April 22, 2019

# APTORUM GROUP LTD.
## (NGS:APM)

Aptorum Group Ltd., a Hong Kong-based pharmaceutical company, develops and commercializes therapeutic and diagnostic technologies to treat unmet medical needs. The company also focuses on the development of surgical robotics and medical devices and operates outpatient clinics.

## COMPANY HIGHLIGHTS

* APM: Addressing Orphan Indications and Unmet Needs
* In our view, Aptorum has compiled an impressive pipeline of early-stage assets that we expect to drive significant value, both from internal development and external collaborations.
* In mid-2018, Aptorum launched a medical clinic in Hong Kong. Over time, we expect revenue from this business to help mitigate the company's R&D cash burn.
* In December 2018, Aptorum raised approximately $11 million from an initial public offering. The Company ended 2018 with $27.1 million in cash/restricted cash and marketable securities, which should be sufficient to advance at least one of its lead clinical programs to Phase I trials.
* Based on our sum-of-the-parts NPV valuation for the company's lead programs and IP and technology assets, we arrive at a fair value estimate of $24 per share, well above current levels.

## INVESTMENT THESIS

Aptorum Group Ltd., based in Hong Kong, is developing a range of therapeutic and diagnostic technologies to treat unmet medical needs. Its primary focus areas include infectious diseases, neurology, gastroenterology, and oncology. Aptorum is also developing product candidates in surgical robotics and medical devices. In mid-2018, the company launched an outpatient clinic in Hong Kong to treat chronic diseases resulting from modern sedentary lifestyles and an aging population.

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## PRICE CHART


## KEY STATISTICS

**Key Stock Statistics**

| | |
|---|---|
| Recent price (4/22/19) | $13.41 |
| 52 week high/low | $15.85-$11.80 |
| Shares oustanding (M) | 28 |
| Market cap (M) | $375.0 |
| Dividend | Nil |
| Yield | Nil |

**Sector Overview**

| | |
|---|---|
| Sector | Healthcare |
| Sector % of S&P 500 | 14.8% |

**Financials ($M)**

| | |
|---|---|
| Cash & Mkt Securities | 27.1 |
| Debt | 10.1 |
| Working Capital ($M) | 16.5 |
| Current Ratio | 2.4 |
| Total Debt/Equity (%) | 31.0% |
| Payout ratio | NM |
| Revenue (M) TTM | 0.4 |
| Net Income (M) TTM | NM |
| Net Margin | NM |

**Risk**

| | |
|---|---|
| Beta | -0.1 |
| Inst. ownership | 0% |

**Valuation**

| | |
|---|---|
| P/E forward EPS | NA |
| Price/Sales (TTM) | NA |
| Price/Book (TTM) | NA |

**Top Holders**

UBS Group AG

**Management**

| | |
|---|---|
| CEO | Mr. Ian Huen |
| CFO | Ms. Sabrina Khan |
| COO | Dr. Angel Siu-yan Ng |
| Company website | www.aptorumgroup.com |

COMPANY SPONSORED REPORT. SEE LAST PAGE FOR DISCLOSURES.

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Aptorum was incorporated in 2010. In early 2017, the company transitioned from a management-owned healthcare investment fund to a holding company with operating subsidiaries. It also began in-licensing assets to build a new drug pipeline with the potential to secure orphan-drug designations or satisfy significant unmet medical needs. Aptorum has ceased passive investment operations and intends to exit all legacy portfolio investments over time as it focuses on internal portfolio development.

Over the past two years, Aptorum has built a diverse portfolio of more than 10 preclinical programs. It initially plans to focus on three lead projects, for which it will allocate up to 80% of its resources. These programs include: ALS-4 for bacterial infections, including MRSA; ALS-1 for influenza A; and NLS-1 for endometriosis.

We expect Aptorum to submit an Investigational New Drug Application ("IND") with the U.S. FDA, or an equivalent filing in other jurisdictions such as China or the European Union, in 2020, and for its other lead programs in 2021. If developed successfully, we expect Aptorum to seek regulatory approval and commercialization of its products in the EU, China and Japan, among others. We also expect them to provide partnership opportunities for the development of longer-term pipeline candidates.

Amid an improving regulatory backdrop for antibacterial therapeutics, we see the potential for ALS-4 to advance rapidly through clinical development and to become Aptorum's lead program. ALS-4 is a small molecule aimed at treating bacterial infections caused by Staphylococcus aureus, including MRSA. MRSA is a difficult-to-treat, hospital-acquired pathogen, often referred to as a "super bug," that is a worldwide cause of morbidity and mortality. In the U.S. alone, MRSA is associated with more than 100,000 hospitalizations and approximately 19,000 deaths annually, according to the company. ALS-4 is the first product candidate to apply chemical genetics to tackle MRSA infection. The company's development team won the Innovation Academy Award at the 4th International Conference on Prevention & Infection Control (ICPIC 2017).

MRSA drugs represented a nearly $3 billion global market in 2016, and we expect continued demand for new treatments and market expansion given increased resistance to a wide range of antibiotics.

To address declines in antibacterial drug research and increases in serious antibacterial drug-resistant infections, the 21st Century Cures Act enacted by Congress in late 2016 established the Limited Population Pathway for Antibiotic and Antifungal Drugs (LPAD). The LPAD enhances the FDA's ability to approve antibacterial or antifungal drugs to help treat serious or life-threatening infections in patients with unmet needs.

Given that ALS-4 must only demonstrate "noninferiority" in a limited patient confirmation study, we think that it could secure approval for commercialization within five years of the start of the Phase 1 study, which is considerably shorter than typical drug development timelines. Over the past five years, major pharmaceutical companies including Pfizer, Merck and Roivant have made major acquisitions in the antibacterial space, underscoring the positive change in the regulatory climate.

ALS-1 aims to treat viral infections caused by Influenza virus A, which accounts for 50%-80% of influenza infections. Globally, influenza epidemics result in 3-5 million cases of severe influenza infections annually, and 290,000-650,000 deaths each year, according to the World Health Organization. ALS-1 acts on a different therapeutic target than many existing products and has outperformed Tamiflu® in the in vitro inhibition of virus replication. The global therapeutic and vaccines market for influenza drugs exceeds $1 billion and continues to grow, as many current treatments are becoming less effective due to increased resistance to the influenza virus.

NLS-1, a molecule derived from green tea, is designed to treat endometriosis, a disease in which tissue normally lining the uterus grows in other areas, including the ovaries and fallopian tubes. Globally, endometriosis affects an estimated 176 million women, often leading to infertility and complications during pregnancy. Endometriosis is usually treated with noninvasive hormonal therapy, but such regimens often cause adverse side effects, such as menopausal symptoms, infertility, bone density loss, higher risk of osteoporosis, etc., and are not permanent cures. Surgery can be effective, but success rates are inconsistent. NLS-1 profiles as noninvasive but with a superior safety profile to hormone-based therapy, and enhanced chemical and metabolic stability compared to previous programs studying EGCG, another naturally occurring molecule extracted from green tea. We estimate that endometriosis represents a $2 billion global market. We also expect further growth as newer and more effective treatment options bring additional patients into therapy.

Beyond these three lead programs, Aptorum plans to allocate roughly 20% of its resources to programs that include surgical robotics candidate SLS-1 and the buildout of its AML Clinic in Hong Kong. SLS-1 is a steerable cardiovascular robotic surgical catheter, which Aptorum plans to bring to market under the 510k clearance pathway, likely as a Class II device. Aptorum has yet to determine a commercialization timeline for SLS-1.

The company's AML Clinic began operations under the name Talem Medical in June 2018. As of April 2019, the clinic had hired one full-time and three part-time physicians, toward a minimum goal of six full-time physicians. Aptorum believes that the clinic could reach operational breakeven within 18 months of meeting its staffing goals and building its brand in the marketplace. Its initial focus will be on treating chronic diseases resulting from modern sedentary lifestyles and an aging population.

As of December 31, 2018, Aptorum had obtained 12 exclusive technology licenses in neurology, infectious diseases, gastroenterology, oncology, surgical robotics, and natural health. As of December 2018, it was the exclusive licensee of 12 U.S. patents and 6 pending U.S. nonprovisional applications, as well as corresponding international patents and patent applications. Aptorum has acquired substantial intellectual property during a short period of time, which we believe bodes well for the acquisition of additional assets going forward.

Given its limited operating resources, we expect Aptorum's strategy to include partnerships outside of its current operating plan. Earlier noncore projects included imaging agents in Alzheimer's disease, autophagy activators for treating neurodegenerative diseases; agents for treating

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## PEER COMPARISON

| Company | Ticker | Recent Price ($) | 52-Week High ($) | 52-Week Low ($) | Mkt. Cap ($MIL) | 1-yr Price Change (%) | 1-yr Rev Growth (%) | 1 YR EPS Growth (%) | P/E Ratio | Beta | Yield (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **APTORUM GROUP LTD** | **APM** | **13.41** | **15.85** | **11.80** | **375** | **-15** | **NA** | **NA** | **NA** | **NA** | **NA** |
| Hutchison China MediTech | HCM | 30.44 | 39.68 | 20.83 | 4005 | -8 | 3 | NA | NA | 1.08 | NA |
| Sinovac | SVA | 6.47 | 8.75 | 5.73 | 640 | -25 | 141 | NA | 13.0 | 0.16 | NA |
| Zai Lab | ZLAB | 29.46 | 33.86 | 14.29 | 1720 | 42 | NA | NA | NA | NA | NA |

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infection and enhancing bacterial infection regimens; and treatments for menopausal symptoms, retinal ischemia/reperfusion injury, and liver cancer. Aptorum has established a Scientific Assessment Committee, which has helped it to select its current projects and should continue to assist in business development decisions.

We also view positively the company's proximity and access to three FDA-accredited facilities in Hong Kong to conduct clinical trials. The company's relationships with these facilities, along with Hong Kong's status as a Special Administrative Region of China, should help to facilitate regulatory approval and market acceptance of new products in China, now the second-largest healthcare market in the world after the United States. In recent years, China has made commitments to speed up drug approvals, allowing the use of data gathered overseas, and its status as a global leader in pharmaceutical research and service delivery has vastly improved. As such, companies are increasingly seeking effective ways to enter this key market.

## RECENT DEVELOPMENTS

Aptorum shares began trading on December 18, 2018 following an initial public offering that yielded net proceeds of approximately $11 million. The stock has underperformed the market since the IPO, declining 15% versus a 14% gain for the S&P 500. Aptorum stock is thinly traded, with average daily volume of 3,700 shares over the past three months, and we expect the shares to be volatile.

In April 2019, Aptorum reported a $0.53 loss per share for 2018. For the 10 months ended December 2017, following a corporate restructuring, Aptorum reported a net loss of $0.09 per share. Former period results were impacted by higher operating expenses, particularly in general and administrative costs, and higher interest expense, while latter period results benefited from the sale of marketable securities related to prior portfolio investments.

In April 2019, Aptorum appointed Dr. Thomas Wai-yip Lee as head of research and development and Dr. Angel Siu-yan Ng as chief operating officer. Dr. Lee had served as CEO and chief scientific officer of subsidiary Aptorum Therapeutics Ltd., and previously spent more than decade at global pharmaceutical companies in the U.S. Dr. Ng was previously the chief operating officer of Aptorum Therapeutics Ltd.

In May 2018, Aptorum completed a private Series A convertible note financing, which raised approximately $1.6 million.

In April 2018, Aptorum issued a $15 million convertible bond, receiving net proceeds of $14.7 million after structuring fees. Of this amount, $1.5 million was converted into Class A ordinary shares upon IPO in December 2018.

## EARNINGS & GROWTH ANALYSIS

We forecast revenues of $800,000 and $1.6 million in 2019 and 2020, respectively, as Aptorum ramps up activity at its AML clinic in Hong Kong. We expect clinic revenues to be the sole source of revenue for the foreseeable future. At the same time, we believe that Aptorum has the ability to expand its clinic model to additional locations given the continued increase in chronic disease due to sedentary lifestyles and population aging.

In our view, 2019 and 2020 are likely to be to be marked by significant R&D investment and, to a lesser extent, AML clinic operating expenses. Assuming full operational capacity, Aptorum expects maximum clinic operating costs of $90,000 per month, or up to $1.1 million on an annualized basis. It expects to achieve operating profitability within 18 months of reaching full operating capacity.

In all, we anticipate operating expenses of approximately $10.5 million in 2019 and $12 million in 2020. We forecast net losses of $0.39 per share in 2019 and $0.41 per share in 2020.

As noted above, Aptorum raised net proceeds of approximately $11 million from an IPO in December 2018. At December 31, 2018, the company had $26.1 million in cash/restricted cash and $1 million in marketable securities, which should be sufficient to advance at least one of its lead clinical programs into Phase I trials, and to reach value-creating inflection points over the next 2-3 years.

## FINANCIAL STRENGTH & DIVIDEND

Our financial strength rating for Aptorum is Medium. Aptorum ended 2018 with $27.1 million in cash/restricted cash and marketable securities. With an estimated cash burn of approximately $10 million in 2019 and $12 million in 2020, we view Aptorum as sufficiently funded for the near term. Aptorum has estimated a cost of $5-$8 million to develop each of its lead projects from their current stage to the completion of Phase 1.

However, as the company's lead products advance and enter human testing in the next year or so, we expect the cash burn rate to accelerate and believe that Aptorum will require additional capital to fund later-stage development. We expect Aptorum to pursue partnerships for certain earlier-stage, nonlead programs, as this will provide some nondilutive capital and moderate its cash burn. We note that Asia-based drug development companies such as Hutchison China MediTech (Nasdaq: HCM), Sinovac (Nasdaq: SVA), and Zai Lab (Nasdaq: ZLAB) have all demonstrated an ability to partner with larger, more established companies.

In 2018, Aptorum's cash flow was driven by financing activities, as highlighted earlier. During 2018, net cash provided by financing activities totaled $25.5 million, more than offsetting $6 million cash outflows from investing activities and $10 million cash outflows from operations. In 2017, cash flow came primarily from the sale of investment securities.

With total liabilities of $12.3 million and most potential milestone payments under current licensing agreements not due until or after the first commercial sales of new drugs, we view Aptorum as having ample resources to invest in its drug pipeline over the next few years.

Aptorum does not pay a dividend, and we do not expect one to be initiated in the near term, as the new public company focuses on expanding its preclinical pipeline, building out corporate infrastructure, and establishing its AML clinic in Hong Kong.

## MANAGEMENT & RISKS

Mr. Ian Huen is the founder, CEO and executive director of Aptorum Group. Mr. Huen has more than 15 years of global asset management experience and previously covered the U.S. healthcare sector as an equity research analyst at Janus Henderson Group plc.

Aptorum's board has seven members, including four independent directors. We view this majority of independent directors favorably and note that Aptorum has assigned only independent directors to the key audit, compensation and nominating/corporate governance committees.

Risks include Aptorum's status as a "controlled company," as CEO Huen and his affiliates have a majority of the voting power. Class B ordinary shares carry a 10-to-1 voting power ratio over Class A shares, and Class B holders, including Aptorum's executive officers and affiliates, hold about 97% of the company's voting power.

Other risks include standard risks in drug development, such as establishing efficacy and safety and maintaining a competitive market position for its lead products. We also note that Aptorum's valuation and enterprise value are relatively high considering the pre-clinical state of its pipeline, following its December 2018 IPO. As such, the company will need to advance its lead programs and effectively manage its operating capital in order to maintain its current momentum.

## COMPANY DESCRIPTION

Aptorum Group Ltd., a Hong Kong-based pharmaceutical company, develops and commercializes therapeutic and diagnostic technologies to

treat unmet medical needs. Its primary clinical focus areas are neurology, infectious diseases, gastroenterology, and oncology. The company also focuses on the development of surgical robotics and medical devices and operates outpatient clinics. Aptorum was incorporated in 2010 and went public in December 2018.

## VALUATION

In our view, Aptorum's recent market capitalization near $400 million underscores investors' positive view of the company's early-stage programs. We think that Aptorum's focus on programs that address unmet medical needs and that are likely to secure orphan-drug status supports a premium valuation given prospects for a) smaller clinical trials required for orphan indications, and b) favorable regulatory pathways for areas of significant need.

Applying a sum-of-the-parts NPV valuation for its three lead programs and IP and technology assets, we arrive at a fair value of $24 per share. We believe that Aptorum offers a compelling long-term growth opportunity. Our valuation model assumes peak annual revenues of $1 billion for ALS-4 for bacterial infections including MSRA ($13 per share), $750 million for ALS-1 for Influenza ($5), $1 billion for NLS-1 for Endometriosis ($3), with the balance ($3) ascribed to the company's IP and technology assets. Our model applies a 7x multiple to peak sales, assumes 11-13 years to reach peak sales, and is discounted at 30-40% annually.

## INCOME STATEMENT

| Growth Analysis ($MIL) | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019E | 2020E |
|---|---|---|---|---|---|---|---|---|
| Revenue | NA | NA | NA | NA | NA | 0.4 | 0.8 | 1.6 |
| Gross Profit | NA | NA | NA | NA | NA | 0.1 | 0.1 | 0.3 |
| G&A | NA | NA | NA | NA | 1.5 | 4.9 | 5.0 | 5.5 |
| R&D | NA | NA | NA | NA | 2.6 | 3.1 | 3.4 | 4.4 |
| Operating Income | NA | NA | NA | NA | -5.7 | -10.3 | -10.4 | -11.7 |
| Interest Expense | NA | NA | NA | NA | 0.0 | -4.5 | -0.9 | -0.9 |
| Pretax Income | NA | NA | NA | NA | NA | NA | NA | NA |
| Tax Rate (%) | NA | NA | NA | NA | NA | NA | NA | NA |
| Net income | NA | NA | NA | NA | -2.6 | -15.1 | -11.4 | -12.4 |
| Diluted Shares | NA | NA | NA | NA | 26.9 | 27.9 | 29.0 | 30.0 |
| EPS | NA | NA | NA | NA | -0.1 | -0.53 | -0.39 | -0.41 |
| Dividend | NA | NA | NA | NA | NA | NA | NA | NA |
| **Growth Rates (%)** | | | | | | | | |
| Revenue | NA | NA | NA | NA | NA | NA | 100.0 | 100.0 |
| Operating Income | NA | NA | NA | NA | NA | NA | NA | NA |
| Net Income | NA | NA | NA | NA | NA | NA | NA | NA |
| EPS | NA | NA | NA | NA | NA | NA | NA | NA |
| **Valuation Analysis** | | | | | | | | |
| Price ($): High | NA | NA | NA | NA | NA | NA | | |
| Price ($):Low | NA | NA | NA | NA | NA | NA | | |
| PE: High | NA | NA | NA | NA | NA | NA | | |
| PE: Low | NA | NA | NA | NA | NA | NA | | |
| PS: High | NA | NA | NA | NA | NA | NA | | |
| PS: Low | NA | NA | NA | NA | NA | NA | | |
| Yield: High | NA | NA | NA | NA | NA | NA | | |
| Yield: Low | NA | NA | NA | NA | NA | NA | | |
| **Financial & Risk Analysis ($MIL)** | | | | | | | | |
| Cash | NA | NA | NA | NA | 16.7 | 26.1 | | |
| Working Capital | NA | NA | NA | NA | 19.0 | 16.5 | | |
| Current Ratio | NA | NA | NA | NA | 15.3 | 2.4 | | |
| LTDebt/Equity (%) | NA | NA | NA | NA | NA | 31.0 | | |
| Total Debt/Equity (%) | NA | NA | NA | NA | NA | 31.0 | | |
| **Ratio Analysis** | | | | | | | | |
| Gross Profit Margin | NA | NA | NA | NA | NA | NA | | |
| Operating Margin | NA | NA | NA | NA | NA | NA | | |
| Net Margin | NA | NA | NA | NA | NA | NA | | |
| Return on Assets (%) | NA | NA | NA | NA | NA | NA | | |
| Return on Equity (%) | NA | NA | NA | NA | NA | NA | | |
| Op Inc/Int Exp | NA | NA | NA | NA | NA | NA | | |
| Div Payout | NA | NA | NA | NA | NA | NA | | |

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