PATRYS LIMITED

Initiation of coverage

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A new cancer paradigm

Patrys' antibody drug candidate, PAT-DX1, offers two key desired characteristics of a cancer drug – selectivity and use in multiple cancers. Its novel mechanism of action (MOA) has the potential to establish a new standard in cancer treatment. Firstly, it localises to tumours while not affecting normal cells. Secondly, it targets highly treatment-resistant cancers by penetrating the cell and impairing gene repair. Thirdly, PAT-DX1's ability to cross the 'impermeable' Blood Brain Barrier (BBB) could significantly expand the number of treatment options for brain cancers by potentially acting as both a stand-alone therapy and as a carrier vehicle to provide combination treatment with other cancer therapies.

Attractive markets for difficult targets

PAT-DX1 is likely to target brain tumours and gene-related cancers such as glioblastoma multiforme (GBM) and triple negative breast cancer (TNBC) brain metastases. Both carry very poor prognoses. Approval in either condition is expected to attract receptive markets. Current sales of poly ADP-ribose polymerase (PARP) inhibitor cancer drugs, which use a different pathway to impair gene repair, are around USD2b per annum.

Strong interest expected in novel therapy

Antibody drugs are driving the cancer market. In 2017, all fourteen novel cancer drugs approved by the U.S. Food and Drug Administration (FDA) were targeted therapies – half of which were given a 'breakthrough' status by the FDA and subsequently received expedited market entry. Three of the four FDA-approved PARP inhibitors were first licensed/acquired in preclinical or Phase I trials. Throughout CY20, Patrys will undertake studies to finalise the preclinical data required to commence clinical trials, planned for H1CY21.

Valuation

Valuation of Patrys has been derived from a risk-adjusted DCF. Both GBM and TNBC are modelled and then an equal weighting of 50% per condition is assigned to determine the market capitalisation. The resulting valuation of $56.8m equates to a price of $0.05 per share.

patrys

Patrys is an ASX-listed therapeutic antibody company focused on cancer treatments. Lead candidate PAT-DX1, licensed from Yale University, has unique characteristics which have the potential to introduce a new standard of cancer treatment. Clinical trials are planned to start in early CY21. Preclinical studies have shown efficacy in treatment-resistant cancers, including glioblastoma and metastatic triple negative breast cancer. These cancers represent high unmet medical needs and there is likely to be keen interest in PAT-DX1.

Stock	**PAB.AX**
Price	**$0.02**
Market cap	**$21.45m**

Company data	
Net cash (FY19):	$6.47m
Shares on issue (FY19):	1,069m
Code:	PAB
Primary exchange:	ASX

Next step

Complete preclinical studies to commence clinical trials in CY2021.

Investment Thesis: Unique Cancer Approach

Patrys, is an emerging ASX listed biotechnology company which is focusing on therapeutic antibody treatments. Antibody drugs have been the success story for a number of serious diseases which include cancer. PAT-DX1, Patrys' lead drug candidate, has the potential to add a new dimension to antibody-based therapy.

Its novel mechanism of action has key advantages over the current antibody drugs. The large size of antibodies generally limits their treatment targets to outside the cell. PAT-DX1 penetrates the cell and its nucleus, allowing it to disrupt DNA repair mechanisms which are essential for cell survival. It is selective to cancer cells. Potentially, the most important characteristic of PAT-DX1, is its ability to cross the 'impermeable' Blood Brain Barrier (BBB). The BBB blocks other antibody therapies and most small-molecule drugs. In terms of cancer, this significantly limits the treatment options for brain cancers and cancers which tend to metastasise in the brain. These include lung, liver, breast and colon cancers.

Combination therapy is the cornerstone of cancer treatment regimens. PAT-DX1 carries the potential to add a new approach to cancer treatment. There is likely to be keen interest in the novel antibody. Review of industry data shows licensing of first-in-class antibody drugs often takes place in late preclinical or early clinical stage. The PARP inhibitor drugs are a new class of small-molecule cancer drugs, with the first approval in 2014. Three of the four FDA approved PARPis were first licensed/acquired in preclinical or Phase I trial. Olaparib, the first PARPi to be developed, was acquired in Phase I.

Potential Near-Term Catalysts

- CY19/20 - Selection of lead antibody(s) or antibody fragment drug candidate
- CY19/20 - Confirmation of manufacturing processes
- CY19/20 - Toxicology studies and pharmacokinetic data to support clinical trial application
- H2CY20 - Investigational New Drug Application submission to FDA
- H1CY21 - Clinical trial commencement

Risks and Sensitivities

- Funding – Patrys will need additional funding to develop PAT-DX1 to commercialisation. Capital raising, licensing or sale are potential options.
- Manufacturing – the manufacturing process and lead candidate are still to be confirmed
- Clinical Trials /Regulatory Approval - clinical trials to demonstrate safety and efficacy of PAT-DX1 and support regulatory approval and market entry are still to be undertaken
- Markets – potential sales revenues and estimation of market entry date and penetration have been based on current industry data. These parameters may change.
- Competitor drugs – New drugs may enter the markets which PAT-DX1 targets. However, the combination regimen used in cancer management is likely to accommodate a drug such as PAT-DX1 with its novel MOA.

Valuation

Valuation of Patrys has been derived from a risk-adjusted DCF. Both GBM and TNBC are modelled and then an equal weighting of 50% per condition is assigned to determine the market capitalisation. The risk adjustment uses industry data on the probability of a new cancer and/or biologic drug candidate reaching each stage of development. Patrys will need to secure additional funding to continue the development of PAT-DX1 to commercialisation. The financial model assumes that a capital raising of AUD15m is undertaken in FY21 and PAT-DX1 is licensed during the Phase II trial stage. Funding of ongoing development costs are assumed to be the responsibility of the licensing partner. The resulting valuation of $56.8m equates to a price of $0.053 per share. The potential values of PAT-DX1's use in other cancers and those as a carrier vehicle and dual therapy have not been included.

Novel antibody offers new cancer treatment approach

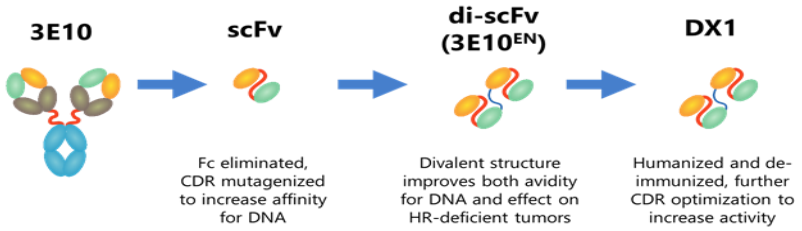
PAT-DX1 antibody offers two key desired characteristics of a cancer drug; cancer cell selectivity and the ability to treat a wide range of cancers, including those considered resistant to current available treatments. Antibody drugs are limited in their therapeutic application, as they are generally too large to traverse the cell membrane and reach potential target antigens in the cell. PAT-DX1 can penetrate the cell and enter its nucleus and compromise deoxyribonucleic acid (DNA) repair[1]. Preclinical studies have shown that PAT-DX1 localises to tumours and selectively kills cancer cells with defects in their DNA repair mechanisms. Its ability to cross the BBB opens the potential to also treat brain-based cancers. Drug treatment for these cancers is very limited.

PAT-DX1 is the optimised version of a novel autoantibody, Deoxymab (3E10[2]), a lupus (systemic lupus erythematosus) antibody. Interest in the antibody was ignited when technology provided insight into its MOA. The first version of 3E10 was a murine monoclonal antibody isolated from a lupus mouse model. A number of modifications have been undertaken to optimise PAT-DX1 in readiness for use in humans. Its affinity for DNA-binding has been improved and it has been 'humanised' to reduce the immunogenic response in humans.

In 2016, Patrys licensed 3E10 and another lupus antibody, 5C6, from Yale University. Patrys and Yale University have continued to develop 3E10/PAT-DX1. A conjugate vehicle[3] and bispecific molecule[4] for combination drug therapy are also being developed, with the latter being developed in conjunction with the Walter and Eliza Hall Institute of Medical Research (WEHI).

Diagram 1 illustrates the key changes made to 3E10 to develop the optimised PAT-DX1. The changes result in a smaller molecule while retaining the active therapeutic sections. Its ability to bind with DNA (avidity) has been improved, enhancing its ability to penetrate into cells. Further modifications have been made to remove components that could carry a risk of causing lupus-like side effects.

Exhibit 1: PAT-DX1 optimised version of the lupus antibody 3E10



Source: Patrys.

Note: Fc= antibody constant region; CDR= complementarity determining region (antigen binding site); HR= homologous recombination; affinity and avidity are measures of the strength of antibody binding to the target antigen); scFv= single-chain variable fragment.

The Current Cancer Treatment Paradigm

The ideal cancer treatment kills cancer cells, while allowing normal cells to remain healthy and functioning. The two main groups of cancer drugs are chemotherapy and biologics. Both have limitations. The challenge of cancer drug development is to design a cancer drug that is both selective and has wide application. PAT-DX1 has both of these characteristics.

[1] DNA is the main constituent of genes

2 3E10, Deoxy 1/PAT-DX1 represent the sequential development of the autoantibody

[3] A conjugate vehicle is a carrier that transports a drug, diagnostic or other agent to the target site

[4] A bispecific molecule is an antibody that binds two different antigens to deliver a combination therapy

Chemotherapy

Chemotherapeutics are small-molecule drugs that penetrate cells more easily and so tend to be indiscriminate, affecting cancer and normal cells alike. They target cells that are dividing rapidly, like cancer cells; however, some of the body's healthy cells also divide rapidly. Due to damage caused to normal cells by chemotherapeutics, a patient's treatment dosage may be limited, thereby limiting the treatment's effectiveness.

Biologics

Antibodies are a relatively new type of biologic therapy. Biologic drugs are derived from living organisms or their components. They are very selective, targeting a specific antigen or molecule. The effects of biologic therapy are generally limited to the cancer cells if the target antigen is unique to the cancer cell. However, side effects may occur where the target molecule is also found on normal cells. The key limitation of biologic drugs is that their larger size prevents them from entering a cell. Many potential treatment targets, the antigens, that could be effective in treating cancer cannot be reached.

PAT-DX1 offers new approach

PAT-DX1 has the potential to overcome the key disadvantages of both small-molecule and existing antibody drugs, bringing the prospect of a new cancer treatment approach.

Selectivity

PAT-DX1's 'selectivity' in targeting cancer cells involves two steps. Firstly, it is attracted to DNA, which is found both inside and outside a cell. The cell releases DNA outside the cell when it is dying and 'decomposing'. In a 'tumour ecosystem' there is rapid cell turnover, leading to higher volumes of DNA being released by cells. The DNA outside the tumour cells gathers like a cloud, attracting PAT-DX1.

Secondly, it only affects cells that have compromised gene repair systems. The repair systems are essential to maintaining DNA structure and normal cell function. DNA damage repair (DDR), is a complex system that manages the estimated 20,000 genes in each cell by correcting any faults that occur as the cell undergoes replication.

PAT-DX1 acts to interrupt the repair but on its own cannot damage the repair systems sufficiently to 'kill' a cell. If it enters a normal cell it will not induce cell death. Its use as a cancer treatment is dependent on a cell's DNA repair system already being partially compromised.

PAT-DX1's wide range of potential applications

Compromise of DNA damage repair systems and breaching the BBB

PAT-DX1's novel MOA offers the potential to treat a wide range of cancers. Firstly, compromised DNA repair systems are found in certain gene mutation cancers and when a number of common cytotoxic drugs or radiation therapy are used. Therefore, PAT-DX1 may be effective as a monotherapy in gene-based cancers and when used in combination with a range of cytotoxic drugs and/or radiation.

Secondly, PAT-DX1's ability to cross the BBB offers potential treatment for brain cancers. The BBB is impenetrable to over 98% of small-molecule drugs and all large-molecule biologic therapies such as monoclonal antibodies, recombinant proteins and antisense (gene) therapies. As such, current treatment for brain cancers is often limited to surgery and radiation.

PAT-DX1 in gene mutation cancers

The DDR gene mutations which can result in cancer include BRCA1, BRCA2 and PTEN deficiencies. BRCA1 and BRCA2 genes help regulate cell growth and the repair of damage to DNA. PTEN genes code for an enzyme that acts as a tumour suppressor. Mutations or deficiencies in these genes can cause DNA to go unrepaired and increase the chance of developing cancer.

BRCA1, BRCA2 and PTEN gene deficiencies are commonly associated with GBM, melanomas, prostate, breast, and ovarian cancers. The lack of effective treatments sees patients face poor prognoses. The median survival period for GBM in patients who have undergone surgery, chemotherapy and radiation is 15-16 months. For TNBC patients with brain metastases, the average survival period is reported as 4.6 months. Both situations represent unmet medical needs and potential targets for PAT-DX1.

PAT-DX1 with DNA-targeting cytotoxic drugs and radiation

DNA-targeting cytotoxic drugs and radiation therapy are both commonly used in cancer treatment. Both act by damaging DNA, and thereby present a potential for combination therapy with PAT-DX1 to further impair the DDR processes within cancer cells.

Exhibit 3 outlines the common cytotoxic drugs that result in DNA impairment and the cancers they treat. Exhibit 5 presents the cancers in which radiation is commonly used. These cancers which include leukemias, lymphomas, breast, lung and colon are potential targets for PAT-DX1. Preclinical studies have shown positive data where PAT-DX1 is used in combination with a DNA-targeting drug and with radiation therapy.

Exhibit 2:

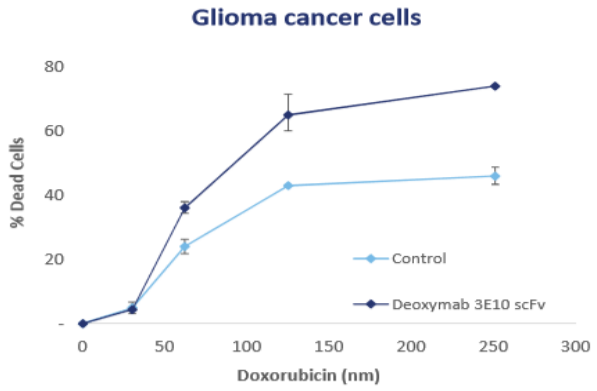
Type of Drug	Drug Name	Therapeutic Applications
Inhibitors Of Nucleotide Synthesis	Methotrexate(MTX) Hydroyuera (HU) 5 - Fluoouracial (5-FU;FU)	•Childhood acute lymphoblastic leukemia; Choriocarcinoma; Some lymphomas and solid tumors; Psoriasis; Rheumatoid arthritis •Chronic myelogenous leukemia; Sickle cell disease •Several carcinomas (gastrointestinal, head and neck, breast)
DNA Polymerase Inhibitors	Cytosine Arabinoside (AraC) Acyclovir (Acy) Ganciclovir (Gan) Foscarnet (FOS) Gemcitabine (dFdC)	• Acute myleocytic leukemia; Childhood leukemia • Herpes Simplex Virus 1 and 2 infections; Varicella Zoster Virus infections • Cytomegalovirus infections in immuno-compromised patients • Pancreatic, lung and bladder cancers
DNA-Template Damaging Agents	Cyclophosphamide Bleomycin (BLM) Doxorubicin (Dox) Mitomycin (MTC) Cisplatin (CDDP)	• Breast cancer and other carcinomas; • Burkitt's lymphoma and other non-Hodgkin's lymphomas' Testicular and ovarian cancer • Carcinomas including breast; Sarcomas including osteogenic; Hodgkin's and non-Hodgkin's lymphomas • Various carcinomas (e.g. cervical, stomach, breast, head and neck, and lung) • Testicular and ovarian cancers; Lung, gastric, and bladder carcinomas
DNA Topoisomerase Inhibitors	Camptothecin (CPT) Etoposide (VP-16) Doxorubicin (Dox) Daunorubicin	• Colon, lung and ovarian carcinomas (including breast) • Leukemia and gastric cancer Testicular, lung and gastric cancers • Sarcomas including osteogenic; Hodgkin's and non-Hodgkin's lymphomas

Sources: National Cancer Institute, National Institutes of Health

Both Yale University and Patrys have conducted studies to evaluate PAT-DX1's activity when used in conjunction with DNA-targeting drugs and radiation therapy. Preclinical studies have shown that the combination of 3E10/PAT-DX1 and doxorubicin, a

DNA-targeting drug, resulted in higher cancer cell death when measured against the use of doxorubicin alone. Doxorubicin inhibits the topoisomerase enzyme that is active in DNA during cell division.

Exhibit 3: Combination with Chemotherapy - doxorubicin



In vitro study showed that 3E10/PAT-DX1 enhanced cancer cell death in combination with doxorubicin

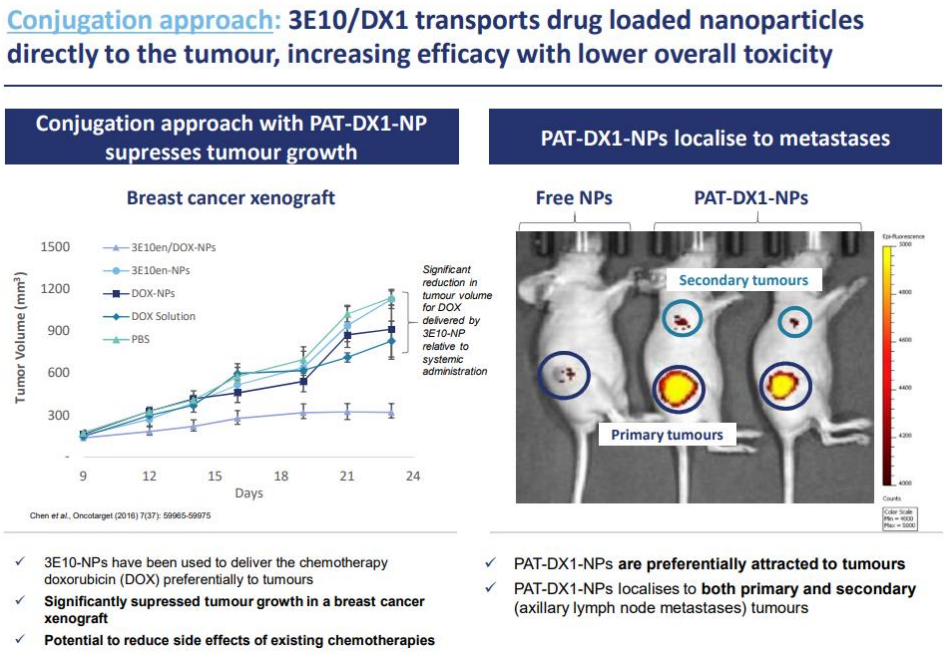
Sources: Company Releases

PAT-DX1 may add an additional benefit to the use of small-molecule drugs in cancer treatment. Small-molecule drugs have been the mainstay of cancer treatments but present a challenge as their non-selectivity affects normal cells. PAT-DX1 is also being developed as a carrier or conjugate vehicle. The conjugate carries a small-molecule drug to the 'DNA clouds' around cancer cells, then penetrates the cancer cells to target DNA and kill the cancer cell. The conjugate format makes small-molecule drugs 'selective' to cancer cells, sparing the normal cells.

Preclinical studies have shown that the conjugate model of 3E10/PAT-DX1, with doxorubicin attached, significantly suppressed breast cancer cell growth in a mouse model. If PAT-DX1's ability to target DNA small-molecule drugs to cancer cells only is confirmed in clinical trials, it is likely to be adopted widely. The side effects caused by small-molecule drugs to normal cells often limits an ideal dosing regime and thereby compromises the clinical outcome.

To date, doxorubicin is the only DNA-targeting drug that Patrys has investigated in a combination and conjugate role. However, from a theoretical chemistry perspective, there are no restrictions on the technology being used in the range of DNA targeting drugs.

Exhibit 4:



Source: Company releases

Radiation therapy is commonly used in cancer treatments, often in conjunction with chemotherapy and/or surgery. It acts to damage DNA and trigger cell death. It is also non-selective to cells and affects both cancer and normal cells indiscriminately.

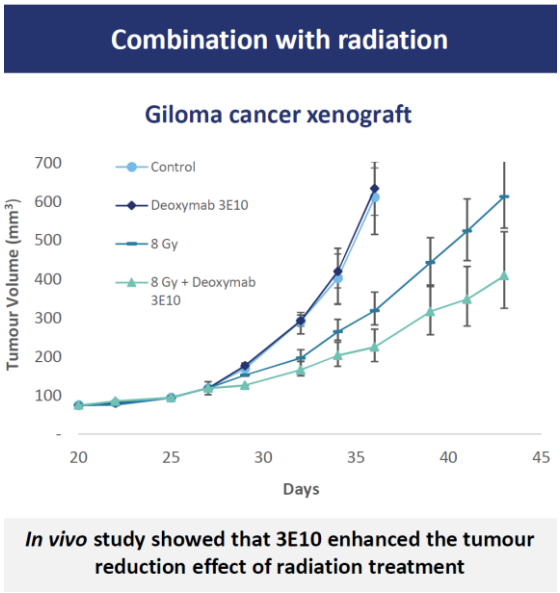
Exhibit 5:

Common radiation uses in cancer	
Bone	Lymphoma
Brain	Meningioma
Head/neck	Oesophagus
Leukemia	Pancreas
Liver	Prostate
Lung	Sarcoma

Source: National Cancer Institute, National Institutes of Health

Preclinical studies have been undertaken to investigate 3E10/PAT-DX1's efficacy in combination with radiation. The animal model study showed a higher rate of reduction in tumour volume when 3E10/PATDX1 and radiation were used in combination for treatment. Together the cancers in which DNA targeting drugs and/or radiation are commonly used account for over 60% of cancers.

Exhibit 6:



Sources: Company Releases

The BBB breached

In terms of its wide application and ability to service an unmet need in cancer, PAT-DX1's most exciting potential therapeutic effect arises from its ability to cross the blood-brain barrier (BBB). The BBB is the major impediment to systemic drug therapy for central nervous system (CNS) diseases. The BBB regulates and maintains homeostasis or 'equilibrium' of the brain by preventing passage of molecules. Almost all small-molecule drugs and all large-molecule drugs, such as antibodies, cannot cross the BBB. Generally, only drugs with molecules that are very small and can readily dissolve into the lipid membranes that encase BBB cells are able to cross the BBB.

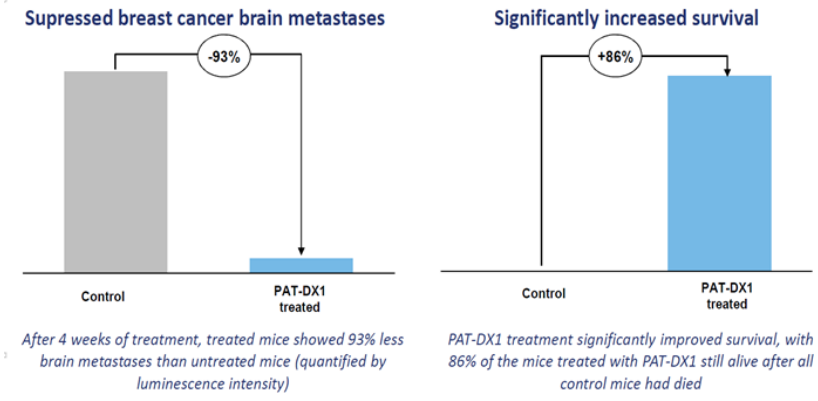
Current cancer treatment is often limited to radiation and/or surgery, both relatively imprecise methods of treatment. In many cases, they cause damage to surrounding healthy tissue and cause significant brain injury and impairment of function. In other cases, the site of the tumour may prevent treatment due to the risk of the treatment also affecting vital areas of the brain.

To pass through the BBB, PAT-DX1 uses the same nucleoside transporter mechanism that permits its passage into the cell. Once through the BBB, PAT-DX1 has the same potential effect that it has outside the CNS. It can act as a monotherapy in DDR-impaired cancers and in combination with radiation and cytotoxic drugs. The DDR impaired cancers include primary brain cancers, such as gliomas, and the brain metastases of non-CNS primary cancers, such as lung, liver, breast, ovary and prostate cancers.

Preclinical studies in animal models confirmed that PAT-DX1 crossed the BBB and increased the rate of survival when used both as a monotherapy and in combination with radiotherapy, to treat GBM and TNBC brain metastases.

Exhibit 7:

Single agent approach: successful pre-clinical mouse model study against TNBC brain metastases[1]



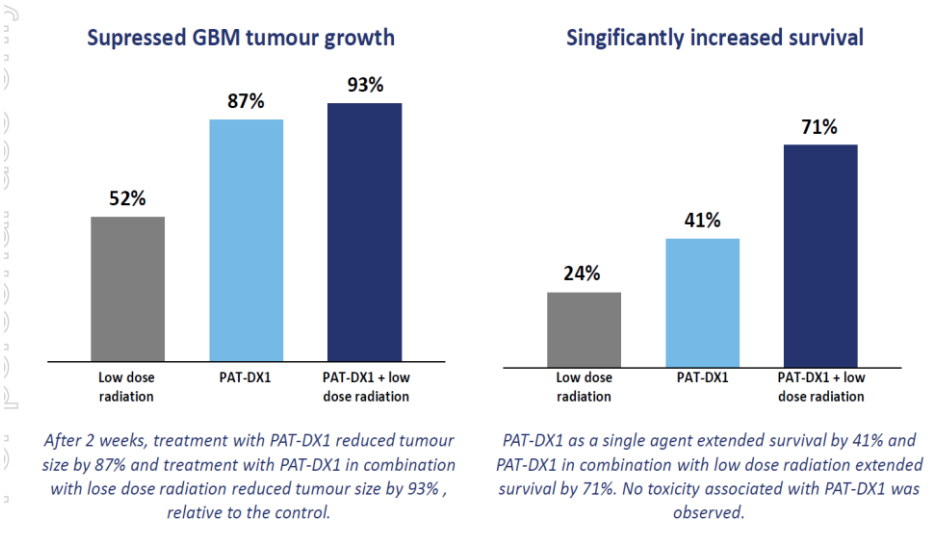
PAT-DX1 showed a higher rate of survival and disease suppression as single agent.

Sources: Company Releases

As there is only a limited number of drug options for the treatment of brain cancers, radiation is commonly used. Its ability to induce DDR impairment creates the opportunity for combined therapy with PAT-DX1. Preclinical studies have demonstrated an increased rate of survival in animal models when PAT-DX1 is used in combination with radiation.

Exhibit 8:

Combination approach: PAT-DX1 significantly improves survival in an animal model of highly aggressive glioblastoma[1]



PAT-DX1 in combination with radiation therapy

Source: Company Releases

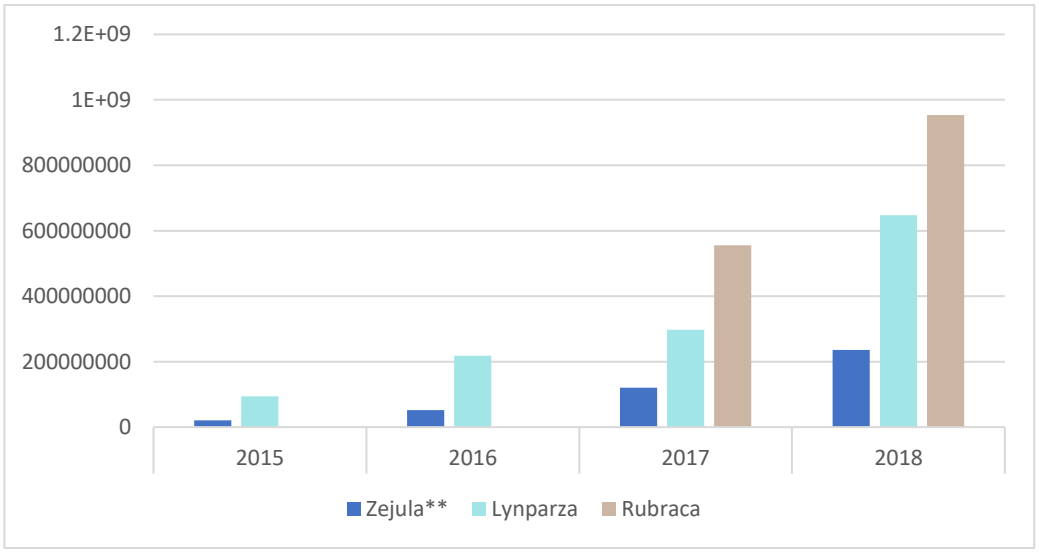
PARPi

Studies have also been undertaken to investigate the role of PAT-DX1 with a new class of cancer drugs, poly ADP-ribose polymerases inhibitors (PARPi). Similarly, to PAT-DX1, PARPis impair DDR. They block PARP enzymes which have a role in repairing damaged DNA.

A study of the impact of PAT-DX1, when co-administered with PARPis, showed that the combination produces a 'synergistic' effect. Synergy is defined as a treatment effect that is greater than the expected additive effect of combined therapies. Synergy may result in greater efficacy at normal dosing levels or achieve normal levels of efficacy at lower doses in patients who are experiencing side effects.

The results imply the possibility of the two drugs being used in combination to induce DDR impairment. Since their launch in late 2014, the sales of PARPi drugs have climbed to around USD2b. Their use is approved for a number of cancers, including BRCA 1 and BRCA2 mutant ovarian and breast cancers.

Exhibit 9: Select PARP Inhibitor Sales (2015-2018) USD



PARPi Sales 2015-2018

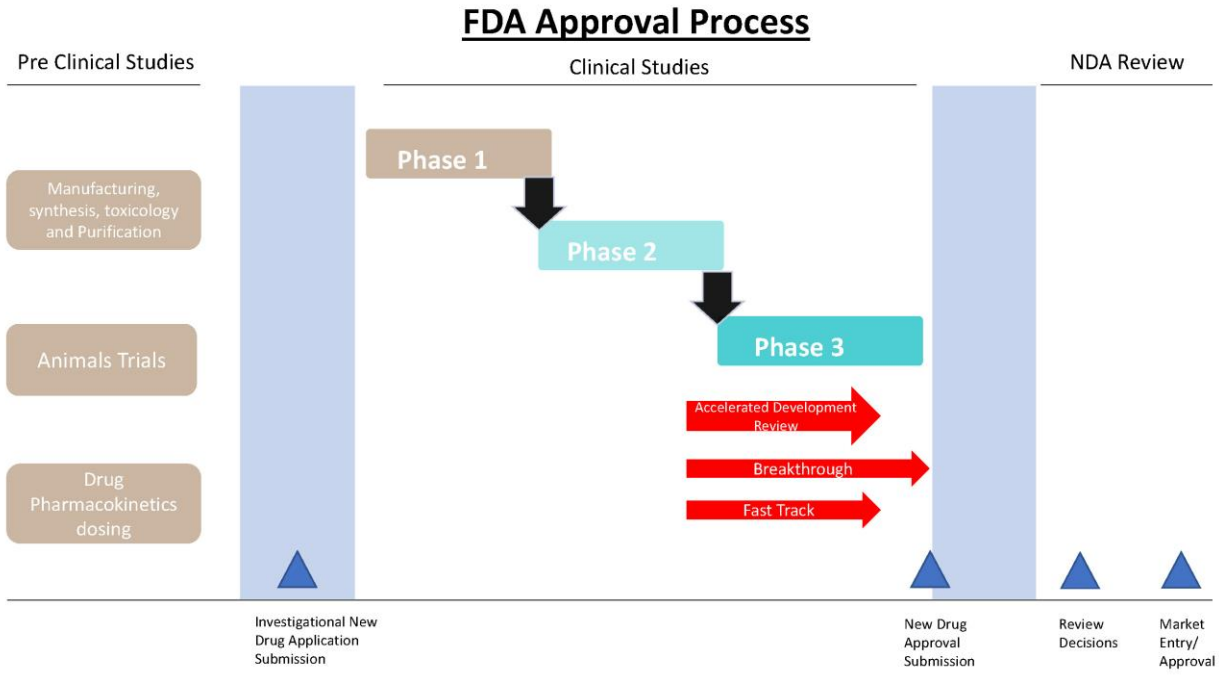
Source: Company releases

Pathway to approval and market entry

Drug development entails preclinical and clinical studies. PAT-DX1 is in the later stages of the preclinical stage. Patrys has undertaken a series of laboratory tests and studies in appropriate animal models to identify PAT-DX1's potential safety and treatment efficacy in different disease applications. Studies continue to provide confirmation of PAT-DX1's characteristics, dosing and pharmacokinetics parameters, and related manufacturing processes. This data will form the basis of submissions to the regulatory authorities to gain permission to undertake clinical trials. The trials will be designed to prove the drug's efficacy and safety in treating the nominated cancers in humans.

E310/PAT-DX1's long history and novel mechanism of action, have seen it the subject of extensive research, including over 25 preclinical studies and 11 animal studies, in monotherapy and combination applications. The conjugated version has been developed over the past 8 years and has involved Yale University which is a well credentialled research body. Preclinical studies have confirmed PAT-DX1's ability to increase survival rates in animal models and have yielded positive data in PAT-DX1's use as a monotherapy, in combination (radiation and doxorubicin) and as conjugated carrier vehicle (doxorubicin). The data will form the basis of an Investigational New Drug Application (IND) to the FDA to commence clinical trials. The submission is planned for 2HCY20.

Exhibit 10:



Source: FDA

Intellectual Property

The PAT-DX1 patents were licensed from Yale University in 2016. The agreement also includes milestone payments and a sliding scale of net royalties on annual sales.

The patents provide protection until at least 2032. The patent portfolio encompasses 9 active patent families and 5 granted patents in Europe, China and Japan. Two patents have been granted in the USA. Further patents are pending in Europe, Canada, Australia, Hong Kong, India, Israel, Japan and China.

Other Assets

5C6

In 2016, Patrys also acquired the rights to 5C6, a lupus antibody. It also penetrates cells and nuclei. In contrast to 3E10/PAT-DX1, studies have shown that 5C6 is nucleolytic, whereby it directly acts to damage the DNA, rather than inhibits the DNA repair mechanisms. Its patents also provide protection until 2032. With the company's resources focused on PAT-DX1, further development of 5C6 has been deferred.

PAT-SC1

In October 2009, Patrys acquired the rights to PAT-SC1 from Debiovision Inc., a member of the global drug development Debiopharm Group. PAT-SC1 is an immunoglobulin M antibody (IgM), while 3E10/PAT-DX1 and 5C6 are immunoglobulin G antibodies (IgG). Patrys has signed an exclusive development and commercialisation agreement for development of PAT-SC1, for all oncology indications in China. In 2019, the company announced that it would allow the patents and associated licences to expire, except those relating to the China agreement.

Valuation

The valuation of Patrys has been derived from a risk-adjusted DCF. It assumes that PAT-DX1 is licensed during the Phase II trial stage and that further funding can be secured to reach this stage of development. A DCF for both metastasised TNBC and GBM is modelled. An equal weight of 50% per condition is assigned to determine the current valuation of $56.8m, or 5.3 cents per share. The valuation assumes that PAT-DX1 demonstrates efficacy in Phase II to warrant market approval. The potential value of PAT-DX1's use for other cancer types and as a carrier or conjugate drug delivery vehicle have not been assigned.

Risk adjustment

Industry data has been used to adjust the DCF valuation to encompass the development risk. Published data provides insight to the probabilities of success for each phase of a drug's development. PAT-DX1 is a monoclonal antibody. Generally, this class of drug therapy group carries a higher success rate in comparison to small-molecule cancer drugs, partly due to their higher selectivity.

Risk is mitigated as progress is made during the drug's development. The key milestones planned for CY20 include confirmation of the manufacturing processes, conclusion of the toxicology studies and establishment of the pharmacokinetics and dosing parameters. Manufacturing poses a relatively minor risk as biopharmaceuticals, such as antibody drugs, can present challenges in process development and production. A risk adjustment factor of 80% has been applied.

Higher risk is assigned to the clinical trial program. The success of antibody drugs has seen the overall approval rate climb. However, successful transition from Phase II cancer trials to Phase III remains at 30% success rate of progression. Phase II is designed to demonstrate the first indications of efficacy and continue safety assessment. It carries the highest risk of failure. Phase I, with its focus on safety, and Phase III, with indication of efficacy already demonstrated in Phase II, generally carry lower risk. PAT-DX1's safety is considered a lower risk as it is derived from a natural autoantibody.

Patient population

The DCF is based on three markets, US, EU and Rest of World (ROW). Published data, including the US National Cancer Institute, have been used to provide incidence data on GBM and TNBC. The potential patient populations have been adjusted to reflect PAT-DX1's targeted markets. PAT-DX1 is believed to be effective in the PTEN gene mutation form of GBM. The potential patient group has been adjusted to reflect the 40% incidence of PTEN deficiency in GBM.

The clinical trial program in TNBC is expected to target patients with brain metastases to demonstrate the effect of PAT-DX1 in crossing the BBB. This group accounts for 16% of TNBC patients. However, it is expected that success in this group would see approval for all TNBC patients who have metastatic disease, irrespective of where metastases are sited. This would double the potential treatment population to around 35% of TNBC patients.

In terms of market penetration, the survival statistics for GBM are very low, with less than 3% of patients surviving 5 years. In comparison, metastatic TNBC's 5-year survival is reported as around 14%. Given the few treatment options and extremely poor prognosis, it is likely that PAT-DX1 will claim a higher proportion of the GBM market in comparison to TNBC.

Pricing

Pricing dynamics vary significantly in the different regions, with the US commanding a significant premium compared to the EU, and again to most of ROW. In 2017, the US median price of new cancer drugs exceeded USD150,000 per year, with the average cost being USD200,000. In terms of pricing in the US, immune antibody drugs average around USD150,000, with PARPi drugs being priced at USD200,000. The model assumes that PAT-DX1 enters the market with an annual cost of USD150,000.

Deal Metrics

Given the unique characteristics of the PAT-DX1, an early licensing deal is likely. The model assumes a licensing deal during Phase II with early efficacy data. This may be conservative, with an earlier deal possible based on the PARPi experience.

The success of PARPis has validated the approach of DNA repair mechanism interference as a cancer treatment. PAT-DX1 may offer several advantages in comparison to PARPis. PAT-DX1 is a biologic and may be more selective in comparison to PARPis, which are small-molecule drugs. PAT-DX1 promises higher efficacy as it targets both double-strand and single-strand DNA repair

mechanisms. PARPis target single-strand repair mechanisms only, which is not as important for DNA repair. PAT-DX1 also offers additional potential value through the conjugate nanoparticle and bispecific drug formulations.

Estimates of sales royalties and milestone payments on licensing, FDA submission, approval and market launch are based on current industry data.

Risks and Sensitivities

Funding

Patrys at FY19 showed cash of around $6m. An estimated $10m of expenditure is required to complete the preclinical studies and some $15m for the clinical trial program to complete Phase II. The Australian government offers an R&D tax incentive scheme which sees a 43.5% refund of R&D expenses. While much of Patrys' R&D expenditure may qualify for the R&D tax scheme, it will need to secure additional funding to continue the development of PAT-DX1. The financial model assumes that a capital raising is undertaken in FY21 and PAT-DX1 is licensed during the Phase II trial stage.

Manufacturing

PAT-DX1 is in late-stage preclinical development. There are several steps to be confirmed before clinical trials can commence. These include toxicology studies, manufacturing processes and selection of the drug candidate.

Clinical Trials and Market Approval

The key purpose of a Phase I trial is to confirm the safety of the drug's use in the treatment of cancer in humans. Drug complications will be weighed against treatment benefits, with serious adverse effects potentially terminating the trial. Safety monitoring will be continued over the total trial period. Clinical trials are planned to commence in early CY21.

Efficacy is fundamental to the drug's success both for approval and commercialisation. Efficacy has been clearly demonstrated in preclinical studies, including animal models. However, the clinical trial program is the definitive testing platform to demonstrate that the preclinical results translate to a meaningful benefit for the patient. In the treatment of cancer, the common measurements are an increased survival rate and/or a longer time for the disease to progress. Phase II trials, which are designed to demonstrate efficacy, are scheduled to commence over late CY22.

Regulatory authorities oversee the major pharmaceutical markets. PAT-DX1 must meet their approval criteria to gain market entry.

MOA

PAT-DX1's mechanism of action has not been fully explained. In general, MOA is important to regulatory authorities and potential licensing partners in understanding the drug's effects. However, an explanation of a drug's MOA is not mandatory and many drugs are approved without a full understanding of how the treatment works.

Competitor drugs

High unmet need diseases such as TNBC and GBM generate keen research interest in possible treatments. The US clinicaltrials.gov website lists some 1,410 clinical trials related to GBM and 631 for TNBC. In March 2019, atezolizumab (TECENTRIQ, Genentech Inc.), an antibody drug, in combination with paclitaxel chemotherapy, was approved for locally advanced or metastatic triple-negative breast cancer (TNBC) in tumours expressing PD-L1. However, the entry of new drugs will not necessarily reduce PAT-DX1's market. The usual treatment regimen for cancer is a combination therapy approach. Therapies offering different mechanisms of action are combined to offer a multi-pronged approach to improve efficacy and help to manage the propensity for cancers cells to mutate. PAT-DX1 offers a unique MOA which works in tandem with other therapies in the treatment of cancer. Its use as part of a combination approach is likely to create interest. Its ability to cross the BBB would also offer a clear advantage over other antibody treatments and many small-molecule drugs.

Sales Revenues

Pricing in the valuation model has been derived from the current prices in the key markets. There is risk that these may change materially over the development period. Higher pricing in the US market in comparison to the EU and other developed markets, is under investigation by the US Congress. Industry feedback suggests that any action to the correct the imbalance is likely to see pricing average across international markets, with any US pricing reduction being offset with commensurate increases in the other markets. Pricing, market entry and penetration have been based on industry norms and current market data. These parameters may change.

Financials

Patrys is an emerging biotechnology company, loss making as it undertakes the clinical development program for its novel drug, PAT-DX1. Additional funding will be needed to support the program until PAT-DX1 receives market approval and the generation of sales revenues. The financial model assumes a capital raising in FY21 of AUD15m. The amount should provide sufficient funding to undertake the Phase II trial. The financial model assumes PAT-DX1 will be licensed during this period, with the partner assuming on-going development costs.

FINANCIAL SUMMARY	FY18a	FY19a	FY20e	FY21e	FY22e
30-Jun					
A$ 000's					
STATEMENT PROFIT LOSS					
R&D tax concession	455	644	733	870	3,915
Total Operating Revenue	488	3,732	733	870	3,915
R&D	-1,307	-1,686	-2,000	-9,000	-2,000
Total Costs	-3,018	-4,255	-3,500	-10,500	-3,500
Net interest received	33	112	0	0	0
Tax (30% Marginal Rate)	0	0	0	0	0
Operating profit (loss)	-2,497	-411	-2,767	-9,630	415
Earnings per share (Basic) cps	-0.27	-0.04	-0.26	-0.70	0.03
BALANCE SHEET					
Total non-current assets	624	580	542	500	458
Cash and cash equivalents	4,605	6,474	3,745	9,157	9,614
Total current assets	7,349	7,354	4,486	9,898	10,355
Total assets	7,973	7,934	5,028	10,398	10,813
Total current liabilities	661	621	479	479	479
Total non-current liabilities	21	16	16	16	16
Total liabilities	682	637	496	496	496
Net Assets	7,291	7,296	4,533	9,903	10,318
Equity					
Share capital	67,039	67,067	67,067	82,067	82,067
Accumulated loss	-60,336	-60,724	-63,491	-73,121	-72,706
Total Equity	7,291	7,296	4,533	9,903	10,318
CASHFLOW					
Net loss for the period	-2,497	-411	-2,767	-9,630	415
Net cash from operating activities	-2,087	-129	-2,725	-9,588	457
Net cash flows used in investing activities	-2,004	1,996	-4	0	0
Proceeds from issues of shares + options	7,015	2	0	15,000	0
Net cash flows from financing activities	6,816	2	0	15,000	0
Net (decrease)/increase in cash and equivalents	2,725	1,869	-2,729	5,412	457
Cash and equivalents at beginning of period	1,911	4,605	6,474	3,745	9,157
Cash and equivalents at end of period	4,605	6,474	3,745	9,157	9,614

Source Company Accounts and MST estimates

Board and Management

Directors

Mr. John Read, Chairman provides broad experience, having held both chair and director positions across the private, public and government sectors in a career spanning venture capital, and private equity firms. He is currently the Chairman of CVC Limited (ASX: CVC) and was previously the Chairman of Eildon Capital Limited (ASX: EDC).

Dr James Campbell, Managing Director and CEO has more than 25 years in the biotechnology sector in research and management roles. He was previously the CFO and COO of ChemGenex Pharmaceuticals Limited (ASX: CXS) during the FDA/EMA clinical trials that resulted in its acquisition by Cephalon for $230m in 2011. Dr. Campbell is a Non-Executive Director of Invion Limited (ASX: IVX) and Prescient Therapeutics Limited (ASX: PTX).

Mr. Michael Stork, **Non-Executive Director** provides his entrepreneurial experience in the technical sector. He is the Managing Director of Stork Holdings Ltd, an Investment Holding company active in the Canadian technology start-up sector. He has both Chair and Director appointments in private start-up companies and university incubator centres.

Ms. Suzy Jones, **Non-Executive Director** is the Founder and Managing Partner of DNA Ink LLC, a life sciences advisory firm in San Francisco. Prior to starting DNA Ink, Ms. Jones spent 20 years working for Genentech. She also serves as a Director of Calithera Biosciences, which focuses on the development of novel cancer small-molecule drugs.

Dr. Pamela M. Klein, Non-Executive Director offers over 20 years of experience as an oncology biotechnology executive. She joined Genentech after having worked at the U.S. National Cancer Institute for 7 years. Her roles included the development of HER (Herceptin, Tarceva, Perjeta), apoptosis (antibodies and small-molecules) and haematology compounds. Her clinical and commercial development expertise will be valued as Patrys enters its planned clinical trial program and potential licensing processes. Dr Klein has advisory and corporate board roles to a number of biotechnology and investment companies. She has served on the Patrys Scientific Advisory Board for 2 years and will continue in this role.

Management

Ms. Melanie Leydin, Company Secretary holds a Bachelor of Business, majoring in Accounting and Corporate Law. She is a Registered Company Auditor and Chartered Accountant and has extensive experience in public company responsibilities, including ASX and ASIC compliance. She is the principal of chartered accounting firm Leydin Freyer, which specialises in the resources, technology, bioscience and biotechnology sectors.

Dr. Deanne Greenwood, Vice President, Business Development and Intellectual Property is responsible for the commercialisation of the Deoxymab and IgM portfolios and the management of the intellectual property portfolio. She oversees processes for business development, contracts and grants.

Ms. Valentina Dubljevic, Vice President, Scientific and Clinical Development is responsible for the preclinical and clinical development of Patrys' product portfolio. Ms. Dubljevic provides more than 20 years of scientific and commercial experience in both small-molecule and antibody therapies for cancer and vaccines. Her roles have included involvement in drug development, management of pre-clinical studies, manufacturing, regulatory and clinical operations, contracts, and project management.

Scientific Advisory Board

Dr Pamela M. Klein offers over 20 years of experience as an oncology biotechnology executive. She joined Genentech after having worked at the U.S. National Cancer Institute for 7 years. Her roles included the development of HER (Herceptin, Tarceva, Perjeta), apoptosis (antibodies and small-molecules) and haematology compounds. Her clinical and commercial development expertise will be valued as Patrys enters its planned clinical trial program. Dr Klein has advisory and corporate board roles to a number of biotechnology and investment companies. She has also been appointed as a non-executive director to Patrys.

Dr Allen Ebens completed his PhD at UCLA and has worked at several biotechnology companies, including Genentech and Juno Therapeutics. He gained experience in developing therapeutics, 'from concept to clinic', across multiple therapeutic platforms including antibodies and small-molecule drugs. Dr. Ebens is currently the Chief Scientific Officer of Trucode Gene Repair.

Share Register

Shareholder Register		
Company Name	**Number held**	**% of total Shares issued**
Stork Holdings 2010 Ltd	98,773,814	9.23
Dr Dax Marcus Calder	85,000,000	7.95
National Nominees Limited	71,185,619	6.65
Kemast Investments Pty Ltd (Km Stokes S/F No 1 Ac)	29,411,765	2.75
Staffwear Pty Ltd (Dax Calder Super Fund A/C)	23,269,274	2.17
Mr Mladen Marusic	21,539,068	2.01
Oncomab Gmbh	20,250,000	1.89
Marginata Pty Ltd (Roy Bolton Super Fund A/C)	20,000,000	1.87
Yale University	16,116,324	1.51
Mr Xiaoke Xie	14,000,000	1.31
LGL Trustee Limited (The Konda Family A/C)	13,999,999	1.31
Dax Calder Pty Ltd	12,000,000	1.12
Estelleanne Pty Ltd	12,000,000	1.12
LGL Trustee Limited (MK Pension Plan - 473278 A/C)	10,823,529	1.01
Valui Pty Ltd (Fortis Super Fund)	10,500,010	0.98
Ms Lisa Sharon Alley	9,100,000	0.85
Mr Steven James Streicher	8,200,000	0.77
Phipp Family Fund Pty Ltd (Phipps Family Fund A/C)	7,500,000	0.70
Ms Karin Jones	7,454,546	0.70
Mr Paul Anthony Henry	7,000,000	0.65
Total	498,123,948	46.56

Patrys acquired the license for the novel anti-DNA antibody platform through a scrip acquisition, with the tranched transaction valued up to A$720,000. Under the terms, the vendors could own approximately 14.36% of Patrys' issued capital.

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