near-term financing is split such that Mologen has received €3m in cash and €2m in interest-free convertible bonds, with a further €2m bond expected once the final contract is signed. It also expects €7m in budgeted expenses (for IMPALA) and €9m in funding for additional combination studies in the short term. Longer-term considerations involve receipt of €20m in additional expenses, up to €200 in development milestones, up to €900m in commercial milestones and a tiered royalty rate on net sales (peak 16%). We note that Oncologie is an early-stage US/China-based biotech and it must complete a mid-double digit funding round to enable the deal to be closed.

IMPALA: Funded to Phase III readout

IMPALA, a 549-patient (enrolled), two-arm, randomised pivotal Phase III trial for the maintenance treatment of mCRC patients, is forecast by Mologen to read out in 2020. With the financing expected from both the Oncologie deal and the capital raise, Mologen is now funded to the completion of the trial. Near-term catalysts could be provided by initial (safety) data from the ICI combination trial and the initiation of a new study with lefitolimod in HIV (TITAN), both of which are expected by year-end.

Financials: Funded into 2020

Net loss in H118 was reduced to €4.8m (H117: €10.7m) as a result of reduction in R&D costs from the completion of the TEACH and IMPULSE studies and the initial payment of €3m from Oncologie. Estimated current net cash of €21m (includes Oncologie financing paid to date and capital raise) should fund Mologen into 2020.

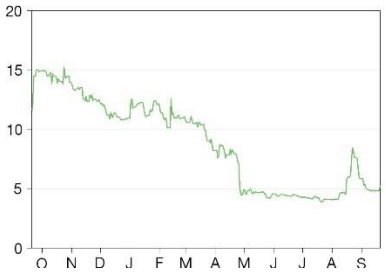
Valuation: €188m (€16.6/share)

We value Mologen at €188m (€16.6/share) vs €243m previously, updated for the Oncologie deal metrics. We note that the reduction in value is driven by a lower royalty rate on net sales compared to our previous assumptions for a deal.

21 September 2018

Price	**€5.20**
Market cap	**€39m**
Net cash (€m) at 30 June 2018	0.7
Shares in issue (pre-raise)	7.54m
Free float	59%
Code	MGN
Primary exchange	Frankfurt (Prime Standard)
Secondary exchange	N/A

Share price performance



%	1m	3m	12m
Abs	(4.1)	(46.4)	(76.5)
Rel (local)	(1.4)	(46.7)	(76.7)
52-week high/low		€19.6	€4.3

Business description

Mologen is a German biopharmaceutical company developing novel biopharmaceuticals. Lead product lefitolimod (TLR9 agonist) is being evaluated in metastatic colorectal cancer maintenance, small cell lung cancer maintenance, HIV and a combination trial in advanced solid malignancies.

Next events

Q318 results	8 November 2018
IMPULSE full data presented at scientific conference	Autumn 2018
IMPALA primary analysis	H120

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Investment summary

Company description: Transitioning beyond lefitolimod

Mologen is predominantly focused on commercialising its lead candidate, lefitolimod, a TLR9 agonist. The Oncologie global assignment and co-development deal, once finalised, signifies a significant step in this strategy. Lefitolimod is currently being tested in two ongoing trials: a Phase III study (IMPALA) for the maintenance treatment of mCRC (data forecast for 2020) and a Phase I combination study in advanced malignancies (initial safety data by year-end). The company expects to initiate a Phase IIa trial (with Aarhus University Hospital) in HIV (TITAN) testing lefitolimod in combination with innovative virus-neutralising antibodies. Development of MGN1601, a therapeutic cancer cell vaccine, which completed a Phase I/II study (ASET) for kidney cancer, is currently on hold and Mologen is looking to divest/spin off the MIDGE technology platform. Its next-generation platform, EnanDIM, is a preclinical asset and Mologen plans to initiate clinical development in 2019. On 1 August 2018, Dr Ignacio Faus took over the role of CEO from Mariola Söhngen. Mologen is based in Berlin and currently has c 52 employees.

Valuation: rNPV of €188m or €16.6/share

Our valuation of Mologen has decreased to €188m (€16.6/share) vs €243m (€21.5/share) previously. We now include the global Oncologie deal in our valuation and, notably, now incorporate clinical and commercial milestones for mCRC, SCLC, HIV and ICI combinations. In total, we forecast that c €600m of the total €1.1bn in milestones are achieved. We forecast that after completing the current trials, Mologen will not incur any R&D costs for future programmes and only incur SG&A expenses in relation to a potential regulatory approval in mCRC. The largest negative impact to our valuation has been a lower than anticipated royalty rate, particularly in mCRC where a peak 16% royalty has been assigned, compared with 30% assumed previously. In our valuation across all indications, we currently assume that an average royalty rate of 12% is achieved, which is in line with Mologen's low double-digit guidance. We note that Mologen recently consolidated its shares to 7.5m from 37.7m, we assume for our valuation that all shares are allocated from the proposed capital raise, increasing the share capital to 11.3 million.

Sensitivities: Clinical and commercial

The key sensitivities relate to lefitolimod's clinical performance, although sensitivities around the partnership deal with Oncologie will become more prominent. In the near term, the closure of the global assignment and co-development agreement for lefitolimod relies on Oncologie's ability to successfully raise a mid-double digit million dollar amount in its next funding round. If the deal closes, future development of lefitolimod will be wholly dependent on Oncologie, and any change in Oncologie's strategic or financial situation could negatively affect Mologen. Oncologie is an early-stage venture capital-backed biotech, which is currently not financed to deliver on future development (≤ €200m) or commercial milestones (≥ €900m) beyond the near-term considerations agreed upon. It also has no track record in developing or commercialising product candidates. IMPALA data (mCRC) will have a major clinical bearing on lefitolimod's chance of regulatory approval and commercial success. The relative infancy of Mologen's other assets means it is dependent on its success in the near term.

Financials: Cash reach into 2020

Gross cash of €6.2m as of June 2018, combined with the expected completion of the €18m gross capital raise, €3m initial cash payment and €2m bond payment from Oncologie, mean Mologen should now be funded to 2020 (total expected gross cash position of c €28m, net cash position of c €21m). Net loss in H118 was reduced to €4.8m (H117: €10.7m) due to the reduction in R&D costs from the completion of the TEACH and IMPULSE studies, and the initial payment of €3m from Oncologie.

Oncologie: Global deal secures near term

Mologen has expanded on its original deal with Oncologie (signed in February 2018) to sign term sheets for a global assignment and co development agreement. Oncologie is a newly formed, Boston-headquartered, private oncology therapeutics company with additional operations in Shanghai, China. It most recently raised $16.5m in seed funding and has in-licensed two assets for development: lefitolimod and a TIM/TAM ligand antibody (bavituximab). The company plans to conduct parallel clinical programmes in the US and China. Management consists of founder and CEO Laura Benjamin (Eli-Lilly, Harvard), CBO David Malek (Pivotal BioVentures, China, Sanofi), CDO Jessica Rege (Eli-Lilly, Eisai) and acting CMO Hagop Youssoufian (Ziopharma Oncology, Sanofi). The company is backed by Pivotal bioVenture Partners China Fund, Nan Fung Life Sciences, China Merchant Bank Investments and Volcanics Ventures.

Oncologie will lead global development of lefitolimod (TLR9 agonist) across all indications, with an initial focus on oncology. Its strategy for lefitolimod, particularly in relation to the indications it plans to prioritise, has not be revealed. The deal is worth over €1bn in milestones (€200m in development milestones and up to €900m in commercial milestones), in addition to royalties on net sales. Approximately €23m in considerations is expected in the near term (Exhibit 1). Near-term financing is split such that Mologen has already received €3m in cash and €2m in interest-free convertible bonds (30% premium to the 10 days volume weighted average stock price, five-year term. First bond issued on 3 September 2018 at €9.702/share) with a further €2m bond expected on deal completion. Budgeted expenses, mainly in relation to the completion of the IMPALA trial, will also be paid to Mologen on a quarterly basis up to a total of €7m. Mologen expects to spend an additional €5m to complete the trial. €9m in funding has been allocated for additional combination studies, although what form these will take is still to be determined. However, management has alluded to the likelihood of two to three small Phase I/II studies testing ICI combinations in particular cancer types.

Longer-term considerations involve payment of €20m in additional expenses relating to regulatory interactions and manufacturing scale up for a commercial launch. Up to €200 in development milestones and up to €900m in commercial milestones are also included. The exact split of these is not known, but will likely be spread across multiple indications, regions and goals. Based on classical clinical milestones (eg successful trial data, regulatory approvals) and commercial milestones on key sales targets, we do not currently anticipate that Mologen will be able to recognise more than €600m based on the current indications and regions that are in development (including China, Hong Kong & Macao, Taiwan and Singapore, where a previous deal with Oncologie was in place). We note that the clinical and commercial success in other cancers, combinations and regions that are yet to be disclosed could enable Mologen to realise a greater contribution of the milestones set out than we have currently forecast. However, clinical failure in one or more indications, changes in treatment standards and commercial sensitivities (eg salesforce effectiveness, pricing and reimbursement) could all negatively affect the number and size of milestones achieved.

In our valuation across all indications, we currently assume an average royalty rate of 12%, in line with Mologen's low double-digit guidance.

Exhibit 1: Oncologie Global deal breakdown

Elements of considerations	In € m	Comments
Near-term consideration	**23**	To finance IMPALA study until read-out and extend development in further combinations and indications
(1) Initial purchase price	3	
(2) Payments for MGN's budgeted development expenses	7	Mainly for IMPALA
(3) Funding of additional studies	9	Combination studies in immuno-oncology
(4) Issuance of convertible bonds	2+2	Mandatory conversion, premium of 30%, interest free, 5 year term
• First convertible bond (€2 m)		• Issued on 3 Sep 18; €9.702/new share
• Second convertible bond (€2 m)		• At signing of contract
Coverage of additional expenses	**~20**	Future development activities, including regulatory interactions and production of drug material to support the future commercialization of lefitolimod
Development milestones	**up to 200**	Based on success of IMPALA and additional indications
Commercial milestones	**ca. 900**	Depending on sales
Tiered royalties on a low double-digit percentage average	**n/a**	Peak royalty rate at 16%

Source: Mologen

Previously (February 2018), Mologen signed an Asia-focused licence and co-development agreement with Oncologie potentially worth over €100m (€3m upfront), a €2m equity investment and double-digit royalties. We currently have no information regarding the strategy in these regions. The new deal supersedes this; in particular, the €2m equity investment has been waived as part of the new deal and has taken the form of the €2m bond that was recently issued (issued 3 September 2018 at €9.702/share).

Lefitolimod: a TLR9 immunotherapy

Mologen's lead asset, lefitolimod, is a TLR9 agonist (DNA-based, double-stem loop immunomodulator) that broadly activates the immune system, and is believed to increase the recognition and combat of abnormal cells. While the majority of immunotherapies (approved and in development) target the adaptive immune system, lefitolimod primarily targets this innate system. The innate component of the immune system is the first line of defence against infection and comprises a set of receptors that recognise foreign DNA, reacting instantly to produce cytokines and other inflammatory mediators, and to stimulate, among others, natural killer (NK) and NK T-cells. As a monotherapy, lefitolimod has demonstrated a benefit in certain patient groups, but the main opportunity could be in its utilisation alongside therapies like PD-(L)1 inhibitors that target the active immune system. We note that while preclinical data have so far hinted at this possibility, we currently have no clinical data that substantiates this.

To date, lefitolimod has been tested in over 450 study participants and is currently being trialled in two ongoing trials: a Phase III study (IMPALA) for the maintenance treatment of metastatic colorectal cancer (data forecast for 2020) and a Phase I combination study in advanced malignancies (initial safety data by year-end).

Exhibit 2: Lefitolimod (MGN1703) trials

Target	Status	Notes
Metastatic colorectal cancer (mCRC); maintenance therapy (post-chemo induction).	Ongoing: Phase III (IMPALA), 540 patients enrolled; OS primary endpoint. Phase II (IMPACT) complete; 59 patients.	IMPALA is an open-label, randomised (1:1), controlled, two-arm, multinational study (120 sites across the EU); full recruitment completed, initial data forecast to be available in 2020.
Small-cell lung cancer (SCLC); maintenance therapy (post-chemo induction).	Completed: Phase II (IMPULSE) initiated Q214; 100 patients; OS (at 12 months) primary endpoint.	IMPULSE was an exploratory, open-label, randomised (3:2), controlled, two-arm, multinational EU study; full recruitment completed. Top-line data demonstrated the primary endpoint of overall survival was missed. However, a benefit was seen in certain subgroups (Patients with a low count of activated B-cells and/or COPD).
Human immunodeficiency virus (HIV).	Completed: Phase I (TEACH) initiated Q215; 15 patients; NK cell activation primary endpoint for expansion study.	TEACH was an exploratory, non-randomised interventional study. Top-line results from the extension study demonstrated that a reduction in viral load was not achieved (primary endpoint); however, in the first part of the trial, the primary endpoint of increasing the proportion of activated natural killer cells was met.
Human immunodeficiency virus (HIV).	Expected to being patient enrolment by end 2018: Phase IIa TITAN	Trial will be run by Aarhus University (Denmark), which received a grant of $2.75m from Gilead in January 2017 to run the trial. The trial will test a combination of lefitolimod and virus-neutralising antibodies that have been developed by the Rockefeller University (US). Mologen will provide lefitolimod.
Advanced solid malignancies	Ongoing: Phase I initiated Q316. 60 patients; maximum tolerated dose primary endpoint. Data expected in 2019	Lefitolimod is being tested in combination with the CTLA-4 immune checkpoint inhibitor ipilimumab. The first patient has been enrolled with end of recruitment by 2018. Initial data readout potentially by end 2018.

Source: Mologen, Edison Investment Research

Most recent clinical data from lefitolimod were presented in 2017 from Mologen's exploratory Phase II SCLC IMPULSE trial and its Phase Ib/IIa HIV TEACH trial. Both trials missed the primary endpoints, but encouraging data in certain subsets were observed. A follow-on trial in HIV is expected to be initiated by partner Aarhus University by year-end (TITAN), with further development of lefitolimod in SCLC to be determined. With the Oncologie deal expected to be finalised by end Q119, we expect ongoing clinical trials to focus on immune checkpoint inhibitor (ICI) combinations with lefitolimod.

ICI TLR9 combinations highlight lefitolimod potential

We note that TLR9 therapies, including Mologen's lead candidate lefitolimod, are gaining industry-wide traction when utilised in combination with ICIs. Most notably, clinical data presented by competitors Idera Pharmaceuticals and Checkmate Pharmaceuticals at ASCO 2018 and AACR 2018 respectively have demonstrated the potential of a TLR9/ICI combination.

At ASCO 2018, Idera Pharmaceuticals presented data on tilsotolimod (IMO-2125), its TLR9 agonist in combination with ipilimumab (CTLA-4 inhibitor, commercially named Yervoy: Bristol-Myers Squibb) in refractory metastatic melanoma patients who have progressed following PD-1 inhibitors. In 21 patients eligible for efficacy assessment, an ORR (overall response rate) of 38.1% (n=8/21) was observed and a DCR (disease control rate) of 71.4% (n=15/21), according to RECIST v1.1 criteria. A CR (complete response) was observed in 9.5% of patients (n=2/21). Idera reported the ORR (38.1%) of the combination compared favourably with historical data in patients treated with ipilimumab as a monotherapy (13.1% ORR). Idera has initiated a global Phase III study and the drug has been granted fast track status by the FDA.

At AACR 2018, Checkmate Pharmaceuticals presented data on CMP-001, its TLR9 agonist in combination with pembrolizumab (PD-1 inhibitor, commercially named Keytruda: Merck) in refractory metastatic melanoma patients who had progressed following PD-1 inhibitors or were not eligible for PD-1 treatment. In 69 intent-to-treat patients across all doses and dosing schedules, an ORR of 22.0% (n=15/69) was observed. In the weekly dosing schedule in patients on 3mg and 5mg doses, an ORR of 33.3% (n=6/18) was observed. In the patient population tested, Checkmate noted that it would typically expect an ORR of no more than 7% if treated with pembrolizumab alone.

In addition to approved immunotherapies, Keytruda and Yervoy, preclinical data highlight the potential of TLR9 agonists in combination with OX40 antibodies. In a preclinical study published in Science, it was demonstrated that the combination of a TLR9 agonist with an OX40 antibody cured mice of existing cancers.

In collaboration with the MD Anderson Cancer Center, Mologen is currently running a Phase I trial testing lefitolimod with Yervoy (CTLA-4 inhibitor) for patients with advanced solid tumours. Patient recruitment is currently ongoing and the trial consists of dose-escalation and dose-expansion cohorts. The primary endpoint is maximum tolerated dose with secondary outcomes measuring tumour response. The trial is expected to enrol 60 patients with initial (safety) data possible by year-end.

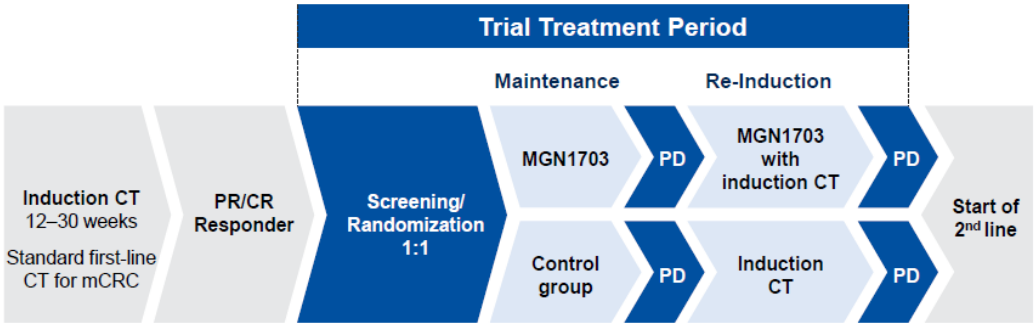
In other preclinical work, Mologen's lead candidate, lefitolimod, demonstrated promising efficacy in mouse models when used in combination with a PD-1 or a PD-L1 immune checkpoint inhibitor (ICI). In an A20 lymphoma model, mean tumour growth inhibition (TGI) of 45.9% for PD-1 antibody-treated and 49.8% for lefitolimod-treated mice was observed. However, when used in combination, the TGI increased dramatically to 99.1% and, consequently, at 60 days survival was 100% compared with approximately 33% for the PD-1 antibody and lefitolimod when used as monotherapies. In a separate colon carcinoma (CT26) mouse model, lefitolimod and a PD-L1 combination demonstrated a mean TGI of 48.4% compared with 27.6% for lefitolimod alone. The PD-L1 ICI had no effect on tumour growth when used as a monotherapy. These early preclinical data highlight the potential of ICI combinations with lefitolimod. However, clinical data are needed in what is now a hotly contested sector.

IMPALA: Funded until completion

IMPALA, a 549-patient (enrolled), two-arm, randomised pivotal Phase III trial for the maintenance treatment of mCRC patients is forecast to read out in 2020. With the financing expected from both the Oncologie deal and the capital raise, Mologen is now funded to the completion of the trial.

IMPALA is a randomised, exploratory, non-blinded, two-arm study, with a primary endpoint of overall survival (Exhibit 3) and secondary endpoints of progression-free survival (PFS), tolerability, safety and quality of life (QoL). The trial is being conducted across 120 centres in eight European countries.

Exhibit 3: IMPALA Phase III study design



Source: Mologen. Note: PD = progressive disease, CT = chemotherapy treatment, PR = partial response, CR = complete response, mCRC = metastatic colorectal cancer.

In April, Mologen published a data-based prediction, which forecasts when the primary analysis of IMPALA will occur. It has predicted that this will most likely occur in April 2020, with a 95% confidence interval of ± five months. Previous forecasts had estimated initial data in late 2019. The time period was based on patient data collected up to April 2018. Mologen plans to repeat this type of analysis to review and, if necessary, adapt its current forecast.

Colorectal cancer is both the third most common cancer diagnosed and the third leading cause of cancer-related deaths in both men and women in the US (source: cancer.org). The American Cancer Society estimates that there will be approximately 97,220 new cases of colon cancer and 43,030 cases of rectal cancer in the US in 2018. A cure is not possible for most patients with mCRC, although in cases where there is limited involvement of other organs, surgery may be curative. For others, chemotherapy, often in combination with biological agents (VEGF and EGFR inhibitors), can improve symptoms and prolong life. However, the five-year survival rate of mCRC is just 12%.

According to clinicaltrials.gov, there are currently 45 Phase III trials in mCRC that are active, indicating the unmet clinical need. A wave of immunotherapy approvals have made the headlines recently.

In July 2017, the FDA granted nivolumab (Opdivo) accelerated approval for mismatch repair-deficient and microsatellite instability-high metastatic colorectal cancer (following treatment with fluoropyrimidine, oxaliplatin, and irinotecan). This was followed up in July 2018 with accelerated approval for the combination of nivolumab and ipilimumab in the same indication.

Other approvals include Taiho Oncology's Lonsurf (trifluridine/tipiracil), which was approved for refractory mCRC in September 2015. In the pivotal trial, median overall survival of 7.1 months in the trifluridine/tipiracil plus best supportive care (BSC) arm was observed (vs 5.3 months for BSC and placebo). Lilly's Cyramza (ramucirumab, approved in April 2015), a VEGF inhibitor, was approved for use in combination with the chemotherapy combination FOLFIRI (irinotecan with 5-FU and folinic acid) in mCRC that has progressed after first-line treatment; in the pivotal trial median overall survival of 13.3 months for patients on the FOLFIRI plus ramucirumab arm was observed (vs 11.7 months for FOLFIRI plus placebo). Capecitabine, an orally administered chemotherapeutic agent, is one of the most commonly prescribed treatments for CRC, while Avastin (Roche), a VEGF inhibitor, tends to lead sales among biologics (approximately CHF3.4bn in H117 across all indications). Avastin demonstrated an overall survival of 20.3 months when used alongside bolus-IFL compared to 15.6 months for bolus-IFL alone.

Combinations of target therapies (tyrosine kinase inhibitors [TKIs], monoclonal antibodies and immunotherapies) and chemotherapy are increasingly becoming the best approach to treating the complex and constantly mutating disease that is cancer. We note that limited therapies exist in the target mCRC maintenance population following first-line treatment.

IMPULSE: Published results confirm potential in subgroups

Mologen has now published clinical data for the IMPULSE trial in SCLC that were originally presented at ESMO 2017. IMPULSE was an exploratory randomised, controlled, two-arm, Europe-based study assessing lefitolimod as a maintenance therapy post-induction chemo in metastatic SCLC (n=102). In the trial lefitolimod missed its primary endpoint of OS in the total study population. Median OS was 279.0 days (95% confidence interval [CI]: 233.0, 320.0) in the lefitolimod arm compared with 272.0 days (95% CI: 231.0, 434.0) in the control arm. The hazard ratio was 1.27 (95% CI: 0.80, 2.01; p=0.53).

However, the data hinted at benefit in certain subgroups. Lefitolimod demonstrated benefit in 38 patients with a low count of activated B-cells (hazard ratio: 0.59; 95% CI: 0.29-1.21). 88 patients could be evaluated (out of 102) and 38 (43.2%) fell below the cut-off of 15.4% of activated B-cells, as determined by a Cox regression model. Mologen hypothesises that activated B-cells, specifically regulatory B-cells, inhibit a lefitolimod-triggered response.

There was an enhanced benefit in another subgroup population of 25 patients with chronic obstructive pulmonary disease (hazard ratio 0.54; 95% CI: 0.21-1.38). The large confidence

intervals reported in both subgroups indicate the low powering of the subgroup analysis; as such, further trials and data will be needed to confirm the observations.

Small cell lung cancer (SCLC) remains a difficult disease to treat (five-year relative survival rate in stage 1 patients is 31%, dropping off to 2% in stage 5 patients) and over the last couple of decades few advances have been made. Subsequently, the response in the subgroups is a positive development, but at this stage only exploratory in nature.

While chemotherapy agents like Etoposide and Cisplatin still lead first-line treatments, it is hoped that new immunotherapies could provide benefit. Recently nivolumab was granted accelerated approval for the treatment of SCLC. Approval was based on an open-label study, which demonstrated an ORR of just 12% in patients (n=109) who had failed after platinum-based chemotherapy and at least one other prior line of therapy.

For a detailed analysis of the IMPULSE study, see our outlook note, Lefitolimod trial readouts hint at future potential, published on 25 September 2017.

TEACH and TITAN: Opportunity in HIV remains

A new trial, designated TITAN, plans to test lefitolimod in combination with virus-neutralising antibodies and is due to start in 2018. The trial will be run by Aarhus University Hospital in Denmark. In January 2017, Aarhus received a $2.75m grant from Gilead to fund the trial and the antibodies have been developed by Rockefeller University in New York. The two unique modes of action are hoped to act in a 'kick-and-kill' manner, where the latent virus is woken up ('kick') in the infected cells before being subsequently 'killed' by the activated immune system; lefitolimod is believed to aid in both the 'kick' and 'kill' stages.

In the original, now completed TEACH study (exploratory, non-randomised Phase Ib/IIa trial) testing lefitolimod in HIV-positive patients, lefitolimod failed the primary endpoint of reduction in viral reservoir in 12 patients receiving it in combination with antiretroviral therapy. However, an increased duration of viral control above what is typically expected was observed in one patient out of nine after stopping antiretroviral therapy (ART).

In the next stage (expansion) of the study, 12 patients received lefitolimod in combination with ART for 24 weeks. Nine patients were then split into two groups, where one group received an extra four weeks of lefitolimod alone. After treatment in both groups, patients underwent ART interruption until their viral load rebounded. This procedure is utilised to determine the size and any reduction that has occurred in the reservoir of latent infected cells.

Lefitolimod and ART did not achieve its primary endpoint of reducing viral load. However, other beneficial findings were observed, including:

- sustained activation of CD4 and CD8 cells throughout the dosing period;
- maturation of B-cells towards antibody-secreting effector cells;
- viral control in one out of nine patients after interruption of ART for 20 weeks; and
- safe and well tolerated in patients for 24 weeks, corroborating the observations in cancer patients.

Other assets to enter the limelight

With the out-licensing of lefitolimod by Oncologie now likely, Mologen's strategy will switch to its other assets, notably MGN1601 and its EnanDIM platform. Additionally, talks continue to spin off the MIDGE platform, which currently consists of two preclinical product candidates (MGN1331 and MGN1333) and a Phase I product candidate (MGN1404).

Exhibit 4: Mologen's active assets (excluding lefitolimod)

Product	Technology/mechanism	Target	Status	Notes
MGN1601	Cell-based cancer vaccine; genetically modified tumour cells transfected with four vectors: GM-CSF, IL-7, CD80 and CD154 (CD40L), and combined with dSLIM (MGN1703).	Metastatic renal cell carcinoma (mRCC).	Phase I/II (ASET) complete; 19 patients.	Mologen has placed this asset on hold but could potentially reinitiate development once Oncologie out-licensing of lefitolimod is complete.
EnanDIM	Next-generation TLR9 agonists; linear DNA construct with structural feature to protect against degradation.	Oncology and anti-infectives	Preclinical model experiments that confirm broad immune activation.	Designed to combine the chemically unmodified DNA components of lefitolimod with the ease of production advantages of linear molecules. Potential patent life extension of the franchise.

Source: Mologen; Edison Investment Research. Note: EnanDIM = Enantiomeric, DNA-based ImmunoModulator.

EnanDIM: Next-generation product candidate

EnanDIM is a technology platform that consists of innovative, linear, DNA-based TLR9 agonists. It aims to provide the safety and durability of lefitolimod with the ease of production of linear DNA. The use of linear single-stranded DNA in the body is problematic as degradation by enzymes means limited lifetimes. To counter this, the EnanDIM family of molecules contains the stereoisomeric form (the same molecular formula and bonding, but differing in three-dimensional orientation) of the ribose molecules at the end of the backbone. These cannot be recognised by DNA-degrading enzymes. Mologen plans to advance the preclinical assets into the clinic. If a third party wants to out-license the platform, Oncologie for a limited time retains first refusal rights on the EnanDIM platform.

In preclinical data presented at ESMO 2017, Mologen presented data on the effect EnanDIM compounds had on a colon carcinoma CT26 mouse model. EnanDIM532 and a PD-1 antibody demonstrated 28.3% and 57.0% TGI, respectively, when utilised as monotherapies, while the combination of both reduced tumour growth substantially, represented by 74.7% TGI.

In addition, Mologen continues to progress its next-generation TLR9 agonists EnanDIM, with data most recently presented at AACR.

MGN1601: On hold, ready for future development

MGN1601 is a therapeutic cancer vaccine specific to renal cell carcinoma (RCC), cultured from a tumour cell line from one patient and genetically modified using the MIDGE technology. This makes the product unique and difficult to copy by a potential generic competitor.

MGN1601 was evaluated in a small, open-label, single-arm Phase I/II study (ASET). The trial treated 19 patients with advanced RCC who had failed prior systemic therapies (intent-to-treat, ITT). 10 patients completed the study per protocol (PP; intradermal injections of 10m cells per dose, administered once-weekly for four weeks, then bi-weekly until 12 weeks). Overall, two patients achieved disease control (1x partial response; 1x stable disease) after 12 weeks and continued treatment in an extension phase (starting at week 24 through to 120 weeks). Subsequently, one patient had PD after 60 weeks, while the other completed all five further vaccinations and was still in tumour remission after 120 weeks. Median OS was 24.8 weeks in the intent to treat (ITT) population and 115.3 weeks in the PP group. The two patients still alive at week 120 were in the PP group. The safety profile was favourable.

MGN1601 development could be reinitiated once Oncologie's out-licensing of lefitolimod is complete.

Sensitivities

The key sensitivities relate to the clinical performance of lefitolimod. However, sensitivities around the partnership deal with Oncologie are becoming more prominent. In the near term, the completion of the global out-licensing deal relies on Oncologie's ability to successfully raise a mid-double-digit million dollar amount in its next funding round. If the deal closes, future development of lefitolimod will be wholly dependent on Oncologie and any change in its strategic or financial situation could negatively affect Mologen. Oncologie is an early-stage, venture capital-backed biotech, which is currently not financed to deliver on future development or commercial milestones. Additionally, it has no track record in developing or commercialising product candidates. Clinically, IMPALA data (mCRC) will have a major bearing on lefitolimod's chance of regulatory approval and commercial success. We have made assumptions about the potential market opportunity available to lefitolimod, which do not currently include significant stratification of patient populations. Lefitolimod may be most active in certain subgroups, which could reduce the target patient pool. However, confirmed activity in a patient subset may result in a higher treatment price, greater reimbursement rates and more favourable economic terms from any partnership. The relative infancy of Mologen's other assets means that in the near term it is dependent on lefitolimod's success.

Valuation

Our valuation of Mologen has decreased to €188m (€16.6/share) vs €243m (€21.5/share) previously. The valuation is based on a risk-adjusted, sum-of-the-parts DCF model, applying a standard 12.5% discount rate and including assumed net cash of €21m (includes June end cash, Oncologie financing paid to date and a capital raise). We assume for our valuation that all shares are allocated from the proposed capital raise, increasing the share capital to 11.3 million and subsequently diluting our per share value.

We now include the global Oncologie deal in our valuation; notably, we now incorporate clinical and commercial milestones for mCRC, SCLC, HIV and ICI combinations. We forecast that c €600m of the total €1.1bn in milestones are achieved. We have based our assumptions on the current clinical trial programme and include predicted milestones for achieving key clinical and sales targets. These assumed milestones are probability adjusted in each indication to reflect the individual forecast success rates. We note that significant sensitivity remains around both the number and size of milestones as clinical programme failures, changing treatment paradigms and commercial effectiveness could negatively affect the amount received, while additional indications and regions could positively affect the figures achieved. In mCRC we forecast c €150m in milestones spread over the life of the product. We have retained all our existing assumptions, including for patient population, pricing, market share and launch timelines.

We forecast that Mologen will not incur any R&D costs for future programmes after completing the current trials, only SG&A expenses in relation to a potential regulatory approval in mCRC.

The largest negative impact on our valuation has been a lower than anticipated royalty rate, particularly in mCRC, where a peak 16% royalty has been announced compared with 30% assumed previously. We note that our previous royalty rate was typically higher than would be expected for the various stages of development of lefitolimod as we did not include upfront fees and/or milestones. In our valuation across all indications, we currently assume an average royalty rate of 12%, in line with Mologen's low double-digit guidance.

Exhibit 5: Valuation assumptions

Product	Status	Market launch	NPV (€m)	Peak sales ($m)	Probability of success	Royalty estimate	rNPV (€m)	rNPV share (€)	Key assumptions
Lefitolimod CRC – US	Phase III-ready	2022	70	303	65%	12%	44.6	3.9	~135,000 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 25% peak share (2026); $40,000 treatment price; 2028 patent expiry, c $150m milestones in total across EU and US.
Lefitolimod CRC – EU	Phase III	2022	114	572	65%	12%	73.2	6.5	~345,000 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 25% peak share (2026); $30,000 treatment price; 2030 patent expiry, c $150m milestones in total across EU and US.
Lefitolimod SCLC – US	Phase II-ready	2024	26	118	15%	12%	4.5	0.4	~225,000 lung cancer cases/yr; 15% SCLC; 75% advanced SCLC; 70% chemo response; 15% peak share (2027); $40,000 price; 2028 patent expiry, c $50m milestones in total across EU and US.
Lefitolimod SCLC – EU	Phase II	2024	17	124	15%	12%	3.3	0.3	~310,000 lung cancer cases/yr; 15% SCLC; 75% advanced SCLC; 70% chemo response; 15% peak share (2028); $30,000 price; 2030 patent expiry, c $50m milestones in total across EU and US.
Lefitolimod HIV – WW	Phase I	2025	93	405	15%	12%	13.1	1.2	~36.7m cases (prevalence), 46% treated, 5% Peak share (2034), $20,000 price, patent expiry 2036 (expected - not yet granted), c $130m milestones in total WW.
Lefitolimod & ICI – ASM (SCLC used as model) – WW	Phase I	2028	74	511	15%	12%	10.9	1.0	~1.8m lung cancer cases worldwide, 12.50% SCLC, 5% peak share (2033), $30,000 price, patent expiry 2036 (expected, not yet granted), c $150m milestones WW total.
Lefitolimod mCRC – China	Phase I	2028	65	203	5%	12%	17.3	1.5	~200 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 10% will receive additional treatment, 1% peak share (2033), €5,000, patent expiry unknown, c $100m milestones in total China.
Portfolio value			714				167	14.8	
Net cash							20.7	1.8	Net cash at 30 June 2018 + €18m gross capital raise (assume net €17m) + €3m initial consideration
Total							**188**	**16.6**	**11.31m shares outstanding**

Source: Edison Investment Research

Financials

Gross cash of €6.2m as of June 2018, combined with the expected to be completed capital raise of gross €18m, €3m initial cash and €2m bond payments from Oncologie, mean Mologen should now be funded through to 2020 (total expected gross cash position of c €28m, net cash position of c €21m). We assume the second bond (€2m) is issued on signing of the Oncologie deal contract. Both Oncologie bonds are 0% interest mandatory convertible notes with a term of five years. The conversion price is a 10-day volume weighted average of the stock price plus a 30% premium.

Mologen recently announced a proposed capital raise by the issue of 3,768,643 new shares. Shareholders are granted subscription rights at a ratio of 2:1 with a subscription price of €4.70 per share. If the capital raise is completely subscribed, Mologen expects to raise c €18m in gross proceeds.

The net loss in H118 was reduced to €4.8m (H117: €10.7m) as the result of a reduction in R&D costs from the completion of the TEACH and IMPULSE studies, and the initial payment of €3m from Oncologie. We forecast a net loss for FY18 of €11.1m versus €19.3m in 2017. We now include €7m in R&D funding from the Oncologie deal (realised as revenue) in 2019.

In addition to current cash, in February 2018 Mologen entered into an agreement with Luxembourg-based financing provider European High Growth Opportunities Securitization Fund (EHGO). Under this agreement, Mologen can require EHGO to subscribe to convertible bonds over a two-year period. The bonds can be issued in amounts of €500,000 in 24 tranches for a total of €12m. In addition, the bonds must be converted 12 months after issue and do no not accrue interest. As of the Q118 results, two tranches have been exercised and both have been converted.

For details of all of Mologen's existing financial arrangements, including previously subscribed convertible bonds, please see our outlook note, Lefitolimod trial readouts hint at future potential, published on 25 September 2017.

Exhibit 6: Financial summary

€'000s	2015	2016	2017	2018e	2019e
Year end 31 December	IFRS	IFRS	IFRS	IFRS	IFRS
PROFIT & LOSS					
Revenue	39	74	47	6,000	7,000
Cost of Sales	0	0	0	0	0
Gross Profit	39	74	47	6,000	7,000
Research and development (cost of materials)	0	(11,780)	(9,752)	(7,314)	(6,948)
Selling, general & administrative (personnel expenses)	0	(5,453)	(5,093)	(5,450)	(5,504)
Other operating income / expense	0	(3,418)	(3,860)	(3,884)	(3,845)
EBITDA	(20,418)	(20,577)	(18,658)	(10,647)	(9,297)
Operating Profit (before amort. and except.)	(20,499)	(20,813)	(18,684)	(10,650)	(9,303)
Intangible Amortisation	(40)	(172)	(23)	(9)	(5)
Exceptionals/Other	0	0	0	0	0
Operating Profit	(20,539)	(20,985)	(18,707)	(10,658)	(9,308)
Net Interest	3	(18)	(574)	(422)	(421)
Other	0	0	0	0	0
Profit Before Tax (norm)	(20,496)	(20,831)	(19,258)	(11,072)	(9,723)
Profit Before Tax (FRS 3)	(20,536)	(21,003)	(19,281)	(11,081)	(9,729)
Tax	0	0	0	0	0
Deferred tax	0	0	0	0	0
Profit After Tax (norm)	(20,496)	(20,831)	(19,258)	(11,072)	(9,723)
Profit After Tax (FRS 3)	(20,536)	(21,003)	(19,281)	(11,081)	(9,729)
Year-End Shares Outstanding (m)	20.7	4.9	6.9	11.3	11.3
EPS - normalised (c)	(0.99)	(4.22)	(2.81)	(0.98)	(0.86)
EPS - FRS 3 (c)	(0.99)	(4.25)	(2.81)	(0.98)	(0.86)
Dividend per share (c)	0.0	0.0	0.0	0.0	0.0
BALANCE SHEET					
Fixed Assets	414	62	44	66	89
Intangible Assets	175	37	17	10	6
Tangible Assets	239	25	27	56	83
Other	0	0	0	0	0
Current Assets	25,981	21,300	8,061	24,283	14,958
Stocks	28	13	16	16	16
Debtors	0	33	13	13	13
Cash	24,592	20,520	6,523	22,745	13,420
Other	1,361	734	1,509	1,509	1,509
Current Liabilities	(6,886)	(7,404)	(7,502)	(7,502)	(7,502)
Creditors	(6,390)	(6,530)	(4,400)	(4,400)	(4,400)
Short term borrowings	0	0	0	0	0
Other	(496)	(874)	(3,102)	(3,102)	(3,102)
Long Term Liabilities	(6)	(2,121)	(5,474)	(10,473)	(10,900)
Long term borrowings	0	(2,119)	(5,419)	(10,418)	(10,845)
Other long term liabilities	(6)	(2)	(55)	(55)	(55)
Net Assets	19,503	11,837	(4,871)	6,374	(3,355)
CASH FLOW					
Operating Cash Flow	(15,095)	(19,270)	(19,696)	(11,493)	(9,718)
Net Interest	0	18	574	424	427
Tax	12	0	0	0	0
Capex	(95)	(57)	(33)	(33)	(34)
Acquisitions/disposals	0	13	35	0	0
Financing	26,207	12,706	477	22,326	0
Dividends	0	0	0	0	0
Other	0	0	0	0	0
Net Cash Flow	11,029	(6,590)	(18,643)	11,223	(9,325)
Opening net debt/(cash)	(13,563)	(24,592)	(18,401)	(1,104)	(12,327)
HP finance leases initiated	0	0	0	0	0
Exchange rate movements	0	1	(8)	0	0
Other	0	398	1,354	0	(427)
Closing net debt/(cash)	(24,592)	(18,401)	(1,104)	(12,327)	(2,575)

Source: Company accounts, Edison Investment Research

Contact details	Revenue by geography
Fabeckstr. 30, 14195 Berlin, Germany +49 (0)30 84 17 88 0 www.mologen.com	N/A

Management team

Chief executive officer: Dr Ignacio Faus	Chief financial officer: Walter Miller
Dr Ignacio Faus joined the Executive Board of MOLOGEN AG in August 2018 as chief executive officer. Most recently, he was an independent consultant, advisor and board member of a number of life science companies. From 2006 to 2013, he led PALAU as CEO through to its divestment in 2013. He has previously held roles at BMS, Ferrer International, Grupo and Uriach. He received his PhD from Indiana University Bloomington and undertook the CEO executive education program at the University of Navarra.	Mr Miller joined Mologen on 1 April 2016, assuming the role of CFO. He was most recently the CFO of Nuvisan, an international contract research organisation (CRO). He has also held various managerial positions at Santhera Pharmaceuticals, initially VP of finance and commercial operations in Germany and subsequently in Switzerland. He was also a member of the group's management team. He started his career at Isra Vision Parsytec in Aachen, Germany.
Chief Medical Officer: Dr Matthias Baumann	
Dr Baumann joined Mologen in May 2017, assuming the role of CMO. From 2011 to 2017, he served as chief medical officer and member of the executive board of NOXXON Pharma, a Berlin-based biotech company focused on novel cancer therapies. From 2002 to 2010, he served as chief scientific officer and MD of FOCUS Clinical Drug Development. Before this, he served in various research and development roles at Roche and Boehringer Mannheim.	

Principal shareholders	(%)
Global Derivative Trading	<25%
Deutsche Balaton Aktiengesellschaft	5%
Signal Krankenversicherung	4%
Baloise Holding	4%

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