EDISON

Mologen

Development update

MGN1703 remains the focus

Pharma & biotech

Mologen is developing novel immunotherapies for use in the post-chemo maintenance setting in cancer and for the treatment of infectious diseases. Lead candidate MGN1703 is in three clinical trials for different indications, including a pivotal Phase III study, IMPALA, in metastatic colorectal cancer (mCRC) with data due in H118. Meanwhile, initial data from the Phase II IMPULSE study in lung cancer in H117 could positively affect partnering or financing options. We value Mologen at €387m, or €17 per share.

Year end	Revenue (€m)	PBT* (€m)	EPS* (€)	DPS (€)	P/E (x)	Yield (%)
12/13	0.2	(9.9)	(0.64)	0.0	N/A	N/A
12/14	0.0	(17.0)	(1.01)	0.0	N/A	N/A
12/15e	0.0	(19.0)	(0.90)	0.0	N/A	N/A
15/16e	0.0	(21.0)	(0.93)	0.0	N/A	N/A

Note: *PBT and EPS are normalised, excluding intangible amortisation, exceptional items.

MGN1703: An innovative immunotherapy

MGN1703, an innovative TLR9 agonist, is in two clinical trials aiming to show that a switch maintenance therapy with an active immunotherapy leads to increased overall survival (OS) in patients who have responded to initial chemo. Preliminary OS data from the Phase IIa IMPACT study in mCRC are encouraging, with the benefit more pronounced in patients who responded to induction chemo. This underscores the designs of IMPALA and IMPULSE, which only include chemo-responders. The TEACH study in HIV is the first non-cancer study for MGN1703.

MGN1703 clinical trials on track

Recruitment has completed for both the IMPULSE study in small cell lung cancer (data H117) and the Phase I TEACH study in HIV (data in Q216). Initial data from IMPULSE could have a major impact on partnering and financing options for MGN1703, potentially covering the cash shortfall required for the completion of IMPALA. Recruitment is on track for the pivotal IMPALA study; full enrolment is expected by end-2016 and data by H118.

MGN1601 development may resume

Development of Phase II-ready MGN1601, the unique renal cancer cell vaccine, remains on hold until fresh financing and/or a partner is found. However, with the new management team taking office we look forward to an update on the strategy for this product; for now we maintain our previous assumptions.

Valuation: Risk-adjusted NPV of €387m

Our valuation of Mologen has increased slightly to €387m, or €17/share (vs €384m, or €17/share) due to rolling the model forward to 2016 and updating for FY15e cash (€25m). This is based on a risk-adjusted NPV analysis of the MGN1703 and MGN1601 programmes. Our model suggests a cash runway into 2017, incorporating key milestones: full enrolment of IMPALA (Q416) and IMPULSE top-line data (H117).

14 December 2015

Price	**€4.55**
Market cap	**€103m**
Net cash (€m) at 30 Sept 2015	30.5
Shares in issue	22.6m
Free float	54%
Code	MGN
Primary exchange	Frankfurt Prime Standard
Secondary exchange	N/A

Share price performance

%	1m	3m	12m
Abs	22.0	6.6	(26.2)
Rel (local)	28.7	4.3	(29.6)
52-week high/low	€8.3		€3.4

Business description

Mologen is a German biotech company developing novel immunotherapies. The lead products are MGN1703 (TLR9 agonist) for metastatic colorectal cancer maintenance and SCLC that has also recently started a study in HIV; and MGN1601, an allogeneic renal cancer cell vaccine.

Next events

FY15 results	March 2016
MGN1703: data from TEACH Phase I study (HIV)	Q216
MGN1703: Initial OS data from IMPULSE Phase II study (SCLC)	H117

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Investment summary

Company description: Innately adaptive

Mologen was founded in 1998 based on research work by Professor Burghardt Wittig, the founding CEO. From 1 November 2015, Dr Mariola Söhngen assumed the role of CEO, taking over from Dr Matthias Schroff. Dr Söhngen is the co-founder of Paion AG, where she was chief medical officer. Mologen was funded by an IPO on foundation and has raised €130m to date, including €28.3 (gross) in April 2015. Mologen's lead candidates are immunotherapies. MGN1703 is in a Phase III study (IMPALA) for the maintenance treatment of metastatic colorectal cancer, a Phase II trial (IMPULSE) for small cell lung cancer; and a Phase I trial (TEACH) in HIV. MGN1601, a renal cancer cell vaccine, has completed a Phase I/II study (ASET) for kidney cancer. The company is based on the Free University campus in Berlin and has 60 employees.

Valuation: rNPV of €387m or €17 per share

Our valuation of Mologen has increased slightly to €387m (vs €384m), or €17/share. Our valuation is based on a risk-adjusted, sum-of-the-parts DCF model, applying a standard 12.5% discount rate, and including estimated end-FY15 net cash of €25m. The key near-term drivers are the outcome of the IMPULSE Phase II study in SCLC and ultimately the IMPALA Phase III trial in mCRC. We await an update on the development strategy for MGN1601, meanwhile maintaining our assumptions.

We assume that a licensing partner for MGN1703 is secured on successful completion of IMPALA (2017/2018), although this may occur earlier (e.g. on positive IMPULSE data [H117]). We do not include any upfront fees and/or milestones that would be expected on securing a partner and successful commercialisation of the product, which offers further potential upside to our valuation.

Sensitivities: Clinical execution risk

The key sensitivities relate to the clinical performance of MGN1703 and the company's ability to secure the additional financing, and/or a partner, to complete the full clinical programme. Results from the IMPULSE and IMPALA studies will have a major bearing on MGN1703's chances of regulatory approvals and commercial success. We have made assumptions about the potential market opportunity available to MGN1703, which do not currently include significant stratification of patient populations. MGN1703 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.

Future development of MGN1601 is dependent on funding and/or partnerships. At present MGN1703 is the priority, however we currently assume that with new management in place active development of MGN1601 may resume in 2016.

Financials: Funded through to key data read-out

Cash at 30 September 2015 was €30.5m, which includes the capital raise in April 2015 when €26.8m (net) was raised from the rights issue (one-for-three) of c 5.7m new shares at €5.00/share. Our model suggests that current cash is sufficient to fund operations to mid-2017, depending on the progress of the IMPULSE and IMPALA studies for MGN1703. While this cash runway incorporates some key milestones (full enrolment of IMPALA [Q416] and IMPULSE top-line data [H117]) there remains a funding gap, in respect of the IMPALA study (initial data estimated H118). We estimate this to be in the €25-35m range and include an illustrative €30m financing, nominally attributed to debt, in our FY17 forecasts, to allow completion of the study. The size and timing of the financing may vary significantly, and could be influenced by the outcome of the IMPULSE study (H216) and potential licensing deals.

Outlook: MGN1703 takes centre-stage

Mologen's lead candidate, MGN1703, is now in three clinical studies: two in the post-chemo maintenance setting for cancer treatment (IMPALA and IMPULSE), and one in HIV (TEACH). The outcomes of the IMPALA and IMPULSE will determine MGN1703's clinical effectiveness and commercial viability. The TEACH study is the first non-cancer study for MGN1703 and promising data from the study could expand the use of MGN1703 beyond cancer applications.

Exhibit 1: Mologen development pipeline

Product	Technology/Mechanism	Target	Status	Notes
MGN1703	TLR9 agonist; dSLIM (double-stem loop immunomodulator) is a dumbbell-shaped, DNA-based construct.	Metastatic colorectal cancer (mCRC); maintenance therapy (post chemo induction).	Phase III (IMPALA) started Q314; 540 patients; OS primary endpoint. Phase II (IMPACT) complete; 59 patients.	IMPALA is an open-label, randomised (1:1), controlled, two-arm, multi-national study (120 sites across EU); full recruitment expected in H216, initial data in H118.
		Small-cell lung cancer (SCLC); maintenance therapy (post chemo induction).	Phase II (IMPULSE) initiated Q214; 100 patients; OS (at 12 months) primary endpoint.	IMPULSE is an open-label, randomised (3:2), controlled, two-arm, multi-national EU study; full recruitment completed Q415; initial data expected in H117.
		Human immunodeficiency virus (HIV).	Phase I (TEACH) initiated Q215; 16 patients; NK cell activation primary endpoint.	TEACH is a non-randomised interventional study. Full recruitment completed Q315; data expected in Q216.
MGN1601	MIDGE-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 assessing next development steps (funding required).
MGN1404	MIDGE-based gene therapy (TNF-alpha expression); needle-free, intra-tumoral jet injection.	Malignant melanoma	Phase I commenced in 2013; 9 patients; recruitment ongoing.	Product development in collaboration with Charité – Universitätsmedizin Berlin and the Max Delbrück Centrum für Molekulare Medizin (MDC) Berlin-Buch
EnanDIM	Next generation TLR9 agonists; linear DNA construct with structural feature to protect against degradation.	Oncology and anti-infectives	Pre-clinical model experiments that confirm broad immune activation.	Designed to combine the chemically unmodified DNA components of MGN1703 with the ease of production advantages of linear molecules. Potential patent life extension of the franchise.

Source: Mologen; Edison Investment Research. Note: MIDGE: minimalistic immunogenically defined gene expression; proprietary platform, also classified as a DNA vector. EnanDIM: Enantiomeric, DNA-based, ImmunoModulator.

Harnessing the immune system to fight disease

Mologen's immunomodulatory approach involves stimulation of innate immunity via the activation of toll-like receptor 9 (TLR9) to take advantage of the inherent anti-cancer and anti-infective capabilities of the immune system. The innate immune system is the first line of defence against infection, comprising a set of receptors that recognise foreign DNA, reacting instantly and non-specifically to produce cytokines and other inflammatory mediators and to stimulate, among others, natural killer (NK) and NK T-cells. The innate immune system ultimately links through to the adaptive immune system; the latter is highly specific to a target antigen, and creates immunological memory after the initial response. The majority of immunotherapies (approved and in development) target the adaptive immune system; in targeting the innate system, Mologen's approach could complement these, and combinatorial therapy approaches could prove synergistic.

Timing is key

Immunotherapies are likely to be most effective when the disease burden is low and the immune system less compromised. Although traditionally thought to be immunosuppressive, some chemotherapies promote 'immunogeneic cell death', whereby the release of tumour-associated antigens induces an immune response, polarising dendritic cells towards a pro-inflammatory phenotype, and partially ameliorating tumour-driven systemic immunosuppression, ultimately

serving to increase the tumour's susceptibility to immunotherapy.[1] This concept has led to the rationale that immunotherapies may have greatest potency when used in adjuvant settings.

Induction chemotherapy to reduce tumour burden and release cancer antigens, followed by a chemotherapy-free interval to allow recovery of immune cells and identify patients that respond best to induction treatment, would appear to be the optimum time to use an immunotherapy agent such as a TLR9 agonist. In this setting, the dendritic cells have been primed and can be activated further by MGN1703. The importance of timing may explain the Phase III failure of Pfizer's TLR9 agonist, PF-3512676 (in non-small cell lung cancer), which was dosed alongside the chemotherapy cycles.

MGN1703: In pivotal territory

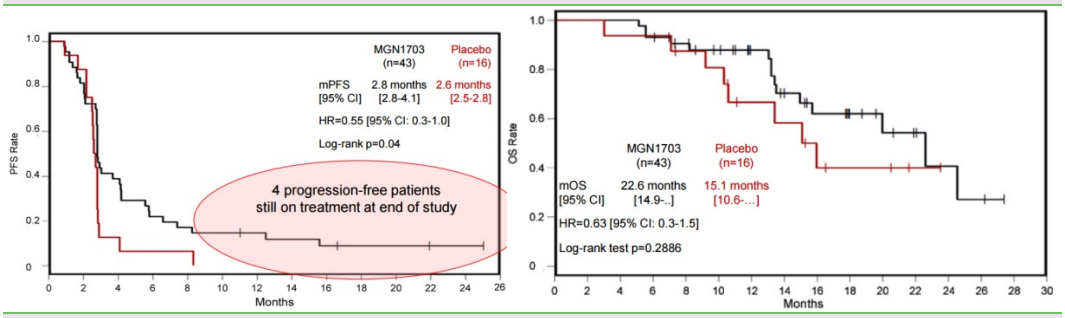
MGN1703 is an immunomodulating drug (TLR9 agonist) that broadly activates the immune system, enabling it to increase the recognition and combat of abnormal cells. It is being developed as a maintenance treatment for use after effective induction chemotherapy, to reduce tumour burden and help stimulate a response against free circulating tumour-associated antigens.

Phase II demonstrated meaningful IMPACT on PFS

The randomised, placebo-controlled Phase II IMPACT study assessed the efficacy and safety of MGN1703 (60mg twice-weekly subcutaneously) as maintenance therapy following first-line induction therapy in metastatic colorectal cancer (mCRC). This was the first placebo-controlled trial to prospectively investigate the impact of an immunomodulator as maintenance therapy in mCRC, based on the hypothesis that patients with disease control could benefit from immunotherapy.

The study recruited patients who had achieved stable disease (SD) or response (complete response [CR], partial response [PR]) after 4.5-6 months of first-line induction chemotherapy (FOLFOX/XELOX or FOLFIRI ± bevacizumab). The patients were randomised 2:1 to maintenance treatment with MGN1703 or placebo. Recruitment was closed prematurely due to slow recruitment (59 out of 129 planned patients were enrolled; 43 MGN1703, 16 placebo).

Exhibit 2: PFS and OS data from IMPACT



Source: Riera-Knorrenschild J, et al; ASCO 2014 poster

The primary endpoint was progression-free survival (PFS) from the start of maintenance therapy (with MGN1703/placebo) until disease progression. Final analysis showed a superior effect in MGN1703 compared to placebo with a hazard ratio (HR) of 0.55 (p=0.04). A subgroup of patients (n=4) were continuously progression-free at the study-end and so continued to receive MGN1703 on a compassionate-use basis. As of August 2015, three of the patients remain progression-free (47-55 months) and continue on MGN1703 maintenance therapy.

At final study analysis, overall survival (OS) data were still not mature, as only 35% and 50% of the MGN1703 and placebo patients, respectively, had an event. The preliminary HR for OS of the

[1] Vanneman M, et al. (2012). Combining immunotherapies and targeted therapies in cancer treatment. Nature Reviews Cancer;12:237-251

intent-to-treat (ITT) population was 0.63 (p=0.29); medial OS was 22.6 months (vs 15.1 months). Mologen no longer expects final data to be available in 2015, due to lack of events.

In terms of safety, MGN1703 was generally well-tolerated, with most adverse events being mild-to-moderate (grade 1/2) and typically linked to injection site reactions (pain, redness, itching) or linked to immune system activation (flu-like symptoms). One patient in the MGN1703 group discontinued treatment because of an adverse event (grade 3 sensory neuropathy, possibly linked to previous oxaliplatin chemotherapy). The lack of treatment interruption in patients experiencing prolonged response, despite therapy for up to 55 months, highlights the tolerability of MGN1703 and indicates its potential suitability as a maintenance therapy. In the failed Phase III trial of Pfizer's PF-3512676, increased toxicity was found in the PF-3512676 combination arm. PF-3512676 is a linear DNA molecule that requires chemical modification to protect from enzyme degradation; however, these modifications can have toxic side-effects. The dumbbell structure of MGN1703 means that no chemical modification is required; accordingly, even at MGN1703 doses significantly higher than those used of PF-3512676, no dose-limiting toxicity has been observed.

Comparability to other immunotherapies

The PFS and OS Kaplan-Meier curves in Exhibit 2 are consistent with observations from other clinical studies with cancer immunotherapies. Typically, for PFS there are minimal differences in the median PFS (eg 2.8 months for MGN1703 vs 2.6 months on placebo), but in a subgroup of patients the treatment benefit can be huge, as demonstrated by the three patients from the MGN1703 arm still progression-free for at least 47 months. Further, in two of the three responders the response was observed as late as nine months after starting treatment, making a carry-over effect from induction chemotherapy unlikely. Conversely, the OS curves can show greater separation at the median, although long-term survival benefit in 10-20% of patients can be dramatic; the PFS and OS curves for Yervoy (ipilimumab; BMS) illustrate this.[2]

Predictive factors identified

Analysing the data from the IMPACT study, Mologen found thee possible factors that could be used to identify patients most likely to respond to MGN1703:

- **Patients with objective response to induction chemotherapy** (CR or PR); in this subgroup PFS HR: 0.40 (p=0.009), and OS HR: 0.40 (p=0.069). This is consistent with the theory of the immunomodulatory effect of chemotherapy, serving to increase the tumour's susceptibility to immunotherapy, as well as the theory that immunomodulatory treatment is more likely to be successful in patients with a relatively low tumour burden.
- **Low-to-normal levels of CEA** (carcinoembryonic antigen, a tumour marker for CRC); PFS HR 0.12 (p=0.003). It is thought that lower CEA levels may be indicative of effective chemotherapy resulting in a smaller and more stable tumour mass.
- **Presence of activated natural killer T-cells (NKT) ≥3.08%;** PFS HR 0.27 (p=0.007). As with CEA levels, a higher proportion of activated NKT cells would also indicate immune activation.

CEA levels and NKT cells could be biomarkers for selecting patients most likely to benefit from MGN1703, although the patient numbers in these sub-groups were small so drawing definitive conclusions at this stage would be premature.

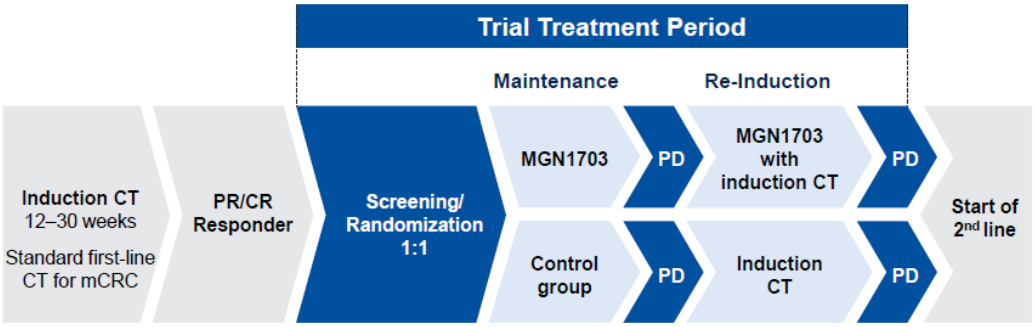
IMPALA: Designed with IMPACT in mind

The pivotal Phase III IMPALA study of MGN1703 in mCRC has been designed to take into account the insights gleaned from the IMPACT trial. The study is an open-label, randomised (1:1), controlled

[2] Hodi S, et al. (2010) Improved Survival with Ipilimumab in Patients with Metastatic Melanoma. NEJM. 363(8):711-23.

two-arm study (n=540; across >120 sites in eight European countries). The key differences from IMPACT include: a more variable induction chemotherapy period (2-7 months); no constraints on the drugs used in chemo-induction (any biological agent allowed); selection of responsive patients (PR/CR only; 50-60% estimated response; PR/CR is the primary driver for patient selection, not duration of chemo); the use of a treatment control group ('doctor's choice'); and a re-induction treatment (with chemo ± MGN1703) phase after first evidence of progressive disease (assessed by a local investigator). Patients in the MGN1703 treatment group will be dosed at the same level as used in IMPACT, 60mg twice-weekly via subcutaneous injection. Patients will be stratified according to the biomarkers (CEA/NKT levels) identified in IMPACT. See Exhibit 3.

Exhibit 3: IMPALA Phase III study design



Source: Mologen presentation (November 2015). Note: PD=progressive disease.

The primary endpoint is overall survival, the gold standard for a pivotal cancer study, which also allows for the open-label study design. Secondary endpoints include PFS, overall response rate, quality of life assessment and safety. Recruitment is ongoing and full enrolment is expected in H216, with initial data 12-18 months later (H118).

Preliminary data confirm mode of action

In November, Mologen presented exploratory immunological data from a preliminary analysis of the IMPALA study at the Annual Meeting of the Society for Immunotherapy of Cancer. The profile of activated immune cells (monocytes, NKT cells, natural killer cells and T-cells) identified in the analysis confirms the evidence already observed in IMPACT and the mode of action of MGN1703.

Limited treatment options for metastatic colorectal cancer

Excluding skin cancers, colorectal cancer is the third most common cancer diagnosed in both men and women in the United States, and is the second leading cause of cancer-related deaths when both sexes are combined (cancer.org). Cure is not possible for most patients with mCRC, although for those with limited involvement of distant organs surgery may be curative. For others, chemotherapy, often in combination biological agents, can improve symptoms and prolong life. Yet the five-year survival rate of mCRC is just 11% (cancer.org).

There are a number of other Phase III candidates in development for mCRC listed on clinicaltrials.gov. The majority appear to be targeted at second- /third-line treatment, typically after disease progression following treatment with approved chemotherapies, biological agents, and other targeted agents. This suggests that MGN1703 could occupy a unique space as part of the first-line treatment for patients with mCRC.

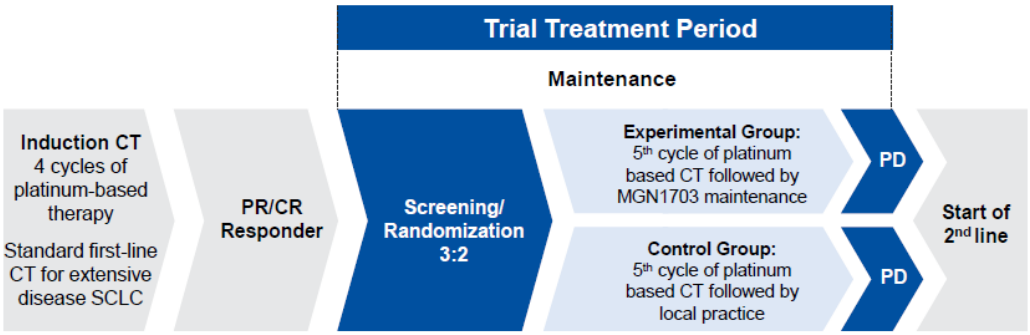
The FDA has approved two new therapies for mCRC in 2015. Lilly's Cyramza (ramucirumab) was approved for use in combination with the chemotherapy combination FOLFIRI (irinotecan with 5FU and folinic acid) in mCRC that has progressed after first-line treatment; median OS 13.3 months for patients on the FOLFIRI plus ramucirumab arm (vs 11.7 months for FOLFIRI plus placebo). Taiho

Oncology's Lonsurf (trifluridine/tipiracil) was approved for refractory mCRC; median OS 7.1 months in the trifluridine/tipiracil plus best supportive care (BSC) arm (vs 5.3 months for BSC and placebo).

Recruitment complete for Phase II IMPULSE study

IMPULSE is a randomised, controlled, two-arm, multi-national study assessing MGN1703 as a maintenance therapy post-induction chemo in metastatic small-cell lung cancer (SCLC; n=100). The design is similar to that of IMPACT (Exhibit 4). Recruitment completed in October 2015.

Exhibit 4: IMPULSE Phase II study design



Source: Mologen presentation (November 2015). Note: PD=progressive disease.

In this patient population, the response to first-line chemotherapy is often good (c 70%). Unfortunately, disease progression is almost inevitable, occurring in a short time period and with treatment options then largely palliative. Therefore, a maintenance therapy such as MGN1703 could have a significant benefit in this disease. Patients will be stratified according to biomarkers: NKT levels and NSE (neuron specific enolase, a tumour marker for lung cancer). The primary endpoint is OS and Mologen expects to begin the analysis after 12 months or by end-2016, and to present the data at ASCO 2017. The OS rate in this patient population is typically <12 months.

The data from the Phase III trial of the immunotherapy Yervoy (ipilimumab; BMS) in combination with chemotherapy for the treatment of SCLC are expected before the year end. The primary endpoint is also OS. BMS is also conducting two other Phase III trials in SCLC. CheckMate 451 is investigating Opdivo (nivolumab) and Opdivo in combination with Yervoy as maintenance therapy in patients with metastatic SCLC after completion with first-line chemo; the same target population as MGN1703. CheckMate 331 is investigating Opdivo vs chemotherapy in patients with relapsed SCLC. Both trials started recruitment in August 2015, with initial OS data due in 2018.

The FDA recently approved Lilly's antibody therapy, necitumumab, alongside two types of chemotherapy for patients with metastatic squamous non-small cell lung cancer (NSCLC) who have not received any form of therapy; NSCLC is more common than SCLC (85% of all lung cancers), but like SCLC the squamous type is difficult to treat, with few treatment options. The approval came despite the fact that in combination with two chemotherapies OS benefit was just 1.6 months vs the chemotherapies alone, and the PFS benefit was less than a week; it also carries black-box warnings due to cardiovascular and thromboembolic risks. This illustrates the need for treatment options in these difficult-to-treat lung cancer patients, where even a modest benefit is valuable.

TEACH study: The first non-cancer study for MGN1703

The broad activation of the immune system triggered by MGN1703 means that its potential may not be limited to cancer immunotherapy. To this end, in collaboration with the Aarhus University Hospital, Denmark, a Phase I study is underway to assess whether MGN1703 can activate the innate and adaptive immune system in patients with HIV leading to enhanced killing of HIV infected cells. The study has received funding from the American Foundation for AIDS Research.

Aarhus University Hospital is conducting the non-randomised interventional trial in two hospital centres in Denmark (Mologen is providing the MGN1703). Patients will receive four weeks of MGN1703 (60mg subcutaneously twice weekly; n=16). The primary endpoint is the change in proportions of activated natural killer cells; secondary endpoints include a collection of virological, immunological, pharmacodynamic and safety data. Recruitment completed in September 2015, and results are expected in Q216. Promising findings could expand the range of applications of MGN1703, broadening its appeal to potential future partners.

Mid-stage pipeline update

MGN1703 remains the focus for Mologen; however, its pipeline does include other cancer immunotherapies. Mologen is also working on the preclinical EnanDIM (Enantiomeric, DNA-based, ImmunoModulator), an innovative linear DNA-based TLR9. It has been designed to combine the chemically unmodified DNA components of MGN1703 with the ease of production advantages of linear molecules; this could also potentially extend the patent life of the franchise.

MGN1601: Unique renal cancer cell vaccine

MGN1601 is a cell-based 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 impossible to copy by a potential generic competitor. The cells are also combined with MGN1703 (used as an adjuvant, at a lower-dose), and the product can be stored and shipped frozen, providing an off-the-shelf cancer vaccine.

Encouraging outcomes in Phase I/II study

MGN1601 was evaluated in a small, open-label, single-arm, Phase I/II study (ASET). The trial treated 19 patients with advanced RCC who 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 PR; 1x SD) 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 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.

Development has taken a backseat to MGN1703

Despite encouraging initial findings in a subgroup of patients, and identifying potential biomarkers, development has not visibly progressed since ASET completed in 2013. Fresh funding and/or a partner will be required to proceed to a larger study, or studies in combination with other agents.

The FDA recently approved Opdivo to treat advanced RCC in patients who have received prior anti-angiogenic therapy. It is only the second drug approved for the condition, and the first in nearly nine years. The Phase III CheckMate-025 trial was stopped early this July after an independent panel determined that Opdivo improved OS vs standard of care (median OS benefit of 25 months vs 19.6) in patients with advanced RCC; FDA Breakthrough Therapy designation was granted shortly after.

MGN1404: Phase I in malignant melanoma ongoing

MGN1404 is a MIDGE-based gene therapy targeting malignant melanoma. Mologen is collaborating with the Charité University Medicine Berlin and Max-Delbrück Center for Molecular Medicine (MDC) in Berlin for MGN1404's development. The Charité is leading a Phase I trial investigating its safety and tolerability, with additional data on mechanism of action to be collected. The study began in 2013 and recruitment is ongoing (aiming to recruit nine patients).

Valuation

Our valuation of Mologen has increased slightly to €387m (vs €384m), or €17/share, primarily due to rolling the model forward to 2016 and updating for estimated end-FY15 cash of €25m. At present we maintain our assumptions for the MGN1703 and MGN1601 programmes until the new management has provided an update on strategy. Given the early stage of development we do not include MGN1703 for use in HIV at present. Our sum-of-the-parts DCF model applies a standard 12.5% discount rate. Our key assumptions and valuation metrics are summarised in Exhibit 5.

Exhibit 5: Mologen valuation metrics and assumptions

Product	Status	Market launch	NPV (€m)	Peak sales ($m)	Probability of success	Royalty estimate	rNPV (€m)	rNPV share (€)	Key assumptions
MGN1703 - CRC - US	Phase III-ready	2018	136	429	65%	25%	86	3.80	~135,000 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 25% peak share (2024); $50,000 treatment price; 2025 patent exp.
MGN1703 - CRC - EU	Phase III	2018	227	629	65%	25%	144	6.36	~345,000 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 25% peak share (2024); $30,000 treatment price; 2025 patent exp.
MGN1703 - CRC - Japan	Phase III-ready	2020	15	92	50%	15%	7	0.32	~40,000 CRC cases/yr; 25% metastatic + 5% regional; 60% chemo response; 25% peak share (2026); $40,000 treatment price; 8 yrs exclusivity.
MGN1703 – SCLC – US	Phase II-ready	2020	40	223	30%	15%	12	0.53	~225,000 lung cancer cases/yr; 15% SCLC; 75% advanced SCLC; 70% chemo response; 20% peak share (2023); $50,000 price; 2025 patent exp.
MGN1703 – SCLC – EU	Phase II	2020	29	236	30%	15%	4	0.19	~310,000 lung cancer cases/yr; 15% SCLC; 75% advanced SCLC; 70% chemo response; 25% peak share (2025); $30,000 price; 2025 patent exp.
MGN1703 – SCLC – Japan	Phase II-ready	2022	3	27	25%	15%	1	0.04	~38,000 lung cancer cases/yr; 15% SCLC; 75% advanced SCLC; 70% chemo response; 25% peak share (2025); $40,000 price; 8 yrs exclusivity.
MGN1601-RCC - US	Phase II-ready	2022	291	390	25%	70% operating margin	66	2.93	~63,000 RCC cases/yr; 35% advanced RCC; 15% peak penetration (2024); $75,000 treatment price; 12yrs BLA exclusivity (2032).
MGN1601-RCC - US	Phase II-ready	2022	188	259	25%	70% operating margin	41	1.79	~75,000 RCC cases/yr; 35% advanced RCC; 15% peak penetration (2024); $50,000 treatment price; 10yrs BLA exclusivity (2030).
MGN1601-RCC - US	Phase II-ready	2022	4	25	25%	15%	1	0.04	~6,000 RCC cases/yr; 35% advanced RCC; 15% peak penetration (2025); $60,000 treatment price; BLA exclusivity (2030).
Portfolio value			**933**				**362**	**16.00**	
Cash							25	1.10	FY15e net cash
Total							**387**	**17.10**	20.6m shares out

Source: Edison Investment Research. Note: Cancer incidence rates from SEER/American Cancer Society/Globocan.

Positive results from the TEACH study (expected in Q216) that indicate the potential for MGN1703 to expand beyond cancer immunotherapy offers upside to our valuation. The key near-term drivers are the outcome of the IMPULSE Phase II study in SCLC and ultimately the IMPALA Phase III trial in mCRC. Positive results would prompt higher probabilities of success, leading to potentially significant valuation increases (see unadjusted NPV).

Our valuation assumes that a licensing partner will be secured on successful completion of the IMPALA study, with a 25% royalty rate in mCRC. Since the SCLC programme will have completed Phase II, we assume a more modest 15% royalty. In reality, the royalty rate may fall somewhere between the two levels. However, we have not included any upfront fees and/or milestones that would be expected on securing a partner and successful commercialisation of the product, which offers further potential upside to our valuation. While we assume a deal on completion of IMPALA, we note that a partnership could be secured ahead of IMPALA study data in 2018 (for example, on the back of positive IMPULSE data in 2017).

In September, the US Patent and Trademark Office declared that it will grant a patent for the combined use of MGN1703 with a chemotherapeutic agent (as is the dosing regimen used in the 're-induction' treatment phase of the IMPALA trial). Mologen expects that this patent will permit a longer exclusive commercialisation than the initial patent for MGN1703 alone; we have extended the patent protection to 2025 in the US (previously 2023).

For MGN1601, we assume Mologen will commercialise the product itself in the US and Europe, with a 15% COGS and 15% marketing costs, giving a 70% operating margin. A partner would be required in Japan/RoW, and therefore royalties would be receivable (estimated at 15%).

Sensitivities

The key sensitivities relate to the clinical performance of MGN1703 and the company's ability to secure the additional financing and/or an appropriate partner to complete MGN1703's full clinical programme. Results from the IMPULSE Phase II study in SCLC (H117) and the IMPALA Phase III trial in mCRC (2018) will have a major bearing on MGN1703's chances of regulatory approvals and commercial success. We have made assumptions about the potential market opportunity available to MGN1703, which do not currently include significant stratification of patient populations. In the final analysis it may be that these candidates are most active in certain subgroups (eg levels of tumour antigens and/or immune cells), which could significantly reduce the target patient pool. However, should a biomarker-related response be confirmed, this could be offset by being able to extract a higher treatment price, gain greater reimbursement from payers (governments/insurance companies), and secure more favourable economic terms from any partnership.

Future development of MGN1601 is dependent on funding and/or partnerships. At present MGN1703 is the priority, however we currently assume that with new management in place active development of MGN1601 may resume in 2016.

Financials

Cash at end-Q315 was €30.5m, which includes the capital raise in April 2015 when €28.3m gross (€26.8m net) was raised from the rights issue (one-for-three) of c 5.7m new shares at €5.00 per share. Our model suggests that current cash is sufficient to fund operations to mid-2017, depending on the progress of the IMPULSE and IMPALA studies. Importantly, this provides a cash runway that accommodates some important milestones, particularly the completion of patient recruitment into the IMPALA trial (H216) and the primary analysis of the IMPULSE study data in SCLC (H117). There does, however, remain a funding gap, in respect of the IMPALA study (primary endpoint estimated 2018). We estimate this to be in the €25-35m range and include an illustrative €30m financing, nominally attributed to debt, in our FY17 forecasts, to allow completion of the study. The size and timing of the financing may vary significantly, and could be influenced by the outcome of the IMPULSE study and potential licensing deals.

Exhibit 6: Changes to forecasts

€m	2015e old	2015e new	% change	2016e old	2016e new	% change
Revenue	0.05	0.05	-14	0.04	0.04	+0
R&D expenses (cost of materials)	(9.2)	(9.9)	+7	(11.1)	(11.9)	+7
G&A expenses (personnel expenses)	(5.6)	(5.3)	-6	(5.7)	(5.4)	-6
Operating profit	(18.2)	(19.1)	+5	(20.1)	(21.2)	+5
Profit Before Tax	(18.1)	(19.0)	+5	(20.0)	(21.0)	+5
Profit After Tax	(18.1)	(19.0)	+5	(20.0)	(21.0)	+5
EPS (€)	(0.90)	(0.90)	-0	(0.96)	(0.93)	-3
Cash	24.1	24.9	+3	4.7	4.3	-9

Source: Edison Investment Research

In the first nine months of 2015, net loss amounted to €13.3m (equal to the same period in 2014). R&D expense, as classified by Mologen, is mainly derived from 'cost of materials' of €6.4m (€7.1m in Q1-Q314) and 'personnel expenses' of €3.8m (€3.9m in Q1-Q314), as reported in the income statement. Mologen continues to guide that FY15 R&D will exceed that of FY14 (€8.7m) as the IMPALA and IMPULSE studies progress; our R&D forecast (cost of materials) has increased slightly to €9.9m for FY15, offset slightly by reduced estimated SG&A (personnel expenses) of €5.3m. This drives a higher net loss than in 2014 (€17.1m); we forecast €19.1m, in line with management's reiterated financial outlook. Our revised forecasts are illustrated in Exhibit 6.

Exhibit 7: Financial summary

€000s	2013	2014	2015e	2016e	2017e
Year-end 31 December	IFRS	IFRS	IFRS	IFRS	IFRS
PROFIT & LOSS					
Revenue	227	12	47	40	50
Cost of Sales	0	0	0	0	0
Gross Profit	227	12	47	40	50
Research and development (cost of materials)	(2,904)	(8,687)	(9,900)	(11,880)	(8,910)
Selling, general & administrative (personnel expenses)	(4,364)	(5,113)	(5,275)	(5,381)	(5,434)
Other operating income / expense	(2,803)	(3,199)	(3,828)	(3,825)	(3,825)
EBITDA	(9,844)	(16,987)	(18,957)	(21,046)	(18,119)
Operating Profit (before GW and except.)	(9,923)	(17,059)	(18,980)	(21,071)	(18,152)
Intangible Amortisation	(935)	(38)	(93)	(84)	(50)
Exceptionals/Other	0	0	0	0	0
Operating Profit	(10,858)	(17,097)	(19,073)	(21,155)	(18,202)
Net Interest	30	19	10	25	1
Other	0	0	0	0	0
Profit Before Tax (norm)	(9,893)	(17,040)	(18,971)	(21,046)	(18,151)
Profit Before Tax (FRS 3)	(10,828)	(17,078)	(19,063)	(21,130)	(18,201)
Tax	0	0	0	0	0
Deferred tax	0	0	0	0	0
Profit After Tax (norm)	(9,893)	(17,040)	(18,971)	(21,046)	(18,151)
Profit After Tax (FRS 3)	(10,828)	(17,078)	(19,063)	(21,130)	(18,201)
Average Number of Shares Outstanding (m)	15.4	16.8	21.1	22.6	22.6
EPS - normalised (€)	(0.64)	(1.01)	(0.90)	(0.93)	(0.80)
EPS - FRS 3 (€)	(0.70)	(1.02)	(0.90)	(0.93)	(0.80)
Dividend per share (€)	0.0	0.0	0.0	0.0	0.0
BALANCE SHEET					
Fixed Assets	457	440	423	426	454
Intangible Assets	237	206	168	101	61
Tangible Assets	220	234	254	325	393
Other	0	0	0	0	0
Current Assets	15,480	14,613	26,607	6,046	18,401
Stocks	33	30	28	27	27
Debtors	0	0	0	0	0
Cash	14,765	13,563	24,903	4,343	16,698
Other	682	1,020	1,676	1,676	1,676
Current Liabilities	(943)	(1,747)	(6,136)	(6,136)	(6,136)
Creditors	(943)	(1,747)	(6,136)	(6,136)	(6,136)
Short term borrowings	0	0	0	0	0
Long Term Liabilities	(10)	(8)	(7)	(7)	(30,007)
Long term borrowings	0	0	0	0	(30,000)
Other long term liabilities	(10)	(8)	(7)	(7)	(7)
Net Assets	14,984	13,298	20,887	329	(17,289)
CASH FLOW					
Operating Cash Flow	(8,869)	(15,605)	(14,650)	(20,448)	(17,534)
Net Interest	0	0	0	0	0
Tax	0	0	0	0	0
Capex	(146)	(93)	(104)	(113)	(111)
Acquisitions/disposals	1	0	0	0	0
Financing	8	14,495	26,095	0	0
Dividends	0	0	0	0	0
Other	0	0	0	0	0
Net Cash Flow	(9,006)	(1,203)	11,340	(20,561)	(17,645)
Opening net debt/(cash)	(23,777)	(14,765)	(13,563)	(24,903)	(4,343)
HP finance leases initiated	0	0	0	0	0
Exchange rate movements	(6)	1	0	0	0
Other	0	0	0	0	0
Closing net debt/(cash)	(14,765)	(13,563)	(24,903)	(4,343)	13,302

Source: Mologen accounts; Edison Investment Research

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

Management team

Chief Executive Officer: Dr Mariola Söhngen	Chief Medical Officer: Alfredo Zurlo, MD
Dr Söhngen joined Mologen on 1 November 2015, assuming the role of CEO. She is the co-founder of PAION AG and PAION Deutschland GmbH; she served as managing director at both. She also held the position of chief medical officer of PAION AG from 2004-15. Prior to founding PAION she worked for Grünenthal GmbH and Ferrer Internacional SA. She has a medical degree, a PhD in medicine, a diploma in pharmaceutical medicine and a master of business communication.	Dr Zurlo was appointed CMO in April 2013, responsible for clinical development and clinical strategy. He previously held numerous positions at Roche (2003 to 2011), including medical director oncology and senior international medical leader. Prior to joining industry, he was medical advisor at EORTC (1999 to 2003). Dr Zurlo obtained his medical degree at the University of Rome, Italy.
Chief Financial Officer: Jörg Petraß	**Member of the Executive Board: Dr Matthias Schroff**
Mr Petraß joined Mologen in 2001 (initially focused on investor relations and accounting) and was appointed CFO in 2007, and is responsible for controlling, accounting, finance, law, human resources and investor relations.	Dr Schroff was Mologen's leading scientist at foundation. He joined the board in 2005, was appointed CEO in 2008, and is also responsible for research, business development, strategy and partnering. He holds a PhD in biochemistry from the Free University, Berlin. He was replaced as CEO in 2015 by Dr Mariola Söhngen.

Principal shareholders	(%)
Global Derivative Trading	24
Deutscher Ring Krankenversicherungsverein	6
Baloise Holding	6
Deutsche Balaton Aktiengesellschaft	5
Salvator Vermoegensverwaltungs	5

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