13 October 2014
Americas/United States
Equity Research
Biotechnology

Celladon (CLDN)

Rating	**OUTPERFORM* [V]**
Price (10 Oct 14, US$)	9.47
Target price (US$)	20.00[1]
52-week price range	16.32 - 7.50
Market cap. (US$ m)	219.08
Enterprise value (US$ m)	152.82

**Stock ratings are relative to the coverage universe in each analyst's or each team's respective sector.*
[1]Target price is for 12 months.
[V] = Stock considered volatile (see Disclosure Appendix).

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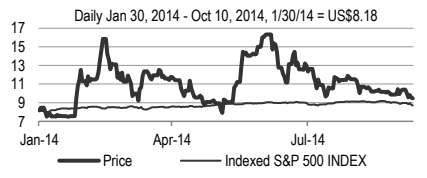
INITIATION

A High Risk, Higher Reward Heart Failure Play

- **Initiating coverage with an Outperform rating and $20 TP.** The key asset is PII Mydicar, a gene therapy (high risk) targeting SERCA2a (novel = high risk) in systolic heart failure (high risk); higher reward = unmet need, >$1.5B sales potential and $240M market cap; key PIIb catalyst due April 2015. We estimate bear case/failure = $3/share; Base/clear signal warranting PIII = upside to >$20/share; Bull/filing on PIIb = >$50/share. We highlight ballpark 4-6x peak sales multiple for late-stage product plays in M&A, thus implying the Street's <5% assumption of ultimate success for Mydicar.
- **Mydicar replaces SERCA2a, which has been implicated as a key cause of heart failure.** SERCA2a regulates flow of calcium, which are critical in the pumping action of the heart. CUPID 1 PIIa data showed that Mydicar has promising efficacy in systolic heart failure. In CUPID 1, Mydicar reduced time to recurrent (non-terminal) events by 82% in the first year and stabilized or improved various clinical parameters. The CUPID 2 PIIb study could serve as a registrational trial with FDA and EMA pending results. Our modeling assumes a PIII program is needed and Mydicar is launched in 2019/2020.
- **High risk, higher reward.** Our blue-sky scenario assumes that CLDN stock could reach ~$105/share if FDA and EMA approve Mydicar by 2018. The downside is if Mydicar shows no benefit in systolic heart failure; the stock could trade to ~$3/share. We note various "in-between" scenarios in which CUPID 2 does not hit statistical significance, but reinforces promising efficacy from CUPID 1, placing CLDN above where it is currently trading.
- **Valuation.** Our DCF-derived TP of $20 assumes: (1) 25% risk weighting of Mydicar being approved as a treatment for systolic heart failure in the US and EU; (2) Mydicar peak sales of ~$1.5B in 2025; (3) Protection from biosimilar competition until 2031/2029 in US/EU; (4) 10% discount rate. Our DCF does not include Mydicar's other indications and CLDN's pipeline.

Share price performance



On 10/10/14 the S&P 500 INDEX closed at 1906.13

Quarterly EPS	Q1	Q2	Q3	Q4
2013A	—	—	—	—
2014E	-0.60	-0.38	-0.36	-0.35
2015E	—	—	—	—

Financial and valuation metrics

Year	12/13A	12/14E	12/15E	12/16E
EPS (CS adj.) (US$)	-27.09	-1.60	-1.35	-1.69
Prev. EPS (US$)	—	—	—	—
P/E (x)	-0.3	-5.9	-7.0	-5.6
P/E rel. (%)	-1.9	-34.6	-46.0	-41.0
Revenue (US$ m)	—	—	—	—
EBITDA (US$ m)	-19.9	-29.6	-33.7	-48.5
OCFPS (US$)	-18.32	-1.48	-1.16	-1.45
P/OCF (x)	—	-6.4	-8.1	-6.5
EV/EBITDA (current)	-10.6	-5.2	-3.2	-1.5
Net debt (US$ m)	-8	-66	-112	-144
ROIC (%)	-300.03	-269.02	-304.57	-433.22

Number of shares (m)	23.13	IC (current, US$ m)	6.65
BV/share (Next Qtr., US$)	—	EV/IC (x)	—
Net debt (Next Qtr., US$ m)	—	Dividend (current, US$)	—
Net debt/tot eq (Next Qtr., %)	—	Dividend yield (%)	—

Source: Company data, Credit Suisse estimates.

Celladon CLDN

Price (10 Oct 14): **US$9.47**, Rating**: OUTPERFORM [V]**, Target Price: **US$20.00**

Income statement (US$ m)	12/13A	12/14E	12/15E	12/16E
Revenue (US$ m)	—	—	—	—
EBITDA	**(20)**	**(30)**	**(34)**	**(48)**
Depr. & amort.	(0)	(0)	(0)	(0)
EBIT (US$)	**(20)**	**(30)**	**(34)**	**(49)**
Net interest exp.	0.01	(0.01)	0.09	0.13
Associates	—	—	—	—
Other adj,	(0.14)	(0.20)	(0.16)	(0.16)
PBT (US$)	**(20)**	**(30)**	**(34)**	**(49)**
Income taxes	—	—	—	—
Profit after tax	**(20)**	**(30)**	**(34)**	**(49)**
Minorities	0	—	—	—
Preferred dividends	—	—	—	—
Associates & other	(4)	—	—	—
Net profit (US$)	**(24)**	**(30)**	**(34)**	**(49)**
Other NPAT adjustments	—	—	—	—
Reported net income	**(24)**	**(30)**	**(34)**	**(49)**

Cash flow (US$)	12/13A	12/14E	12/15E	12/16E
EBIT	(20)	(30)	(34)	(49)
Net interest	0.01	(0.01)	0.09	0.13
Cash taxes paid	—	—	—	—
Change in working capital	2	(1)	0	2
Other cash & non-cash items	2	3	4	5
Cash flow from operations	(16)	(28)	(29)	(42)
CAPEX	(0.09)	(0.10)	(0.10)	(0.10)
Free cash flow to the firm	**(16)**	**(28)**	**(29)**	**(42)**
Acquisitions	—	—	—	—
Divestments	—	—	—	—
Other investment/(outflows)	11	(1)	(0)	(2)
Cash flow from investments	**11**	**(1)**	**(1)**	**(2)**
Net share issue/(repurchase)	—	88	75	75
Dividends paid	—	—	—	—
Issuance (retirement) of debt	1	(1)	—	—
Other	12	0	0	1
Cash flow from financing	**13**	**87**	**75**	**76**
Effect of exchange rates	—	—	—	—
Changes in Net Cash/Debt	**8**	**58**	**46**	**32**
Net debt at start	—	(8)	(66)	(112)
Change in net debt	**(8)**	**(58)**	**(46)**	**(32)**
Net debt at end	(8)	(66)	(112)	(144)

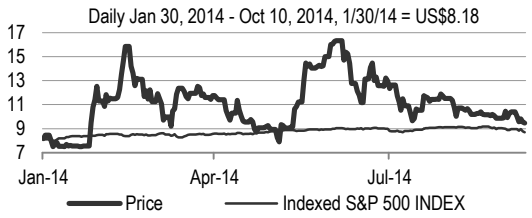
Balance sheet (US$ m)	12/13A	12/14E	12/15E	12/16E
Assets				
Cash and cash equivalents	8	66	112	144
Accounts receivable	—	—	—	—
Inventory	—	—	—	—
Other current assets	11	11	11	11
Total current assets	**19**	**77**	**123**	**155**
Total fixed assets	0.31	0.34	0.37	0.40
Intangible assets and goodwill	—	—	—	—
Investment securities	—	—	—	—
Other assets	2	3	4	6
Total assets	**21**	**81**	**127**	**161**
Liabilities				
Accounts payable	4	3	4	6
Short-term debt	—	—	—	—
Other short term liabilities	2	—	—	—
Total current liabilities	**7**	**3**	**4**	**6**
Long-term debt	—	—	—	—
Other liabilities	0	0	0	0
Total liabilities	**7**	**3**	**4**	**6**
Shareholders' equity	15	77	123	155
Minority interest	—	—	—	—
Total equity & liabilities	**21**	**81**	**127**	**161**
Net debt (US$ m)	(8)	(66)	(112)	(144)

Per share data	12/13A	12/14E	12/15E	12/16E
No. of shares (wtd avg)	1	19	25	29
CS adj. EPS (US$)	**(27.09)**	**(1.60)**	**(1.35)**	**(1.69)**
Prev. EPS (US$)	—	—	—	—
Dividend (US$)	—	—	—	—
Dividend payout ratio	—	—	—	—
Free cash flow per share	(18.42)	(1.49)	(1.17)	(1.46)

Key ratios and valuation	12/13A	12/14E	12/15E	12/16E
Growth(%)				
Sales	—	—	—	—
EBIT	—	48.5	13.8	43.9
Net profit	—	24.6	13.3	43.7
EPS	—	94.1	15.6	(24.8)
Margins (%)				
EBITDA margin	—	—	—	—
EBIT margin	—	—	—	—
Pretax margin	—	—	—	—
Net margin	—	—	—	—
Valuation metrics (x)				
EV/sales	—	—	—	—
EV/EBITDA	(10.6)	(5.2)	(3.2)	(1.5)
EV/EBIT	(10.6)	(5.2)	(3.2)	(1.5)
P/E	(0.3)	(5.9)	(7.0)	(5.6)
P/B	0.6	2.3	1.9	1.8
Asset turnover	—	—	—	—
ROE analysis (%)				
ROE stated-return on	—	(65.0)	(33.8)	(34.9)
ROIC	(300.0)	(269.0)	(304.6)	(433.2)
Interest burden	1.0	1.0	1.0	1.0
Tax rate	—	—	—	—
Financial leverage	—	—	—	—
Credit ratios (%)				
Net debt/equity	(54.3)	(85.7)	(91.0)	(92.8)
Net debt/EBITDA	0.4	2.2	3.3	3.0
Interest coverage ratio	1,996.4	(2,964.2)	378.7	379.3

Quarterly data	12/13A	12/14E	12/15E	12/16E
EPS for Q1	—	(0.60)	—	—
EPS for Q2	—	(0.38)	—	—
EPS for Q3	—	(0.36)	—	—
EPS for Q4	—	(0.35)	—	—

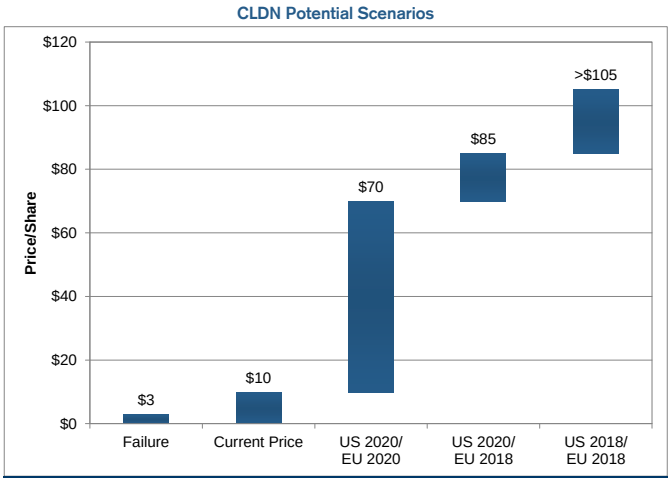
Source: Company data, Credit Suisse estimates.



On 10/10/14 the S&P 500 INDEX closed at 1925.78

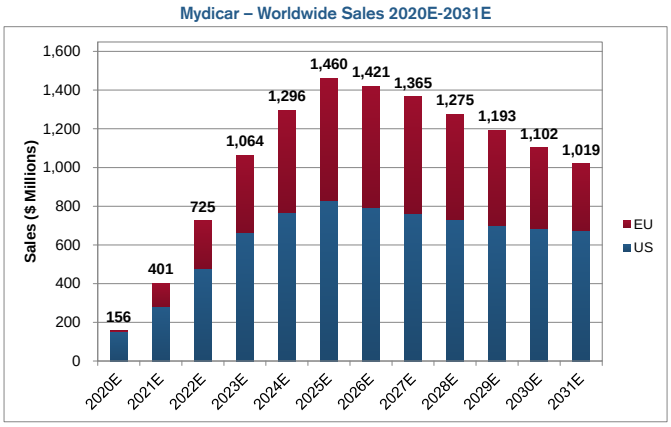
CLDN Key Charts

Exhibit 1: CLDN Potential Scenarios



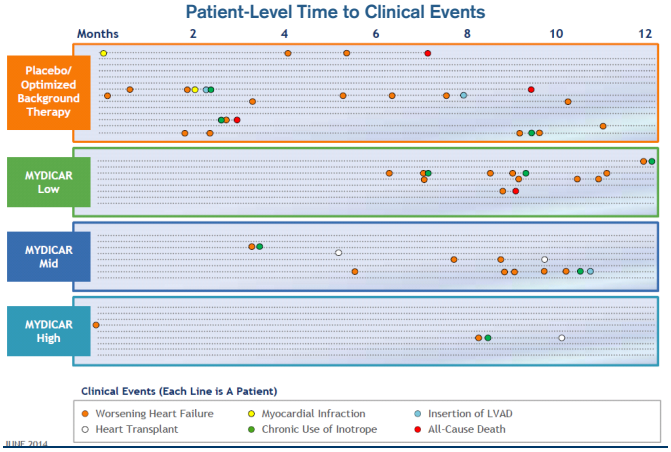
Source: Credit Suisse estimates

Exhibit 2: Mydicar – Worldwide Sales 2020E-2031E



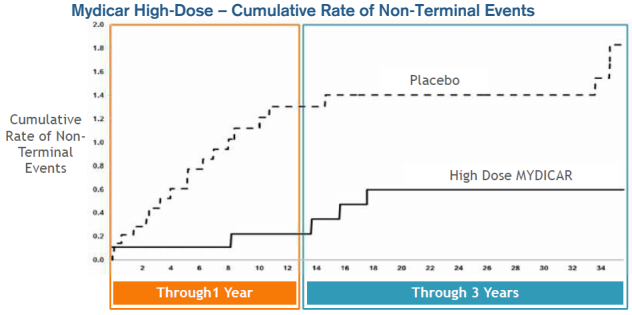
Source: Credit Suisse estimates

Exhibit 3: Patient-Level Time to Clinical Events



Source: Celladon

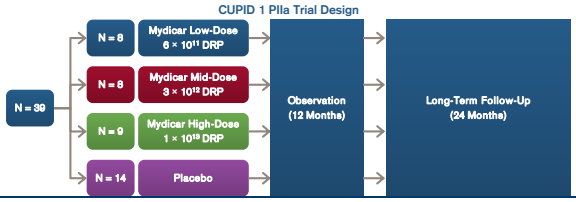
Exhibit 4: Cumulative Rate of Non-Terminal Events



	Through1 Year	Through 3 Years
Hazard Ratio (CI)	0.12 (0.03, 0.49)	0.18 (0.03, 0.99)
Risk Reduction	88%	82%
P-Value	p = 0.003	p = 0.048

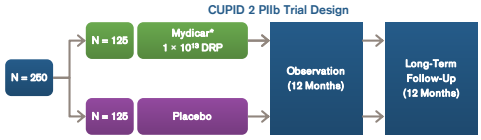
Source: Celladon

Exhibit 5: CUPID 1 PIIa Trial Design



Source: Celladon, Credit Suisse research

Exhibit 6: CUPID 2 PIIb Trial Design



Source: Celladon, Credit Suisse research

Investment Summary

We are initiating coverage of Celladon Corporation with an Outperform rating and $20 target price. Founded in 2004, Celladon is a biopharmaceutical company based in San Diego, California. Celladon specializes in the research and development of agents targeting sarco/endoplasmic reticulum Ca^{2+}-ATPase (SERCA) enzymes. Celladon's lead pipeline asset is Mydicar, a genetic enzyme replacement therapy for correcting SERCA2a enzyme deficiency, that is being developed as a potential treatment of systolic heart failure. Mydicar received Breakthrough Therapy Designation from the FDA in April 2014. Celladon is currently evaluating Mydicar in systolic heart failure in the CUPID 2 PIIb trial. This trial was fully enrolled as of February 2014. Topline CUPID PIIb data is expected in April 2015.

Mydicar replaces SERCA2a enzyme via gene transfer. Mydicar utilizes a recombinant adeno-associated viral vector 1 (AAV1) serotype to deliver the gene for SERCA2a enzyme. Deficiency of SERCA2a enzyme has been implicated as a central cause of heart failure. Patients with advanced heart failure have unusually low levels of SERCA2a enzyme. SERCA2a enzyme controls the pumping action of the heart by regulating calcium ion levels. During a contraction of the heart, calcium ions are released from the sarcoplasmic reticulum, activating myofilaments resulting in muscle contraction. During a relaxation of the heart, SERCA2a enzyme via the protein phospholamban brings the majority of the calcium ions back into the sarcoplasmic reticulum. Dysregulation of calcium ion levels affects systolic (i.e. contractile) as well as diastolic (i.e. relaxative) function.

There is a significant need for more efficacious therapies to treat heart failure. The current first-line treatment involves a combination of angiotensin-converting-enzyme (ACE) inhibitors and β-Blockers. Other drugs including aldosterone antagonists, diuretics, and digoxin are used as well. As the disease progresses to the end stage, medical devices including implantable cardioverter-debrillators (ICDs) and left ventricular assist devices (LVADs) are used. Inevitably, a heart transplant will ultimately be required. Mortality is still high: (1) ~50% of patients diagnosed with heart failure will die within 5 years. (2) ~50% of Medicare patients with heart failure die within 3 years following a hospitalization due to this disease. It is estimated that the prevalence of heart failure is ~5.2M in the US and ~12.4M in the EU. The number of patients diagnosed with heart failure is expected to increase, driven by an aging population and rising obesity rates. The direct costs to the healthcare system is also substantial. It is projected that the total medical costs for heart failure in the US is expected to increase 2.5-fold from ~$21B in 2012 to ~$53B in 2030. The majority (~80%) of these costs are attributed to hospitalizations.

Mydicar will be used on top of current pharmacological standard-of-care in heart failure. Mydicar is expected to complement drugs that are currently used to treat systolic heart failure. Mydicar involves a one-time outpatient cardiac catherization, in which a catheter is put into a blood vessel in the arm, upper thigh, or neck and threaded to the heart. The SERCA2a gene is then infused into the coronary arteries and makes contact with cardiac muscle cells. A non-pathologic adeno-associated virus (AAV) delivers the SERCA2a gene to the cell nucleus.

Mydicar has shown promising efficacy in treating systolic heart failure in CUPID 1. CUPID 1 was a 39-patient PIIa trial evaluating 3 doses of Mydicar (6×10^{11} , 3×10^{12}, and 1×10^{13} DNase Resistant Particles (DRP)) and placebo in patients with NYHA Class III/IV systolic heart failure. Mydicar High-Dose (1×10^{13} DRP) showed a reduction in frequency as well as delay in the onset of recurrent clinical events relative to placebo. Specifically, Mydicar High-Dose showed a statistically significant reduction in recurrent (non-terminal) cardiovascular events relative to placebo through 1 year (88% risk reduction, HR=0.12, p=0.003). These differences were sustained through 3 years (82% risk reduction, HR=0.18, p=0.048). There appears to be a slight trend in survival improvement that favors Mydicar High-Dose. Mydicar High-Dose also stabilized or improved various clinical parameters relative to placebo. There were some imbalances in baseline patient characteristics across

the treatment arms in CUPID 1. In particular, there was a higher percentage of healthier patients in Mydicar arms relative to placebo arms. Post-hoc sensitivity analyses though suggested that the differences in baseline patient characteristics could not completely explain the clinical outcomes observed in CUPID 1.

The key valuation inflection point is the readout of CUPID 2. CUPID 2 is a 250-patient PIIB trial evaluating Mydicar High-Dose (1×10^{13} DRP) in patients with NYHA Class II/III/IV systolic heart failure. The primary endpoint is time to recurrent hospitalization in the presence a terminal event (all-cause death, heart transplant, LVAD implant). This trial has 83% power to detect at least a 45% reduction in risk (HR=0.55) with a p-value of 0.05. The trial was fully enrolled as of February 2014. Topline CUPID 2 PIIb data is expected in April 2015.

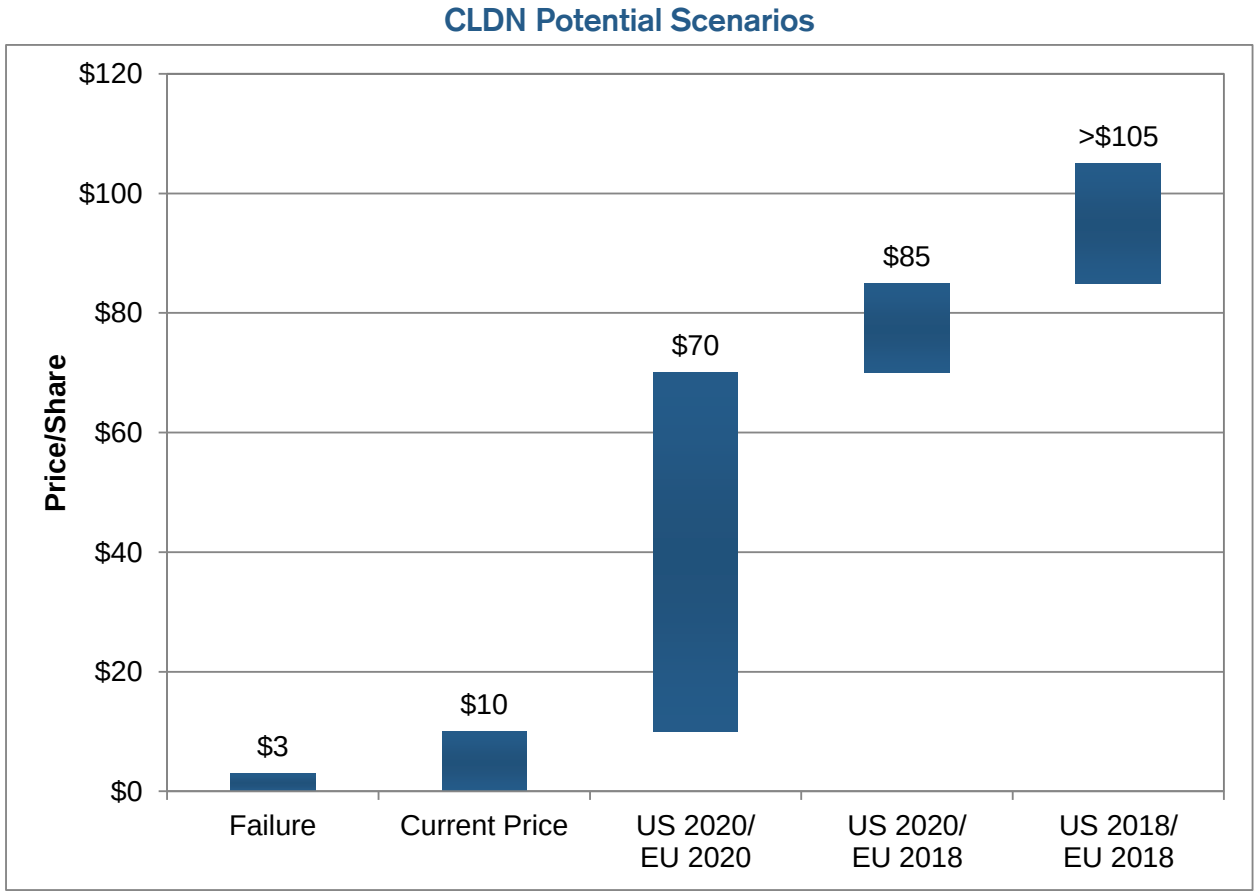
There are few other genetic therapies in clinical development for heart failure. Other clinical-stage genetic therapies include: (1) JVS100 (Juventas) uses a non-viral plasmid encoding stromal cell-derived factor. JVS100 is being evaluated in a PII trial. (2) Ad.HAC6 (Renova) uses an adenovirus serotype 5 encoding human adenyl cyclas type 6. Ad.HAC6 is being examined in a PI/II trial. Preclinical-stage genetic therapies include BB-R12 (Beat Biotherapeutics), Carfostin (NanoCor), and VN-100 (VentiNova).

Mydicar is projected to reach worldwide peak sales of ~$1.5B by 2025. Our sales estimates for Mydicar are based on the following assumptions: (1) Mydicar is approved as a treatment for systolic heart failure in the US and EU. (2) The addressable population in the US and EU is ~350K. (3) Mydicar achieves a penetration of 35% in the US and 25% penetration in the EU after 8 years from initial launch. (4) Celladon sells Mydicar directly in the US and EU. (5) The net price per (one-time) infusion for Mydicar is ~$36K in the US and ~$23K in the EU. (6) The timing of peak sales for Mydicar though will depend on the outcome of CUPID 2 as well as the FDA's and EMA's acceptance of CUPID 2 as a registrational trial. Our modeling assumes that a PIII program will be required and Mydicar will be launched in late 2019 / early 2020. If CUPID 2 hits the primary endpoint and is accepted as a registrational trial by FDA and EMA, then Mydicar could be launched in 2018. Otherwise, assuming the requirement of a PIII trial, Mydicar could reach the market in late 2019 / early 2020. (7) Mydicar is protected from biosimilar competition until 2030.

The rest of the pipeline could drive further upside. Celladon is currently exploring additional indications for Mydicar that are currently not included in our valuation. Celladon is currently enrolling a PI/II trial examining Mydicar in patients with advanced heart failure with LVAD. Celladon plans to start a PIIa trial evaluating Mydicar in arteriovenous fistula maturation failure soon as well. Topline data from this study is expected in 2015. Celladon is also evaluating the potential of Mydicar in diastolic heart failure in preclinical studies. In addition to Mydicar, Celladon has 2 preclinical-stage compounds – SERCA2b small molecule and Stem Cell Factor.

Exhibit 7: **CLDN Scenario Overview**

CLDN Scenario Overview



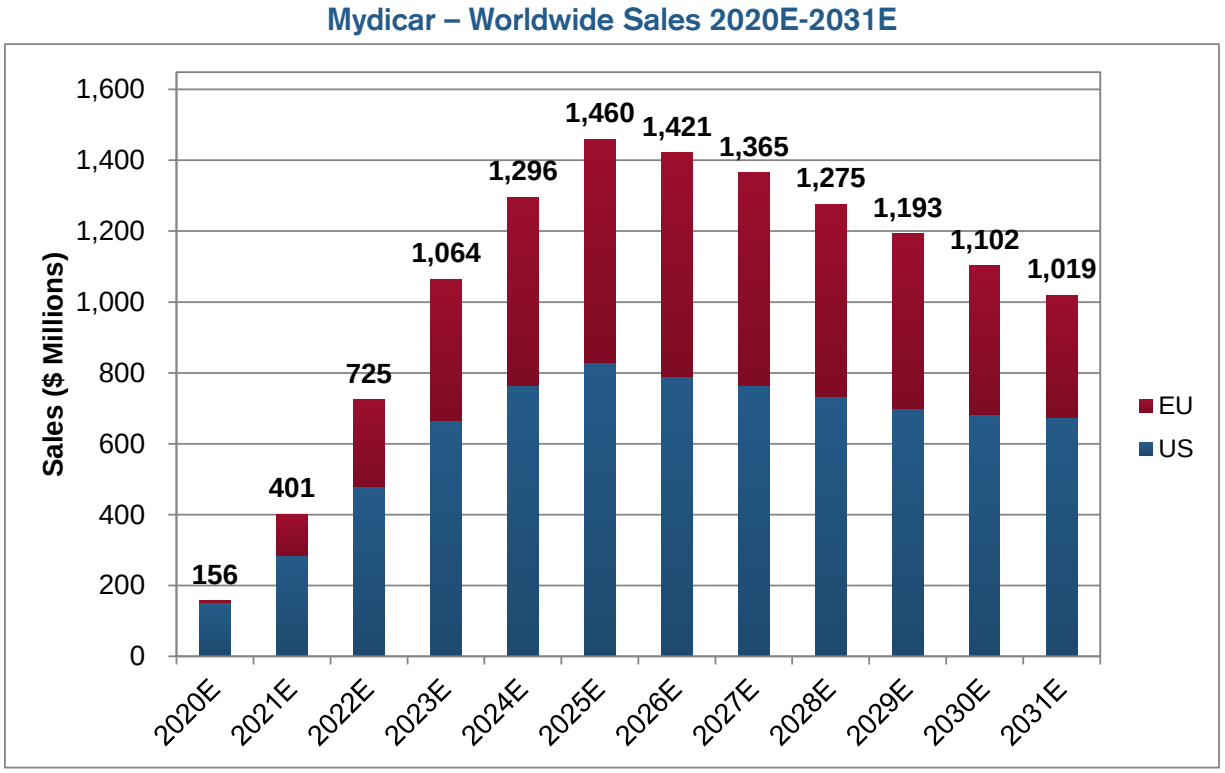
CLDN Scenarios

- **Failure:** CUPID 2 shows that Mydicar has no clinical benefit in systolic heart failure. CLDN stops clinical development of Mydicar.
- **US 2020 / EU 2020:** CUPID 2 shows that Mydicar has clinical benefit in systolic heart failure. FDA and EMA require a PIII program. Mydicar is approved in the US and EU in 2020.
- **US 2020 / EU 2018:** CUPID 2 hits the primary endpoint. FDA requires that CLDN run a PIII trial whereas EMA accepts CUPID 2 as a registrational trial. Mydicar is approved in the US in 2020 and EU in 2018.
- **US 2018 / EU 2018:** CUPID 2 hits the primary endpoint. FDA and EMA accept CUPID 2 as a registrational trial. Mydicar is approved in the US and EU in 2018.

Source: Credit Suisse estimates

Exhibit 8: **Our base case assumes that Mydicar launches in 2020 and reaches worldwide peak sales of $1.5B; however, there is potential for Mydicar to launch as early as 2018 pending on the outcome of CUPID 2**

Our base case assumes that Mydicar launches in 2020 and reaches worldwide peak sales of $1.5B; however, there is potential for Mydicar to launch as early as 2018 pending on the outcome of CUPID 2



- CLDN is required to run a PIII program in order to gain approval from the FDA and EMA.
- Mydicar receives approval in systolic heart failure in 2020 from the FDA and EMA after a positive PIII data.
- Mydicar is used mainly in the hardest to treat patients (New York Heart Association [NYHA] Class IIIB/IV systolic heart failure).
- Mydicar reaches worldwide peak sales of ~$1.5B in 2025.
- Mydicar is protected from biosimilar competition until 2031 in the US and 2029 in the EU.
- Competition to Mydicar first enters the systolic heart failure market beginning in 2022.

There is a possibility that Mydicar receives from FDA and/or EMA in 2018 depending on the totality of the data set from CUPID 2, of which topline data is expected in April 2015

Source: Credit Suisse estimates

Exhibit 9: **Our risk-weighted, DCF-derived target price for CLDN is $20**

Our risk-weighted, DCF-derived target price for CLDN is $20

Discounted Cash Flow Valuation

(Dollars '000s except per-share data)

Discounted Cash Flow Valuation	2015E	2016E	2017E	2018E	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Adjusted Free Cash Flows	(28,774)	(29,196)	(41,979)	(57,519)	(53,896)	(63,392)	48,106	213,428	355,621	518,368	669,592	779,932	769,608	727,042	668,511	609,162
PV of Free Cash Flows	**(28,231)**	**(26,040)**	**(34,039)**	**(42,399)**	**(36,117)**	**(38,618)**	**26,642**	**107,455**	**162,767**	**215,688**	**253,282**	**268,200**	**240,591**	**206,622**	**172,716**	**143,075**

PV of Cash Flows (2015-2030)	**1,591,594**
Net Cash	76,727
Shares Out	23,108
Value/Share	**$20.33**
Risk Weighting	***25%***
Cash/Share	**$3.32**

Valuation Methodology

- Our DCF-derived target price of $20 assumes cash flows generated from Mydicar in systolic heart failure until 2031, ~25% risk-weighting, 10% discount rate, and no terminal value.

Mydicar – Key Modeling Assumptions

- Mydicar is approved as treatment for systolic heart failure in the US and EU.
- ~25% probability that CLDN will need to run a PIII program for Mydicar in systolic heart failure.
- ~35% penetration in the US in 2027 and ~25% penetration in the EU in 2027.
- Priced at ~$36K and ~$23.4K on a net basis in the US and EU respectively.
- Achieves total peak Mydicar revenues of ~$1.5B in 2025.
- Sells Mydicar directly in the US and EU.
- Launches Mydicar in the US and EU both in 2020.
- Protected from biosimilar competition until 2031 in the US and 2029 in the EU.

Source: Credit Suisse estimates

Risk Factors

- **Mydicar is not approved or significantly delayed.**
  - CLDN is heavily dependent on the success of their lead compound, Mydicar. If Mydicar is commercialized later than anticipated or fails to obtain regulatory approval for Mydicar, then its business could be materially harmed. Under the scenario in which Mydicar is not commercialized, Celladon may be valued at cash per share of $3.
- **Mydicar does not demonstrate efficacy and/or safety expected from data on studies to date.**
  - Our assumptions are based on expectations regarding Mydicar's efficacy and/or safety. If Mydicar is shown to be less efficacious and/or safe than is expected, then our sales estimates for Mydicar could fall short of our expectations.
- **Mydicar could underperform our expectations for the product launch ramp and/or peak sales.**
  - In modeling Mydicar sales, we have developed a patient-driven model in an attempt to forecast the launch trajectory and peak sales. However, if any of the following parameters (i.e. pricing, treatment rate, competitive landscape) are worse than our expectations, then our sales estimates for Mydicar could be too high.
- **The systolic heart failure market may not become as large as expected**
  - We currently have projected a particular size of the systolic heart failure market based on a patient-driven model. If the number of projected patients seeking treatment is lower than projected, then the total systolic heart failure market could be significantly lower than forecast.

Source: Credit Suisse research

Exhibit 11: **CLDN Quarterly Income Statement 2014**

CLDN Quarterly Income Statement 2014

Celladon Quarterly Income Statement					
(Dollars in '000s, except per share amounts)	**Q1 2014A**	**Q2 2014A**	**Q3 2014E**	**Q4 2014E**	**FY 2014E**
Mydicar	0	0	0	0	0
Other	0	0	0	0	0
Total Revenues	**0**	**0**	**0**	**0**	**0**
Cost of Sales	0	0	0	0	0
Gross Profit	0	0	0	0	0
R&D Expenses	5,218	4,981	5,297	5,641	21,136
SG&A Expenses	1,706	2,024	2,257	2,519	8,506
Total Operating Expenses	**6,924**	**7,005**	**7,553**	**8,160**	**29,642**
Operating Income/(Loss)	**(6,924)**	**(7,005)**	**(7,553)**	**(8,160)**	**(29,642)**
Interest Income	8	21	10	10	49
Interest Expense	(59)	0	0	0	(59)
Other Income/(Expense)	(4)	(8)	(5)	(5)	(22)
Other	(183)	0	0	0	(183)
Total Interest & Other Income/(Expenses)	(238)	13	5	5	(215)
Pre-Tax Profit/(Loss)	**(7,162)**	**(6,992)**	**(7,548)**	**(8,155)**	**(29,857)**
Income Tax Expense	0	0	0	0	0
Effective Tax Rate	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Consolidated Net Income/(Loss)	**(7,162)**	**(6,992)**	**(7,548)**	**(8,155)**	**(29,857)**
Net Income/(Loss) (Non-Controlling Interest)	0	0	0	0	0
Net Income/(Loss) (Celladon)	(7,162)	(6,992)	(7,548)	(8,155)	(29,857)
Accretion to Redemption Value of Redeemable Convertible Preferred Stock	0	0	0	0	0
Change In Fair Value of Non-Controlling Interest	0	0	0	0	0
Deemed Dividend	0	0	0	0	0
Net Income/(Loss) (Common Shareholders)	**(7,162)**	**(6,992)**	**(7,548)**	**(8,155)**	**(29,857)**
Basic EPS	**(0.60)**	**(0.38)**	**(0.36)**	**(0.35)**	**(1.60)**
Diluted EPS	**(0.60)**	**(0.38)**	**(0.36)**	**(0.35)**	**(1.60)**
Basic Shares	11,940	18,512	20,826	23,221	18,625
Diluted Shares	11,940	18,512	20,826	23,221	18,625

Source: Credit Suisse estimates

Exhibit 12: **CLDN Annual Income Statement 2013-2024**

CLDN Annual Income Statement 2013-2024

Celladon Annual Income Statement												
(Dollars in '000s, except per share amounts)	**2013A**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**	**2021E**	**2022E**	**2023E**	**2024E**
Mydicar	0	0	0	0	0	0	0	156,030	400,554	724,576	1,063,849	1,295,840
Other	0	0	0	0	0	0	0	0	0	0	0	0
Total Revenues	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**156,030**	**400,554**	**724,576**	**1,063,849**	**1,295,840**
Cost of Sales	0	0	0	0	0	0	0	15,603	40,055	72,458	106,385	129,584
Gross Profit	0	0	0	0	0	0	0	140,427	360,499	652,118	957,464	1,166,256
R&D Expenses	16,927	21,136	22,675	35,269	50,078	66,671	85,779	106,474	127,178	145,842	160,209	171,332
SG&A Expenses	3,037	8,506	11,063	13,276	14,603	15,378	39,541	63,743	85,265	110,156	137,116	164,083
Total Operating Expenses	19,964	29,642	33,738	48,545	64,681	82,049	125,320	170,217	212,443	255,997	297,325	335,415
Operating Income/(Loss)	**(19,964)**	**(29,642)**	**(33,738)**	**(48,545)**	**(64,681)**	**(82,049)**	**(125,320)**	**(29,789)**	**148,055**	**396,121**	**660,139**	**830,840**
Interest Income	69	49	89	128	165	199	230	226	252	426	764	1,258
Interest Expense	(59)	(59)	0	0	0	0	0	0	0	0	0	0
Other Income/(Expense)	25	(22)	5	5	5	5	5	5	5	5	5	5
Other	(162)	(183)	(170)	(170)	(170)	(170)	(170)	(170)	(170)	(170)	(170)	(170)
Total Interest & Other Income/(Expenses)	(127)	(215)	(76)	(37)	0	34	65	61	87	261	599	1,093
Pre-Tax Profit/(Loss)	**(20,091)**	**(29,857)**	**(33,814)**	**(48,582)**	**(64,681)**	**(82,014)**	**(125,256)**	**(29,728)**	**148,142**	**396,382**	**660,739**	**831,934**
Income Tax Expense	0	0	0	0	0	0	0	0	3,161	29,729	190,924	262,059
Effective Tax Rate	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*2.1%*	*7.5%*	*28.9%*	*31.5%*
Consolidated Net Income/(Loss)	**(20,091)**	**(29,857)**	**(33,814)**	**(48,582)**	**(64,681)**	**(82,014)**	**(125,256)**	**(29,728)**	**144,981**	**366,653**	**469,814**	**569,875**
Net Income/(Loss) (Non-Controlling Interest)	96	0	0	0	0	0	0	0	0	0	0	0
Net Income/(Loss) (Celladon)	(19,995)	(29,857)	(33,814)	(48,582)	(64,681)	(82,014)	(125,256)	(29,728)	144,981	366,653	469,814	569,875
Accretion to Redemption Value of Redeemable Convertible Preferred Stock	0	0	0	0	0	0	0	0	0	0	0	0
Change In Fair Value of Non-Controlling Interest	(3,105)	0	0	0	0	0	0	0	0	0	0	0
Deemed Dividend	(856)	0	0	0	0	0	0	0	0	0	0	0
Net Income/(Loss) (Common Shareholders)	**(23,956)**	**(29,857)**	**(33,814)**	**(48,582)**	**(64,681)**	**(82,014)**	**(125,256)**	**(29,728)**	**144,981**	**366,653**	**469,814**	**569,875**
Basic EPS	**(27.09)**	**(1.60)**	**(1.35)**	**(1.69)**	**(2.02)**	**(2.36)**	**(3.29)**	**(0.74)**	**3.59**	**9.01**	**11.44**	**13.75**
Diluted EPS	**(27.09)**	**(1.60)**	**(1.35)**	**(1.69)**	**(2.02)**	**(2.36)**	**(3.29)**	**(0.74)**	**3.30**	**8.27**	**10.48**	**12.59**
Basic Shares	884	18,625	24,996	28,785	31,982	34,696	38,080	40,159	40,413	40,716	41,067	41,446
Diluted Shares	884	18,625	24,996	28,785	31,982	34,696	38,080	40,159	43,901	44,354	44,810	45,273

Source: Credit Suisse estimates

Exhibit 13: **CLDN Balance Sheet 2013-2024**

CLDN Balance Sheet 2013-2024

Celladon Balance Sheet												
(Dollars in '000s, except per share amounts)	**2013A**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**	**2021E**	**2022E**	**2023E**	**2024E**
ASSETS												
Current Assets:												
Cash & Cash Equivalents	7,903	66,260	111,927	144,052	186,207	212,383	246,802	205,349	297,827	554,403	974,207	1,542,729
Short-Term Investments	10,467	10,467	10,467	10,467	10,467	10,467	10,467	10,467	10,467	10,467	10,467	10,467
Accounts Receivable	0	0	0	0	0	0	0	21,374	82,306	198,514	262,319	284,020
Inventory	0	0	0	0	0	0	0	2,137	8,231	19,851	27,689	31,952
Other Current Assets	180	267	304	437	582	738	1,128	1,532	1,912	2,304	2,676	3,019
Total Current Assets	**18,550**	**76,993**	**122,698**	**154,956**	**197,256**	**223,589**	**258,397**	**240,860**	**400,743**	**785,539**	**1,277,358**	**1,872,186**
Property, Plant, & Equipment, Net	308	344	374	399	510	692	934	1,223	1,461	1,656	1,817	1,949
Other Assets	2,296	3,409	3,880	5,583	7,438	9,436	14,412	19,575	24,431	29,440	34,192	38,573
TOTAL ASSETS	**21,154**	**80,746**	**126,952**	**160,937**	**205,204**	**233,717**	**273,742**	**261,658**	**426,634**	**816,635**	**1,313,367**	**1,912,708**
LIABILITIES												
Current Liabilities												
Accounts Payable & Accrued Expenses/Other	4,400	3,409	3,880	5,583	7,438	9,436	14,412	19,575	24,431	29,440	34,192	38,573
Convertible Notes, Net of Discount	1,044	0	0	0	0	0	0	0	0	0	0	0
Warrant Liability	1,116	0	0	0	0	0	0	0	0	0	0	0
Total Current Liabilities	**6,560**	**3,409**	**3,880**	**5,583**	**7,438**	**9,436**	**14,412**	**19,575**	**24,431**	**29,440**	**34,192**	**38,573**
Other Non-Current Liabilities	37	59	67	97	129	164	251	340	425	512	595	671
TOTAL LIABILITIES	**6,597**	**3,468**	**3,947**	**5,680**	**7,568**	**9,600**	**14,662**	**19,915**	**24,856**	**29,952**	**34,787**	**39,244**
EQUITY												
Shareholders' Equity:												
Preferred Stock	65,548	0	0	0	0	0	0	0	0	0	0	0
Common Stock	0	23	27	31	33	36	40	40	41	41	41	42
Additional Paid-In-Capital	61,593	219,697	299,233	380,064	487,121	595,613	755,828	768,218	783,273	801,525	823,607	848,616
Accumulated Other Comprehensive Income	2	2	2	2	2	2	2	2	2	2	2	2
Retained Earnings/(Deficit Accumulated)	(112,586)	(142,443)	(176,257)	(224,839)	(289,520)	(371,534)	(496,790)	(526,518)	(381,537)	(14,884)	454,930	1,024,805
TOTAL SHAREHOLDERS' EQUITY	**14,557**	**77,278**	**123,005**	**155,258**	**197,637**	**224,117**	**259,080**	**241,742**	**401,778**	**786,684**	**1,278,580**	**1,873,464**
TOTAL LIABILITIES & EQUITY	**21,154**	**80,746**	**126,952**	**160,937**	**205,204**	**233,717**	**273,742**	**261,658**	**426,634**	**816,635**	**1,313,367**	**1,912,708**

Source: Credit Suisse estimates

Exhibit 14: **CLDN Cash Flow Statement 2013-2024**

CLDN Cash Flow Statement 2013-2024

Celladon Cash Flow Statement												
(Dollars in '000s, except per share amounts)	**2013A**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**	**2021E**	**2022E**	**2023E**	**2024E**
OPERATING CASH FLOWS												
Net Income/(Loss)	(20,091)	(29,857)	(33,814)	(48,582)	(64,681)	(82,014)	(125,256)	(29,728)	144,981	366,653	469,814	569,875
Adjustments (Net Loss To Net Cash Reconciliation):												
Depreciation	67	64	70	75	89	117	159	211	262	305	339	368
Stock-Based Compensation	1,388	3,242	4,214	5,057	5,563	5,952	6,250	6,562	6,890	7,235	7,597	7,976
Other	493	0	0	0	0	0	0	0	0	0	0	0
Changes in Operating Assets & Liabilities:												
Accounts Receivable	0	0	0	0	0	0	0	(21,374)	(60,932)	(116,208)	(63,805)	(21,701)
Inventory	0	0	0	0	0	0	0	(2,137)	(6,093)	(11,621)	(7,838)	(4,263)
Accounts Payable & Accrued Expenses	1,843	(991)	471	1,703	1,856	1,997	4,976	5,163	4,856	5,009	4,753	4,380
Other Operating Assets/Liabilities	104	(87)	(37)	(133)	(145)	(156)	(389)	(404)	(380)	(392)	(372)	(343)
NET OPERATING CASH FLOWS	**(16,196)**	**(27,630)**	**(29,096)**	**(41,879)**	**(57,319)**	**(74,104)**	**(114,260)**	**(41,708)**	**89,585**	**250,980**	**410,488**	**556,293**
INVESTING CASH FLOWS												
Proceeds/(Purchases) of Investment Securities	10,941	0	0	0	0	0	0	0	0	0	0	0
Proceeds/(Purchases) of Property & Equipment	(87)	(100)	(100)	(100)	(200)	(300)	(400)	(500)	(500)	(500)	(500)	(500)
Other	0	(1,091)	(463)	(1,673)	(1,823)	(1,963)	(4,890)	(5,073)	(4,772)	(4,922)	(4,670)	(4,304)
NET INVESTING CASH FLOWS	**10,854**	**(1,191)**	**(563)**	**(1,773)**	**(2,023)**	**(2,263)**	**(5,290)**	**(5,573)**	**(5,272)**	**(5,422)**	**(5,170)**	**(4,804)**
FINANCING CASH FLOWS												
Proceeds from Common Stock Issuance	0	88,136	75,000	75,000	100,000	100,000	150,000	0	0	0	0	0
Proceeds from Stock Options	0	85	326	778	1,497	2,542	3,969	5,828	8,165	11,017	14,486	17,033
Proceeds/(Repayment) of Debt	1,097	(1,044)	0	0	0	0	0	0	0	0	0	0
Other	(1,693)	0	0	0	0	0	0	0	0	0	0	0
NET FINANCING CASH FLOWS	**(596)**	**87,177**	**75,326**	**75,778**	**101,497**	**102,542**	**153,969**	**5,828**	**8,165**	**11,017**	**14,486**	**17,033**

Source: Credit Suisse estimates

Exhibit 15: **CLDN Pipeline Overview**

CLDN Pipeline Overview

	Target Indication(s)	Stage	Current Status	Comments
Mydicar SERCA2a AAV	▪ Systolic Heart Failure ▪ FDA Breakthrough Therapy Designation	▪ Phase IIb	▪ CUPID 2 was fully enrolled as of February 2014. ▪ Topline CUPID 2 PIIb data is expected in April 2015.	▪ This indication is the major valuation driver for CLDN. ▪ CUPID 2 could be a registrational trial in the US and/or EU.
	▪ Advanced Heart Failure with LVAD	▪ Phase I/II	▪ The PI/II trial is currently enrolling patients.	▪ This indication is not included in our valuation.
	▪ AV Fistula Maturation Failure	▪ Preclinical	▪ CLDN plans to initiate a PIIa trial. ▪ Topline PII data is expected in 2015.	▪ This indication is not included in our valuation.
	▪ Diastolic Heart Failure	▪ Preclinical	▪ Preclinical studies are ongoing. ▪ CLDN plans to start a clinical trial in 2015.	▪ This indication is not included in our valuation.
SERCA2b Small Molecule	▪ Diabetes ▪ Metabolic Disease	▪ Preclinical	▪ Preclinical studies are ongoing.	▪ The SERCA2b small molecule is not included in our valuation. ▪ Servier has an Ex-US option.
	▪ Neurodegenerative Disease	▪ Preclinical	▪ Preclinical studies are ongoing.	▪ The SERCA2b small molecule is not included in our valuation.
Stem Cell Factor	▪ Cardiovascular Disease	▪ Preclinical	▪ Preclinical studies are ongoing.	▪ The Stem Cell Factor is not included in our valuation.

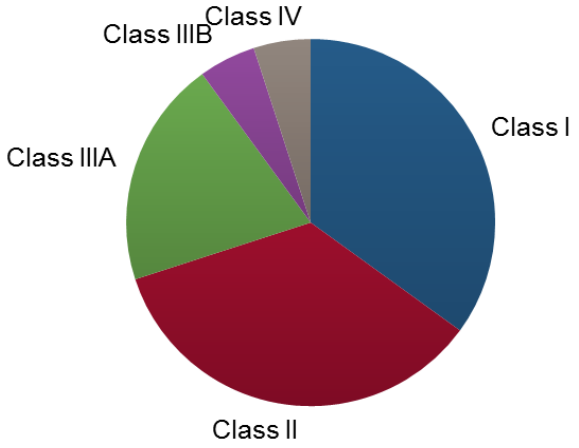
Source: Celladon, Credit Suisse research

Exhibit 16: **HF is a disease with high unmet medical needs**

HF is a disease with high unmet medical needs

- **HF is a significant burden.**
  - It is estimated that ~5.2M have heart failure are diagnosed each year in the US.
  - It is estimated that ~12.4M have heart failure are diagnosed each year in the EU.
  - The number of diagnosed HF patients is expected to increase, driven by an aging population and rising rate of obesity.
  - The total medical costs for HF is expected to increase 2.5-fold from ~$21B in 2012 to ~$53B in 2030. The majority (~80%) of these costs are attributed to hospitalizations.
- **Significant unmet medical needs remain in HF.**
  - The first-line treatment involves ACEi + β-Blockers. Slide 11 shows other pharmacotherapy and medical-device therapy used in the treatment of HF.
  - Mortality is high: (1) ~50% of patients diagnosed with HF will die within 5 years; (2) ~50% of Medicare patients with HF die within 3 years following a hospitalization due to HF.
- **HF is a substantial commercial opportunity.**
  - Mydicar will likely be used to treat patients who have NYHA Class IIIB/IV systolic heart failure and qualifying NAb levels.
  - As such, the potential target patient population for Mydicar is ~100K in the US and ~150K in the EU.
  - This specific patient population will most likely benefit the most from reducing the hospitalization rate.

Systolic Heart Failure Patients by NYHA Class



NYHA Class – Clinical Symptoms

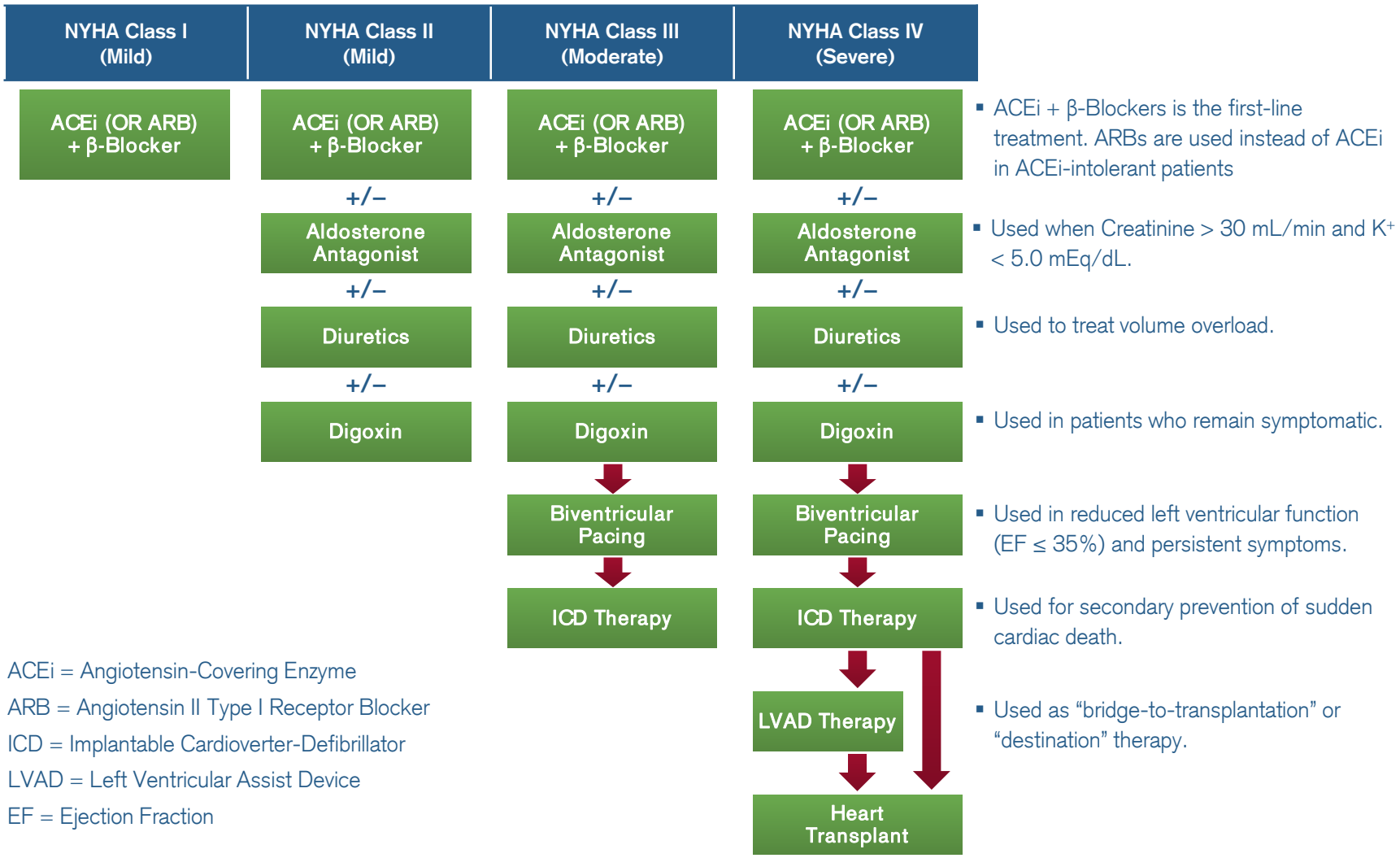
NYHA	Severity	Description
Class I	Mild	▪ Patients experience no or very mild symptoms with ordinary physical activity
Class II	Mild	▪ Patients experience fatigue and shortness of breath during moderate physical activity
Class III	Moderate	▪ Patients experience shortness of breath during even light physical activity
Class IV	Severe	▪ Patients are exhausted even at rest

Source: AHA, P. Heidenreich et al. Circulation – Heart Failure 2013, A. Go etl al. Circulation 2014, L. Miller Circulation 2011, Celladon, Novartis, Credit Suisse research

Exhibit 17: **Systolic Heart Failure – Current Treatment Paradigm Overview**

Systolic Heart Failure – Current Treatment Paradigm Overview

Current Treatment Paradigm in Systolic Heart Failure



ACEi = Angiotensin-Covering Enzyme
ARB = Angiotensin II Type I Receptor Blocker
ICD = Implantable Cardioverter-Defibrillator
LVAD = Left Ventricular Assist Device
EF = Ejection Fraction

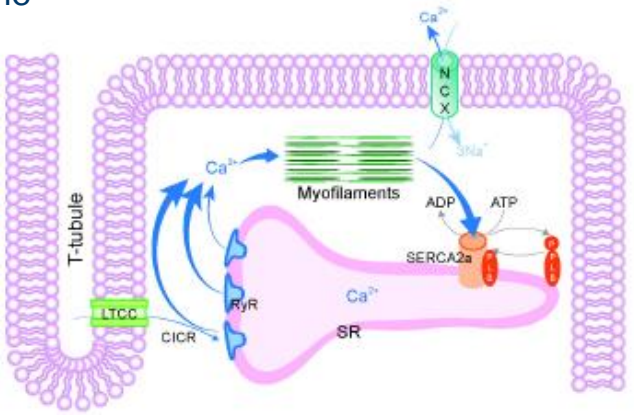
Source: AHA, University of Michigan, Credit Suisse research

SERCA2a – Linchpin For Solving Abnormalities In Heart Failure

- Heart failure remains a major cause of morbidity and mortality in the developed world.
- >5 million patients in the US have heart failure
- One of the key abnormalities in human heart failure is abnormal intracellular calcium ion (Ca^{2+}) handling caused by a defect in a sarcoplasmic reticulum (SR) function.
- Deficient SR Ca^{2+} uptake in myocytes is associated with a decrease in the expression and activity of the **s**arco/**e**ndoplasmic **r**eticulum **c**alcium **A**TPase cardiac isoform **2a** (**SERCA2a**).
- Low expression of SERCA2a has been associated with low systolic Ca^{2+} released from the SR.

How Does SERCA2a Work?

- During systole, the action potential induces a minor Ca^{2+} - influx through sarcolemmal L-type calcium channel (LTCC). This is followed by Ca^{2+} release from the SR via ryanodine receptor (RyR). The combination of Ca^{2+} influx and release raises free intracellular Ca^{2+} concentration which results in Ca^{2+} binding the myofilament protein that controls muscle contraction.
- Muscle relaxation is initiated by RyR closing, accompanied by Ca^{2+} dissociation and its reuptake into SR by SERCA2a (**75% of Ca^{2+} removal in human**).
- SERCA pump serves a dual function:
  - (1) to cause muscle relaxation
  - (2) to restore SR Ca^{2+} load necessary for muscle contraction



Source: Credit Suisse research, Park et al., 2013 BMB

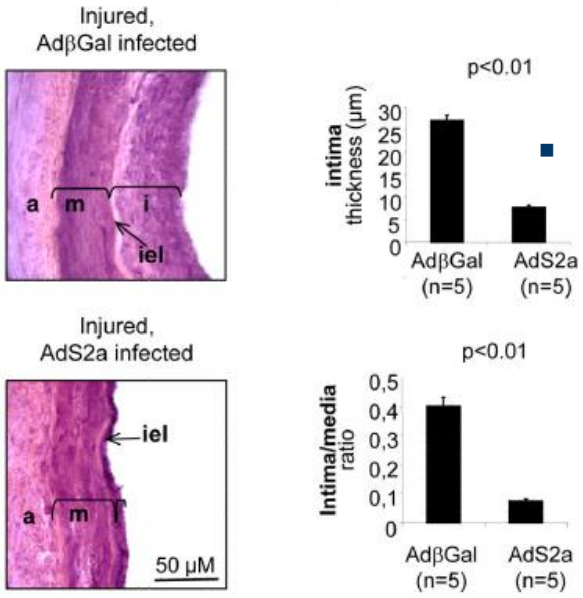
Preclinical And Phase I Studies Show That SERCA2a Gene Transfer Improves Systolic Functions In Patients With Heart Failure

- Systolic heart failure happens when the left side of the heart doesn't pump blood out to the body as well as it should.
- It is evident by a low ejection fraction, ie reduced contractility.
- Potential causes of systolic heart failure are:
  - Heart attack
  - Cardiomyopathy
  - High blood pressure
  - Aortic stenosis
  - Mitral regurgitation
  - Viral myocarditis
  - Arrhythmia
- SERCA2a gene therapy is beneficial on multiple levels:
  - As Ca^{2+} plays a critical role in cardiac contraction and relaxation and SERCA2a regulates Ca^{2+} flow, gene transfer of SERCA2a improves both Ca^{2+} release and uptake and thus improves both systolic and diastolic functions.
  - Overexpression of SERCA2a reduces the number of arrhytmic episodes and prevents cardiomyopathy.

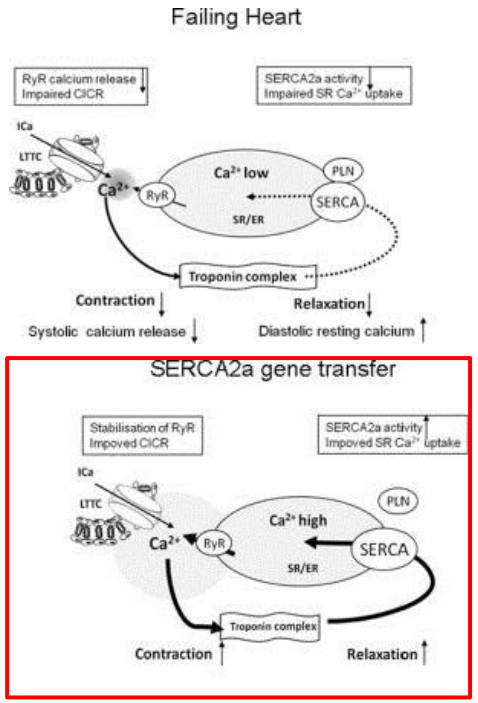
Source: Credit Suisse research, Jaski et al., 2009

SERCA2a Gene Therapy Success In Pre-clinical And Animal Models

- Only cardiac specific isoform SERCA2a is therapeutically useful.
- Adenovirus-mediated gene transfer of SERCA2a to failing human cardyomyocytes (from patients with end-stage HF) restored the Ca^{2+} transient and improved contraction and relaxation velocity to the level of non-failing myocytes [del Monte et al., 1999].
- Overexpression of SERCA2a resulted in the enhanced contractility due to the:
  - (1) enhanced SR Ca^{2+} uptake during diastole
  - (2) increased SR Ca^{2+} content
  - (3) more effective Ca^{2+} efflux during systole



- SERCA2a gene transfer in a human *ex vivo* model of left internal mammal artery (hIMA) intimal thickening prevented vascular remodeling and significantly reduced the intimal thickening [Lipskaia et al., 2013]



Source: CLDN IR, Credit Suisse research

Exhibit 21: **SERCA2a Gene Therapy Success In Pre-clinical And Animal Models**

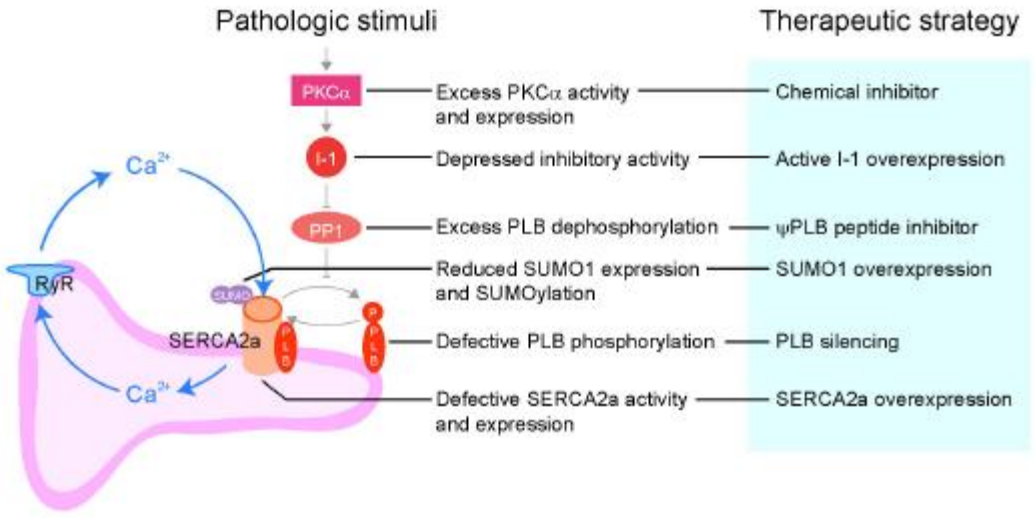
SERCA2a Gene Therapy Success In Pre-clinical And Animal Models

- Intracoronary delivery of AAV1.SERCA2a in diseased heart pigs resulted in:
  - **Improvement of left ventricle remodeling**, as measured by % change in left ventricle internal systolic diameters
  - Cardiac SERCA2a expression was restored to normal levels.
  - Absence of histopatological evidence of acute myocardial inflammation or necrosis.
- SERCA2a restores cardiac energetics by **improving mechanoenergetics** and **energy supply**:
  - In diseased hearts, the oxygen cost of LV contractility is increased. SERCA2a gene transfer in rats restored the increased oxygen cost to the normal level [Sakata et al., 2007].
  - Restoring SERCA2a expression was also shown to correct the creatine kinase activity by normalizing the creatine to ATP ratio in animal models of HF [del Monte et al., 2001].
- SERCA2a **restores arrhytmias**:
  - Diastolic Ca^{2+} overload occurring in ischemia and chronic HF is responsible for cellular electric instability resulting in tachyarrythmias.
  - Overexpression of SERCA2a in animal cardiomyocytes results in rapid inactivation of subsequent Ca^{2+} currents and reduced Ca^{2+} entry through LTCC, thereby **reducing ventricular arrhythmias** [Prunier et al., 2008; Davia et al., 2001]
- Restoration of SERCA2a levels via gene transfer results in differential transcription levels that might offer insights into underlying mechanism:
  - One of the genes that is rescued by SERCA2a overexpression is **Tensin**, which is important link for **cardioprotection** from cell death and cell **survival** signaling pathways [del Monte et al., 2004].

Source: Credit Suisse research, Sakata et al., 2007, del Monte et al., 2001, 2004, prunier et al., 2008, Davia et al., 2001

Multiple Approaches Are Possible For Increasing SERCA2a Expression In Cardyomyctes

- SERCA2a activity and expression can be increased by downregulating its upstream modulators: PKCα, I-1, PP1.
- SERCA2a is SUMOylated at two lysine residues. The levels of SUMOylation and SERCA2a are greatly decreased in diseased hearts. Overexpression of SUMO1 appears as efficient as overexpression of SERCA2a in improving cardiac function.
- SERCA2a activity is directly modulated by a 52-amino acid endogenous inhibitor, phospholamban (PLB). Inhibiting PLB might be another strategy to restore SERCA2a expression levels.



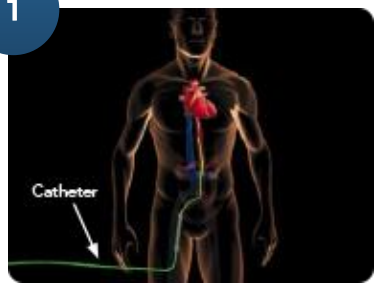
Source: Park et al., BMB , Credit Suisse research

Exhibit 23: **Mydicar will be used on top of current standard of care**

Mydicar will be used on top of current standard of care

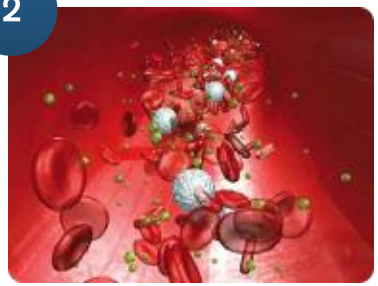
Mydicar Treatment Overview

1



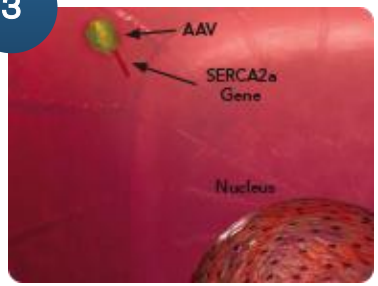
- Mydicar involves a one-time outpatient cardiac catherization, in which a catheter is put into a blood vessel in the arm, upper thigh, or neck and threaded to the heart.

2



- The SERCA2a gene is infused into the coronary arteries and makes contact with cardiac muscle cells.

3



- A non-pathologic AAV delivers the SERCA2a gene to the cell nucleus.

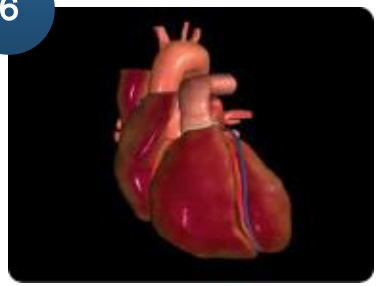
4

- SERCA2a gene provides fresh genetic instructions to restore SERCA2a enzyme production inside cardiac cells.

5

- SERCA2a enzyme powers the sarcoplasmic reticulum (SR), which controls the flow of calcium ions in and out of cardiac cells.

6



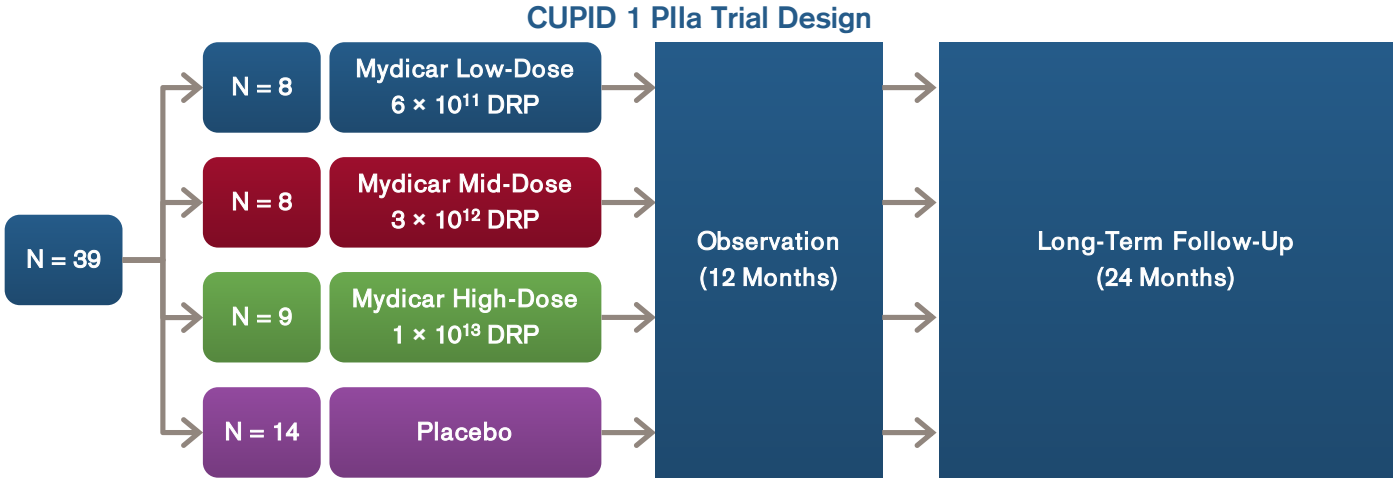
- Restoration of SERCA2a enzyme production and SR function improves the heart's ability to pump blood and slows progression of heart failure.

- Mydicar will complement current optimized therapy for patients with systolic heart failure.

Source: Company data, Credit Suisse estimates

Exhibit 24: **CUPID 1 was a small PIIa trial evaluating Mydicar in 39 patients**

CUPID 1 was a small PIIa trial evaluating Mydicar in 39 patients



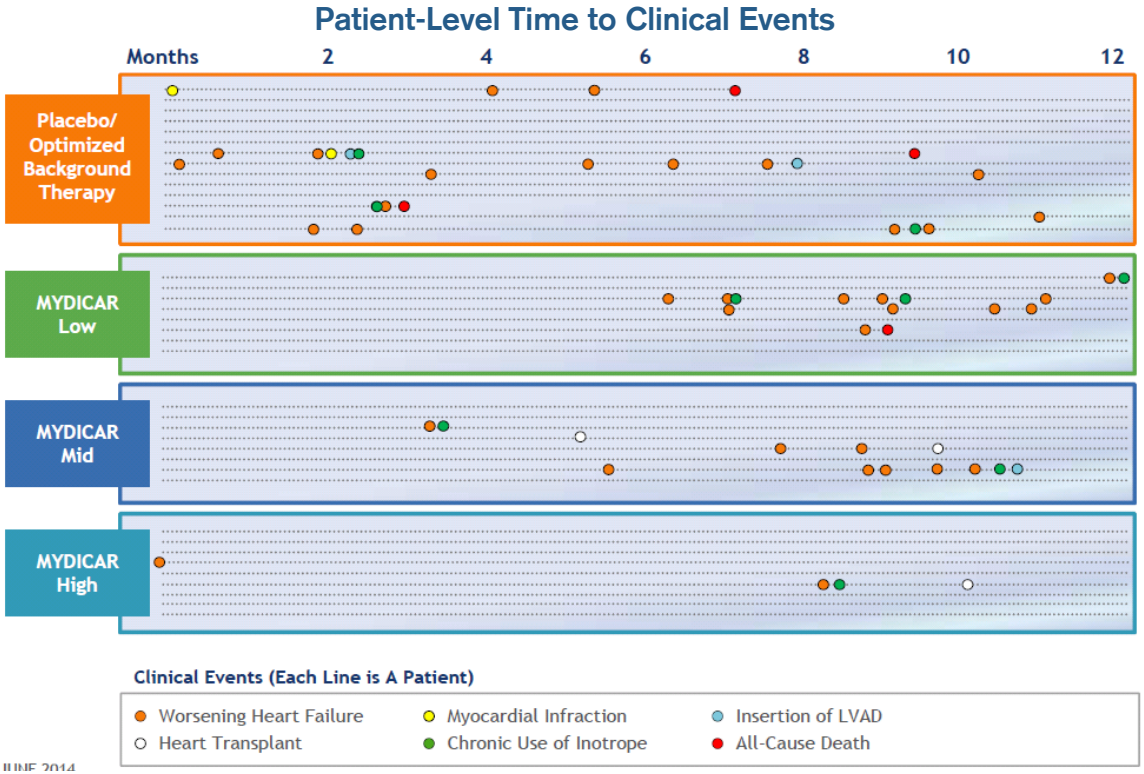
Locations	▪ Sites in US
Patient Population (Key Criteria)	▪ Inclusion Criteria: (1) Aged 18-75 years old; (2) Diagnosed with NYHA Class III/IV for ≥3 months; (3) LVEF ≤ 35%; (4) VO_2 max ≤20 ml/kg/min ▪ Exclusion Criteria: (1) No evidence of functional or viable myocardium; (2) Expected survival < 1 year in investigator's medical opinion; (3) LFTs >2× ULN; (4) Bleeding diathesis or thrombocytopenia (<50,000 platelets/µl); (5) Anemia (< 10 g/dL)
Primary Endpoint(s)	▪ (1) Incidence of TEAEs at 12 months; (2) Length of cardiovascular-related hospitalizations at 6 months; (3) Change in (symptomatic) MLWHFQ score from BL to Month 6; (4) Change in 6MWT from BL to Month 6; (5) Change in VO_2 Max from BL to Month 6; (6) Change in absolute levels of NT-proBNP from BL to Month 6; (7) Change in %LVEF from BL to Month 6; (8) Change in absolute LVESV from BL to Month 6
Secondary Endpoint(s)	▪ (1) Length of cardiovascular-related hospitalizations at 12 months; (2) Change in (symptomatic) MLWHFQ score from BL to Month 6; (3) Change in 6MWT from BL to Month 6; (4) Change in VO_2 Max from BL to Month 6; (5) Change in absolute levels of NT-proBNP from BL to Month 6; (6) Change in %LVEF from BL to Month 6; (7) Change in absolute LVESV from BL to Month 6
Readout	▪ Published in Circulation 2011

BL = Baseline; LFT = Liver Function Tests; LVESV = Left Ventricular End Systolic Volume; MLWHFQ = Minnesota Living With Heart Failure Questionnaire; NT-proBNP = N-terminal of the Prohormone Brain Natriuretic Peptide; TEAE = Treatment-Emergent Adverse Events; ULN = Upper Limit of Normal; 6MWT = 6 Minute Walk Test

Source: www.clinicaltrials.gov, M. Jessup et al. Circulation 2011, Celladon, Credit Suisse research

Exhibit 25: **Mydicar showed promising efficacy through 12 months in CUPID 1**

Mydicar showed promising efficacy through 12 months in CUPID 1



- Mydicar High-Dose showed a reduction in frequency as well as delay in the onset of recurrent clinical events relative to placebo.
- In contrast, Mydicar Low-Dose and Mid-Dose only delayed the onset of clinical events relative to placebo. The incidences of events in these 2 treatment arms were generally comparable to placebo.
- The hazard ratios for recurrent clinical events adjusted for correlated terminal events* were 0.40 (p=0.11), 0.44 (p=0.12), and 0.12 (p=0.003) for low, mid, and high doses respectively.
- CUPID 1 though is a very small trial; as such, these observations for Mydicar relative to placebo are likely be highly variable.

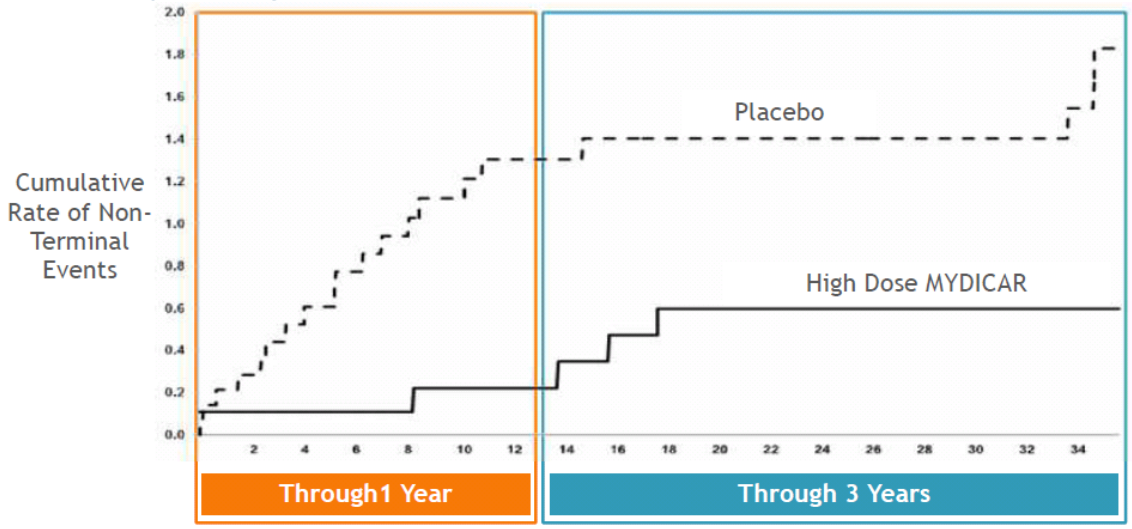
	Low Dose	Mid Dose	High Dose	Placebo
Terminal Events*	1	3	1	6
Terminal Event Rate	*0.13*	*0.38*	*0.11*	*0.43*
Non-Terminal Events	14	10	3	20
Non-Terminal Event Rate	*1.75*	*1.25*	*0.33*	*1.43*
Total Events	15	13	4	26
Total Event Rate	*1.88*	*1.63*	*0.44*	*1.88*

Source: M. Jessup et al. Circulation 2011, Celladon, Credit Suisse research

Exhibit 26: **Mydicar High-Dose showed a statistically significant reduction in recurrent (non-terminal) cardiovascular events relative to placebo**

Mydicar High-Dose showed a statistically significant reduction in recurrent (non-terminal) cardiovascular events relative to placebo

Mydicar High-Dose – Cumulative Rate of Non-Terminal Events



Hazard Ratio (CI)	**0.12 (0.03, 0.49)**	**0.18 (0.03, 0.99)**
Risk Reduction	**88%**	**82%**
P-Value	**p = 0.003**	**p = 0.048**

- Mydicar High-Dose had a lower non-terminal event rate relative to placebo through 12 months (0.33 vs. 1.43). Mydicar High-Dose had 3 non-terminal events (vs. 20 for placebo).
- The non-terminal event rates between Mydicar High-Dose and placebo were generally comparable between 12 and 36 months (0.33 vs. 0.36). Mydicar High-Dose had 3 non-terminal events (vs. 5 for placebo).
- In general, these data suggest that the vast majority of recurrent (non-terminal) events in patients in the placebo arm occurs within the first 12 months.

Source: M. Jessup et al. Circulation 2011, K. Zsebo et al. Circulation Research 2013, Celladon, Credit Suisse research

Mydicar High-Dose stabilized or improved various clinical parameters relative to placebo in CUPID 1

Mydicar Impact on Various Clinical Parameters

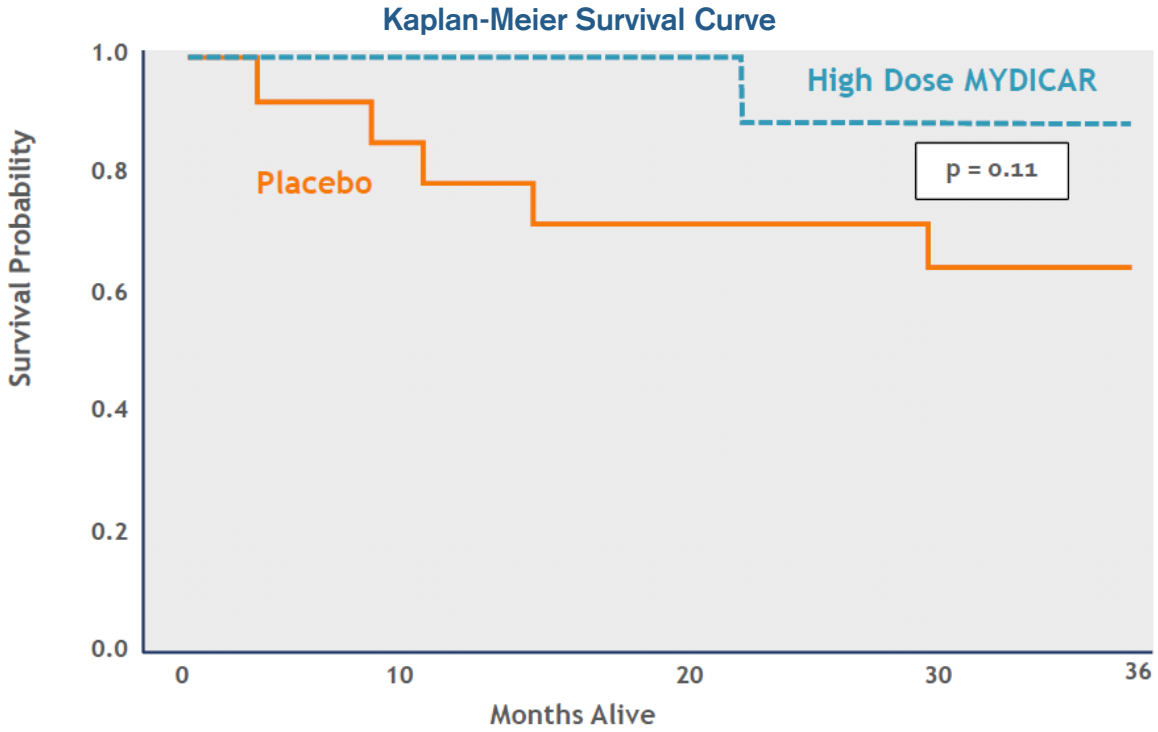
	Low Dose	Mid Dose	High Dose	Placebo
Symptomatic				
Change in NYHA Class	–0.8	–0.8	**–0.6**	**–0.2**
p-Value (vs. Placebo)	*p = 0.101*	*p = 0.132*	***p = 0.273***	***p = - - -***
Change in MLWHFQ	–7.6	+7.9	**–10.3**	**+3.4**
p-Value (vs. Placebo)	*p = 0.709*	*p = 0.798*	***p = 0.208***	***p = - - -***
Functional				
6-Minute Walk Test	+13.00	–59.50	**+1.00**	**–86.60**
p-Value (vs. Placebo)	*p = 0.137*	*p = 0.749*	***p = 0.181***	***p = - - -***
VO_2 Max	–0.73	–1.07	**–0.43**	**–2.10**
p-Value (vs. Placebo)	*p = 0.530*	*p = 0.633*	***p = 0.342***	***p = - - -***
Biomarker				
NT-proBNP (Absolute)	+694.1	+2,073.1	**–13.5**	**+5,540.0**
p-Value (vs. Placebo)	*p = 0.628*	*p = 0.509*	***p = 0.372***	***p = - - -***
NT-proBNP (Relative)	+52.4%	+119.2%	**–12.4%**	**+198.5**
p-Value (vs. Placebo)	*p = 0.300*	*p = 0.619*	***p = 0.220***	***p = - - -***
Remodeling				
ESV (Absolute)	+0.4	+10.5	**–9.6**	**+18.2**
p-Value (vs. Placebo)	*p = 0.286*	*p = 0.964*	***p = 0.057***	***p = - - -***
ESV (Relative)	+2.1%	+10.7%	**–4.0%**	**+10.7%**
p-Value (vs. Placebo)	*p = 0.285*	*p = 0.749*	***p = 0.029***	***p = - - -***
EF (Absolute)	0.0	–1.5	**–0.7**	**–2.1**
p-Value (vs. Placebo)	*p = 0.248*	*p = 0.446*	***p = 0.174***	***p = - - -***

- Mydicar High-Dose showed a modest improvement in NYHA class, but a substantial improvement in MLWHFQ relative to placebo at 6 months.
- Mydicar High-Dose showed stabilization in the 6MWT and VO_2 Max relative to placebo at 6 months.
- Mydicar High-Dose showed stabilization in the absolute and relative change in NT-proBNP as compared to placebo at 6 months.
- Mydicar High-Dose showed stabilization in ejection fraction (EF), but improvement on absolute as well as relative improvement in end systolic volume (ESV) as compared to placebo at 6 months.

Source: M. Jessup et al. Circulation 2011, Celladon, Credit Suisse research

Exhibit 28: **Mydicar High-Dose has the potential to improve all-cause mortality relative to placebo**

Mydicar High-Dose has the potential to improve all-cause mortality relative to placebo



- There was a trend in all-cause mortality improvement favoring Mydicar High-Dose over placebo.
- Mydicar High-Dose had a slightly better K-M survival curve relative to placebo. This difference though was not statistically significant.
- Mydicar High-Dose had a lower incidence of death (38%) relative to placebo (42%).
- These observations for Mydicar High-Dose relative to placebo will likely be highly variable, given that CUPID 1 is a very small trial.

	Low Dose	Mid Dose	High Dose	Placebo
Deaths (≤12 Months)	1	0	0	3
Death Rate (≤12 Months)	*13%*	*0%*	*0%*	*21%*
Deaths (>12 Months)	2	3	1	3
Death Rate (>12 Months)	*25%*	*38%*	*11%*	*21%*
Total Deaths (36 Months)	3	3	1	6
Total Death Rate (36 Months)	*38%*	*38%*	*11%*	*42%*

Source: M. Jessup et al. Circulation 2011, K. Zsebo et al. Circulation Research 2013, Celladon, Credit Suisse research

However, there were imbalances in baseline patient characteristics

Patient Baseline Characteristics in CUPID 1

	Mydicar Low-Dose	Mydicar Mid-Dose	Mydicar High-Dose	Placebo
Age (Mean)	60.3 years old	63.9 years old	56.6 years old	61.0 years old
Sex				
Female	1 (12.5%)	0 (0.0%)	3 (33.3%)	1 (7.1%)
Male	7 (87.5%)	8 (100.0%)	6 (66.7%)	13 (92.9%)
Heart-Failure Treatment Regimen				
Angiotensin-Converting Enzyme Inhibitor	6 (75.0%)	6 (75.0%)	7 (66.7%)	8 (57.1%)
Angiotensin II Receptor Blocker	1 (12.5%)	2 (25.0%)	2 (22.2%)	4 (28.6%)
Aldosterone Antagonist	4 (50.0%)	3 (37.5%)	4 (44.4%)	8 (57.1%)
β-Blocker	**8 (100.0%)**	**7 (87.5%)**	**6 (66.7%)**	**14 (100.0%)**
Diuretic	8 (100.0%)	8 (100.0%)	8 (88.9%)	12 (85.7%)
Clinical Measures				
NYHA Class III	8 (100.0%)	8 (100.0%)	9 (100.0%)	14 (100.0%)
MLWHFQ Total Score (Mean)	**57.6**	**35.0**	**41.4**	**48.7**
Creatinine	**1.0 mg/dL**	**1.5 mg/dL**	**1.1 mg/dL**	**1.6 mg/dL**
NT-proBNP (Mean)	**1353 pg/mL**	**3310 pg/mL**	**2141 pg/mL**	**4072 pg/mL**
6-Minute Walk Test (Mean)	**359 m**	**334 m**	**347 m**	**336 m**
VO_2 Max (Mean)	**14.8 mL/kg/min**	**14.4 mL/kg/min**	**15.1 mL/kg/min**	**12.4 mL/kg/min**
LVEF (Mean)	**25.4%**	**26.6%**	**27.9%**	**22.6%**
LVESV (Mean)	**206 mL**	**236 mL**	**169 mL**	**201 mL**

- CUPID 1 did have imbalances in baseline patient characteristics across treatment cohorts (**bolded** in the table above).
- Notably, Mydicar High-Dose had a lower usage of β-Blockers (67% vs. 100%), lower creatinine (1.1 mg/dL vs. 1.6 mg/dL), lower mean NT-proBNP level (2141 pg/mL vs. 4072 pg/mL), higher VO_2 max (15.1 mL/kg/min vs. 12.4 mL/kg/min), higher LVEF (28% vs. 23%), and lower LVESV (169 mL vs. 201 mL) relative to placebo.
- These differences generally point to healthier patients in the Mydicar High-Dose cohort relative to the placebo cohort.

Source: M. Jessup et al. Circulation 2011, Celladon, Credit Suisse research

Post-hoc sensitivity analyses though suggest that the clinical impact of Mydicar High-Dose could not be fully explained by these differences

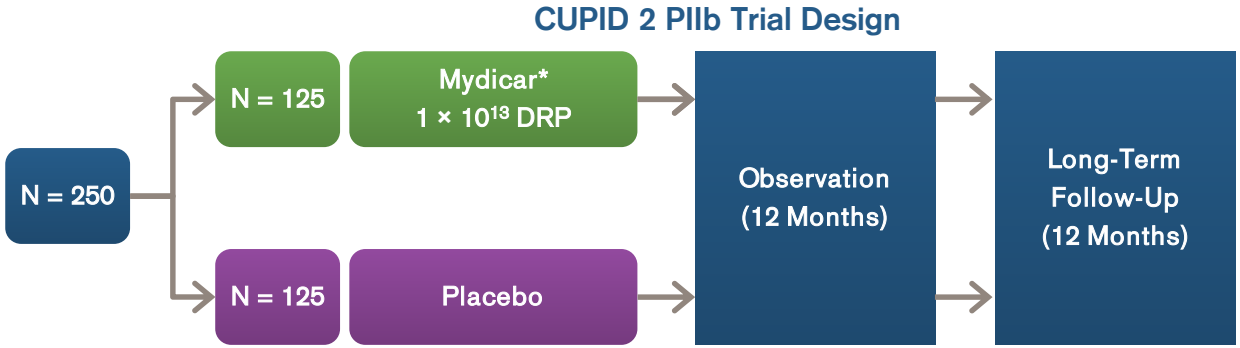
- **The differences in baseline patient characteristics likely do not completely explain the impact observed with Mydicar High-Dose on clinical parameters. Nevertheless, these differences likely impact the observed clinical trends to some degree.**
  - The post-hoc sensivitiy analyses were significantly biased in favor of placebo. These sensivity analyses involved exclusion of the "highest risk" placebo patients based on the lowest VO_2 max, highest creatinine, and very high NT-proBNP.
  - In general, the differences in baseline patient characteristics were narrowed between Mydicar High-Dose and placebo. However, there were still some differences in clinical criteria between these 2 patient cohorts.

- **The observed clinical impact favoring Mydicar High-Dose over placebo generally remained intact after these post-hoc analyses**
  - Mydicar continued to show favorable trends on clinical impact on changes in NYHA class, MLWHFQ, 6-minute walk test, peak VO_2, NT-proBNP, end-systolic volume, and ejection fraction over placebo.
  - The hazard ratios for time-to-recurrent events at 6-months, 9-months, and 12-months for Mydicar High-Dose relative to placebo increased slightly to 0.19 (from 0.13), 0.14 (from 0.10), and 0.15 (from 0.12) respectively.
  - The trends for primary endpoints at 6 months remain intact after adjusting for baseline imbalances in VO_2 max. Notably, Mydicar High-Dose had an adjusted duration of cardiovascular hospitalizations of 1.9 days (vs. 0.5 days for placebo, p=0.199), individual efficacy score of -1.1 (vs. +1.0 for placebo, p=0.10), and a hazard ratio of 0.21 for time-to-multiple events as compared to placebo.
  - There were no correlations between the individual efficacy score and baseline LVESV or VO_2 max.

Source: M. Jessup et al. Circulation 2011, Celladon, Credit Suisse research

Exhibit 31: **CUPID 2 is a PIIb trial evaluating Mydicar in 250 patients**

CUPID 2 is a PIIb trial evaluating Mydicar in 250 patients



Locations	▪ Sites in the US and EU
Patient Population (Key Criteria)	▪ Inclusion Criteria: (1) Aged 18-80 years old; (2) Diagnosed with chronic systolic heart failure due to ischemic or non-ischemic cardiomyopathy; (3) Diagnosed with NYHA class II, III, or IV heart failure; (4) LVEF ≤35%; (5) Treated with therapy consistent with ACG/AHA and ESC practice guidelines; (6) Presenting with at least 1 of the following risk factors – (a) Hospitalization for heart failure within 6 months of screening or in lieu of hospitalization, at least 2 outpatient interventions for the intended treatment of signs and symptoms of worsening heart failure; (b) NT-proBNP >1200 pg/mL (BNP >225 pg/mL) within 30 days of screening; if subject is in atrial fibrillation, NT-proBNP >1600 pg/mL (BNP >275 pg/mL) within 30 days of screening (7) AAV Nab titer negative ▪ Exclusion Criteria: (2) LFTs >3× ULN; (2) Anemia defined as Hb <9 g/dL; (2) Bleeding diathesis or thrombocytopenia defined as <50,000 platelets/µl
Primary Endpoint(s)	▪ Time-to-current, heart-failure-related hospitalizations in presence of terminal events (all-cause death, heart transplant, or LVAD implantation)
Secondary Endpoint(s)	▪ (1) Time-to-first terminal event (all-cause death, heart transplant, or LVAD implantation); (2) Symptoms; (3) Exercise capacity; (4) Quality of life
Sample Size/Powering	▪ 125 patients per treatment group with 186 recurrent events allows for 83% power to detect ≥45% risk reduction (HR = 0.55)
Readout	▪ **Topline data is expected in April 2015**

Source: www.clinicaltrials.gov, B. Greenberg et al. JACC–HF 2014, Celladon, Credit Suisse research

Mydicar is currently ahead of other gene therapies in clinical development for HF

HF Competitive Pipeline

Compound	Company	Stage	Mechanism of Action	Potential Launch Year	Comments
Mydicar	Celladon	PIIb	▪ Uses adeno-associated virus endoing the SERCA2a gene.	▪ US: 2020 ▪ EU: 2020	▪ Topline CUPID 2 PIIb data is expected in April 2016.
JVS100	Juventas	PII	▪ Uses non-viral plasmid encoding for stromal cell-derived factor-1.	▪ US: 2022 ▪ EU: 2022	▪ This 90-patient PI/II trial is expected to have data in October 2014.
Ad5.HAC6	Renova	PI/II	▪ Uses adenovirus serotype 5 encoding human adenyl cyclase type 6.	▪ US: 2022 ▪ EU: 2022	▪ This 56-patient PI/II trial is expected to have data in October 2014.
BB-R12	Beat	PC	▪ Involved in the delivery of R1R2 gene.	▪ US: - - - - - ▪ EU: - - - - -	▪ Beat plans to start clinical studies in early 2016.
Carfostin	NanoCor	PC	▪ Uses biological nanoparticles to deliver phosphatase-1 inhibitor-1 gene.	▪ US: - - - - - ▪ EU: - - - - -	▪ - - - - -
VN-100	VentriNova	PC	▪ Involved in the delivery of cyclin A2 gene.	▪ US: - - - - - ▪ EU: - - - - -	▪ - - - - -

Source: BioMedTracker, Beat, Celladon, Juventas, NanoCor, Renova, VentriNova, Credit Suisse research

Mydicar is expected to be protected from biosimilar competition through data exclusivity in the US and EU

Mydicar Patent Summary

Patent Family	Comments
Delivery of AAV Vectors to the Heart as a Therapy	▪ CLDN has been issued 2 patents in the US – 8,221,738 and 8,636,998, claiming use of vasodilator in conjunction with Mydicar. The expiration dates for 8,221,738 and 8,636,998 are July 2030 and October 2028 respectively. ▪ CLDN has been issued a corresponding patent in the EU (EP 2044199). The expiration date for this patents is expected to be July 2027 or October 2028.
Composition of MYDICAR	▪ CLDN has in-licensed certain patents in the US – 6,759,237; 7,186,552; and 7,172,893, relating to recombinant hybrid AAV vectors. The expiration dates for these patents are November 2019 and February 2021. ▪ CLDN has been issued a corresponding patent in the EU (EP 1127150). The expiration date for this patent is expected to be November 2019.
Manufacture of AAV Vectors	▪ CLDN has been issued patents in the US – 6,566,118; 6,989,264; 6,995,006; and 6,475,769, relating to the manufcature and purification of AAV vector used in Mydicar. ▪ CLDN has been issued corresponding patents in the EU (EP 1009808 and EP 1109892). The expiration dates for these patents are expected to be September 2018 or 2019.
Use of SERCA2a for the Treatment of Heart Failure	▪ CLDN has licensed certain patent rights in the US – 7,745,416 related to gene therapy for the purpose of increasing SERCA2a expression in the treatment of heart failure. These patent rights are expected to expire in 2015. ▪ CLDN has been issued corresponding patents in the EU (EP 0820310 and EP 1977767). The expiration date for these patents is April 2016.

- Mydicar will likely have data exclusivity of 12 years in the US and 10 years in the EU following approval.
- As such, in our base case, Mydicar will be protected from biosimilar competition until 2031 in the US and 2029 in the EU.
- There is potential that biosimilar competition could enter later than these dates, given that it may be challenging to develop "generic" genetic therapies.

Source: Celladon, Credit Suisse research

CLDN Management

Krisztina Zsebo PhD, CEO: Dr. Zsebo has served as Celladon's President, Chief Executive Officer and a member of the board of directors since 2004. Dr. Zsebo is a biopharmaceutical veteran with 30 years of experience in the industry. She has held numerous executive positions, and pioneered the development of MYDICAR at Celladon from basic research studies. Prior to joining Celladon, Dr. Zsebo was a Venture Partner at Enterprise Partners Venture Capital. At ALZA Corporation, she led the Biopharmaceutical Implant Division, which developed and filed the NDA for Viadur®, an implantable drug/device for prostate cancer patients. At Cell Genesys, she was responsible for filing their first IND for a gene therapy product for AIDS. She also led Cell Genesys' Xenotech division, which developed the first fully human monoclonal antibody producing mouse technology, later spun off to become Abgenix. Earlier in her career, Dr. Zsebo spent eight years at Amgen in where she worked on the discovery of NEUPOGEN®, as well as STEMOGEN®, and various aspects of EPOGEN® development. Dr. Zsebo received her Ph.D. in Biochemistry at UC Berkeley

Paul Cleveland, President and CFO: Mr. Cleveland has served as Celladon's President and Chief Financial Officer since June 2014. Prior to Celladon, Mr. Cleveland was Executive Vice President of Corporate Strategy and Chief Financial Officer of Aragon Pharmaceuticals, Inc. Aragon was sold to Johnson & Johnson in August 2013 for $1 billion. Prior to that, he was a General Partner and the Chief Operating Officer of Mohr Davidow Ventures, a venture capital firm. From 2006 to 2011 he was Executive Vice President, Corporate Development and Chief Financial Officer of Affymax, Inc. Earlier in his career, Mr. Cleveland was an investment banker at JP Morgan and Hambrecht & Quist, and a corporate lawyer at Davis Polk & Wardwell, Sidley & Austin and Cooley LLP. Mr. Cleveland serves on the board of directors of Sangamo BioSciences (SGMO), a public biotechnology company, where he chairs the audit committee. He received a J.D. from Northwestern University School of Law, and an A.B. from Washington University in St. Louis.

Rebecque J. Laba, VP Finance and Administration: Ms. Laba has served as our vice president, Finance and Administration since 2007, and before that, served as a consultant to Celladon on finance and administrative matters since 2005. From 1999 to 2005, Ms. Laba served in various financial and operational roles at Idun Pharmaceuticals, Inc. until Idun was acquired by Pfizer Inc., in 2005. From 1997 to 1999, Ms. Laba worked at Asset Management Group, where she served in various financial and operational roles.

Source: Celladon, Credit Suisse research

CLDN Management (continued)

Jeffrey J. Rudy, VP Clinical Operations: Mr. Rudy has over 20 years of industry experience and has served as our vice president, Clinical Operations since joining us in 2006. From 1997 to 2006, Mr. Rudy worked at Agouron Pharmaceuticals where he served in roles of increasing responsibility within its clinical research operations, including portfolio manager of the ophthalmology franchise and director of development operations. From 1995 to 1997, Mr. Rudy was at Gilead Sciences, Inc., where he was clinical program manager in the clinical research department overseeing a number of antiviral compounds in early development. From 1991 to 1994, Mr. Rudy was at Amgen, where he worked in clinical affairs on a number of antiviral programs. Mr. Rudy received his B.S. in Microbiology from Ohio State University.

Fredrik Wiklund, VP Corporate Development & Investor Relations: Mr. Wiklund has 20 years of biopharmaceutical experience and currently serves as our vice president, Corporate Development and Investor Relations. Prior to Celladon, Mr. Wiklund served as Head of Corporate Development and Investor Relations at Tercica, Inc. At his 5 years at Tercica, Mr. Wiklund assisted in the company's IPO and also completed strategic transactions exceeding $800M, including the company's sale to the Ipsen Group in 2008. Previously, Fred was an investment banker with Lehman Brothers where he assisted both pharmaceutical and emerging biotechnology companies complete capital-raising and strategic transactions. Mr. Wiklund also has over seven years of commercial experience, primarily with Gilead Sciences where he participated in the company's first commercial product launch in 1996. Mr. Wiklund received his M.B.A. from the University of Southern California and his B.A. from the University of San Diego.

Ryan K. Takeya, VP Manufacturing: Mr. Takeya has served as our vice president, Manufacturing since 2012. Prior to Celladon, Mr. Takeya was at Dendreon Corporation, where he was involved with the PROVENGE antigen manufacturing process. From 1996 to 2009, Mr. Takeya served in the Manufacturing Group at Targeted Genetics Corporation, where he oversaw in-house and contract manufacturing of clinical gene therapy products, including clinical supplies used in the MYDICAR clinical program. Earlier in his career, Mr. Takeya held various process development and process transfer roles at Immunex Corporation. Mr. Takeya received his B.A. in Chemistry from the University of Washington.

Source: Celladon, Credit Suisse research

CLDN Management (continued)

Elizabeth E. Reed, VP & General Counsel: Elizabeth E. Reed has served as our Vice President & General Counsel since June 2014. Prior to her appointment, Ms. Reed served as a legal consultant for several companies in the life sciences industry, including Celladon. From 2001 until 2012, Ms. Reed led the legal function at Anadys Pharmaceuticals, Inc., a publicly traded biopharmaceutical company, most recently serving as Senior Vice President, Legal Affairs, General Counsel and Corporate Secretary until Anadys' acquisition by Roche. Prior to Anadys, Ms. Reed was an attorney with the law firms Cooley LLP and Brobeck, Phleger & Harrison LLP. Ms. Reed is a member of the State Bar of California and received her B.S. in Business Administration from the Haas School of Business at the University of California, Berkeley and holds a J.D., cum laude, from Harvard Law School.

Scott Garrett, VP, Commercial Planning: Mr. Garrett has served as our Vice President, Commercial Planning since September 2014. Prior to Celladon Mr. Garrett served as Vice President, Marketing, Hospital Products for Mallinckrodt Pharmaceuticals (previously Cadence Pharmaceuticals) from 20011 to 2014. From 2009 to 2010, Mr. Garrett served as Senior Director, Marketing of Gilead Sciences, Inc. and from 2007 to 2009, Mr. Garrett served as Senior Director, Marketing of CV Therapeutics, Inc., which merged with Gilead Sciences. From 2002 to 2007 Mr. Garrett served in a range of Marketing roles at Scios Inc. which was acquired by Johnson and Johnson in 2004. Prior to that Mr. Garrett served in a variety of Sales, Marketing, Analytics and Product Development roles at Boston Scientific and Nycomed Amersham (now GE Health). Mr. Garrett received a B.S. in marketing from San Diego State University in 1991 and an M.B.A. from U.C. Irvine in 2001.

Source: Celladon, Credit Suisse research

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Companies Mentioned *(Price as of 10-Oct-2014)*

Celladon (CLDN.OQ, $9.47, OUTPERFORM[V], TP $20.0)

Disclosure Appendix

Important Global Disclosures

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Price Target: (12 months) for Celladon (CLDN.OQ)

Method: Our target price of $20 is DCF derived based on Mydicar sales in systolic heart failure in the US and EU, annual cash flows until 2031, 25% risk weighting on annual cash flows, 10% discount rate, and no terminal value.

Risk: The risks to our $20 TP are: (1) Mydicar is not approved or significantly delayed. (2) Mydicar does not demonstrate efficacy and/or safety expected from data on studies to date. (3) Mydicar could underperform our expectations for the product launch ramp and/or peak sales. (4) The systolic heart failure market may not become as large as expected.

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