Sage Therapeutics

An Opportunity Worth Seizing...Initiating at OW

Initiation
Overweight

SAGE, SAGE US
Price: $33.40

Price Target: $42.00

We are initiating coverage of Sage Therapeutics with an Overweight rating based on the potential of SAGE-547 for the treatment of super-refractory status epilepticus (SRSE) – a life threatening state of persistent seizure that is unresponsive to currently available therapies (and an orphan indication). Encouragingly, 9 of the first 10 patients treated responded to SAGE-547's unique mechanism, and additional data from an ongoing Phase 1/2 trial is anticipated in 2H14. We assume regulatory filings in 2016 and model peak US sales for SAGE-547 at ~$1B. Given there are no other therapies approved, we assume SAGE-547 captures 75% of the SRSE market. Sage's pre-clinical follow-on compounds could expand its footprint into earlier lines of therapy (which represent upside to our current estimates). Overall, we see Sage as well positioned with a near-term catalyst as well as likely data updates and regulatory progress throughout 2015 that should continue to de-risk the story and drive upside.

- **It's still early, but SAGE-547's 90% response rate is unprecedented in this condition.** SAGE-547 has been evaluated in 10 SRSE pts via emergency use INDs (n=6) and the Phase 1/2 clinical trial (n=4 so far). Pts developed SRSE for different reasons and had been in medically induced comas (to prevent brain damage) ranging from 4 to >90 days with failure to resolve seizure activity using available therapies. However, SAGE-547 was able to resolve the SRSE in 9 of 10 patients – a much higher rate than is typically seen (~30-50%).
- **With no approved treatments for SRSE, docs were impressed with the efficacy and clean safety profile in the initial patients.** We spoke with a number of KOLs who treat SRSE patients, all of whom were impressed with the early efficacy and especially the clean safety profile to date (no drug-related AEs reported). Every doc indicated the desire to use this drug earlier rather than later in SRSE, and some indicated they would use it even earlier to try and prevent SRSE from developing.
- **Follow-on candidates SAGE-689 and SAGE-217 for earlier lines of SE could grow the top line with significant infrastructure synergy.** These have the same MOA as SAGE-547 but different pharmacology that could make each one useful in different lines of SE. These products (which we think will be somewhat de-risked by 547 given MOA overlap) could add significant long-term revenue potential given larger pt numbers in earlier lines, which represents upside to our estimates.
- **Initiating at OW.** Our YE15 PT of $42 is based on a blended average of our NPV and scenario analysis (50% each). SAGE-547 in SRSE is the key driver. On a sum-of-the-parts basis, we assign ~$29/share to SAGE-547 in the US (60% prob of success) and ~$5/share EU (50% prob of approval, assuming ex-US partnership), plus ~$4/share for the pipeline and ~$4/share in estimated net YE15 cash.

Sage Therapeutics, Inc. (SAGE;SAGE US)

FYE Dec	2012A	2013A	2014E	2015E
EPS reported ($)				
Q1 (Mar)	-	(0.76)	(1.17)A	-
Q2 (Jun)	-	-	(1.22)	-
Q3 (Sep)	-	-	(0.46)	-
Q4 (Dec)	-	-	(0.51)	-
FY	(2.74)	(2.15)	(2.49)	(2.26)

Source: Company data, Bloomberg, J.P. Morgan estimates.

Biotechnology

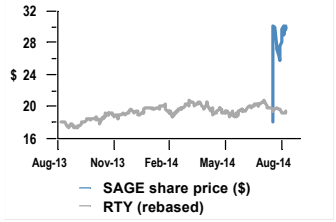
Cory Kasimov AC
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com
Bloomberg JPMA KASIMOV <GO>

Whitney G Ijem
(1-212) 622-4668
whitney.g.ijem@jpmorgan.com

Matthew J. Lowe, Ph.D.
(1-212) 622-0848
matthew.j.lowe@jpmorgan.com

Brittany Terner
(1-212) 622-8527
brittany.terner@jpmorgan.com
J.P. Morgan Securities LLC

Price Performance



	YTD	1m	3m	12m
Abs	66.4%	66.4%	66.4%	66.4%
Rel	68.1%	69.9%	63.3%	58.6%

Company Data	
Price ($)	33.40
Date Of Price	11-Aug-14
52-week Range ($)	32.80-24.25
Market Cap ($ mn)	207.28
Fiscal Year End	Dec
Shares O/S (mn)	6
Price Target ($)	42.00
Price Target End Date	31-Dec-15

See page 35 for analyst certification and important disclosures.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

J.P.Morgan

Table of Contents

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Investment Thesis

Sage Therapeutics (SAGE)

Overweight

SAGE-547 is a $GABA_A$ receptor modulator that binds to the receptor differently than do currently used agents, whose effect wears off over time

SAGE-547 is a proprietary formulation of allopregnanolone, a naturally occurring neurosteroid known to have sedative and anticonvulsant effects via its activity at $GABA_A$ receptors in the brain. Like anti-epileptic drugs used to treat status epilepticus (SE, a state of persistent seizure), SAGE-547 binds to $GABA_A$, inhibiting the seizure activity. Unlike other drugs that bind only to $GABA_A$ in the synapse, SAGE-547 binds to synaptic *and* extrasynaptic receptors. As such, it has the potential to treat super-refractory status epilepticus (SRSE) – or SE that does not respond to treatment with common anti-epileptic mediations. When SE becomes refractory, patients are placed into a medically induced coma to prevent brain damage. SE is deemed super-refractory when currently available medications are not sufficient to bring patients out of the coma without recurrence of seizure activity.

With no other approved therapies and no standard of care, there is significant unmet need in SRSE

There are currently no approved therapies for the treatment of SRSE, and strategies often involve changing the anti-epileptic/anesthetic mediation used for continuous infusion or adding additional medications to try to stop seizure activity. Further, there are no randomized, clinical trials in this setting to guide treatment; thus therapy is based on clinical reports and opinion. In addition to the various anesthetic medications used, non-anesthetic approaches are also often tried. These include magnesium infusions (relatively safe, though limited efficacy), ketogenic diets (case reports provide some evidence of effect), and hypothermia (case studies have shown efficacy, though with significant potential AE burden), among other methods. Our conversations with docs indicate that once a patient becomes super-refractory, the pt is able to be brought out of the medically induced coma only ~25-50% of the time.

Initial experience in SRSE patients via emergency-use INDs and in a clinical trial have shown a 90% response rate to SAGE-547

To date, SAGE-547 has been evaluated in 10 patients with SRSE. Six of the patients were treated under emergency-use INDs at independent centers, and were of ages ranging from 17 months to 28 years of age. Each case of SRSE arose from a presumed different underlying etiology, and all patients had been placed in a long-term medically induced coma. Of these 6 patients, 5 achieved resolution of SRSE during the course of treatment or soon after (only the 17 mos old infant did not). Additionally, Sage initiated a Phase 1/2 trial in January 2014, and 4 patients have been enrolled and treated. All four of these patients met the key efficacy endpoint and were successfully weaned off anesthetic while 547 was being administered. Importantly, no drug-related AEs have been reported to date in these patients.

Doctors were universally enthusiastic about the potential of SAGE-547 and highlighted the lack of AEs as an additional key benefit

We had the opportunity to speak with multiple KOLs in the field of status epilepticus and SRSE, all of whom were impressed with the early efficacy observed, especially in patients who had seen dozens of previous lines of therapy and had been in medically induced comas for months. Similarly, docs pointed to the notable lack of drug-related AEs. These physicians were not surprisingly careful to note that data in

a limited number of patients must be interpreted cautiously. That said, should these impressive results persist, docs unilaterally said they would use SAGE-547 in SRSE patients earlier rather than later given the desire to bring patients out of the coma as quickly as possible. Docs also indicated that, price wiling, they would not reserve this product for just SRSE; they would like to try it earlier in the course of SE with the goal of preventing patients from reaching the SRSE state in the first place.

Follow-on compounds SAGE-689 and SAGE-217 could bolster Sage's top line with significant infrastructure synergy

Sage's proprietary chemistry platform – which is based on a scaffold of chemically modified, endogenous neuroactive steroids – has produced two additional follow on candidates that are also allosteric modulators of the $GABA_A$ receptor both synaptically and extrasynaptically. While both compounds have the same MOA as SAGE-547, each has unique pharmacology that could support use in distinct lines of SE therapy. SAGE-689 is an IV agent currently in IND enabling studies and will be developed for the adjunctive treatment of status epilepticus. SAGE-217 is also in IND-enabling studies for both an IV and oral dosing form. As an oral agent, the compound is being developed in the maintenance setting for status epilepticus, and potentially in the setting of orphan genetic seizure disorders. In the IV formulation, it is being developed for the treatment of refractory status epilepticus.

We estimate peak US sales of SAGE-547 in SRSE of ~$1B

Of the ~150,000 cases/year of SE in the US, Sage estimates ~25K ultimately progress to SRSE. SAGE-547 has been granted fast-track designation from the FDA, and we assume NDA approval and launch in 2H17. We (perhaps conservatively) assume a launch price of $50K per administration, with SAGE-547 reaching peak share of 75% in 2022. Based on doc feedback, we also assume some off-label use in RSE, where it reaches peak penetration of 25% in 2022. Based on these assumptions, we estimate peak US revenues of ~$1B for SAGE-547. In the EU (G7 specifically), Sage believes SE incidence numbers are roughly the same as in the US. In the EU, we model peak sales of ~$500M, of which we assume Sage receives an average 25% royalty. Of note, our current valuation assumes exclusivity through 2024 in the US and 2028 in the EU, driven by orphan exclusivity; however, if pending patents issue, SAGE-547 exclusivity could extend to 2033 (representing upside to our estimates).

Balance sheet: SAGE appears well positioned financially

SAGE ended 1Q14 with ~$55M in cash, and subsequently raised ~$84M from an initial public offering of common stock in July (J.P. Morgan acted as a joint book-runner). We estimate SAGE ends 2014 with ~$108M in cash and believe the company has sufficient capital through at least 2015.

Initiate at Overweight: SAGE-547 is a differentiated treatment for a life-threatening disorder

We are initiating coverage of SAGE with an OW rating and YE15 PT of $42. We believe SAGE-547's unique mechanism of action should continue to generate positive data and that the significant unmet need in SRSE will drive uptake of SAGE-547 upon commercialization. Our target is based on a blended average of our risk-adjusted NPV model (50%) and proprietary scenario analysis (50%). On a sum-of-the-parts basis, we assign ~$29/share to SAGE-547 in the US (60% prob of success) and ~$5/share EU (50% prob of approval, assuming ex-US partnership), plus ~$4/share for the pipeline and ~$4/share in estimated net YE15 cash.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Risks to Rating and Price Target

Sage is susceptible to the standard risks that apply to the entire biotech industry, including development, regulatory, commercial, manufacturing, financing, and IP pitfalls. Risks more specific to Sage are outlined below:

Clinical Risk

SAGE-547 has only been used in 10 patients, 6 of whom were not in the setting of a clinical trial. It is possible that additional patients enrolled in the Phase 1/2 trial may respond differently to the drug, and the trial may not meet the safety and efficacy endpoints. Sage also intends to run a larger pivotal trial; it is possible that efficacy in a larger population may not be as robust and/or that previously unknown safety issues could emerge with broader use of the compound. Given the similarity between SAGE-547 and the pipeline compounds SAGE-689 and SAGE-217, it is possible that any potential safety or efficacy issues that arise with SAGE-547 could have read-through to the earlier pipeline programs.

IP risk

Sage's current IP estate revolves around several patent families of pending patent applications, which Sage has indicated are in the early stage of the prosecution process. It is possible that some of these patents may not issue. It is also possible that claims within each patent could change during the prosecution process, such that the final issued patent may not provide the level of protection intended when the patent application was written. We do note that orphan exclusivity has been granted to SAGE-547, which partially mitigates this risk by providing 7 and 10 years of exclusivity in the US and EU, respectively, regardless of the patent position.

Regulatory risk

As there are no currently approved therapies for the treatment of SRSE, there is no clear regulatory path. Further, as the profile of SAGE-547 is still being determined, details on the design of the pivotal trial are still unknown. Thus, there remains the risk that SAGE-547 will not be approved by the FDA or EMA. Regulatory agencies may want to see additional or longer-term data before approving the drug. If approved, it is possible that the label may not be as the company anticipates, potentially limiting the use of SAGE-547. Further, regulatory agencies could remove SAGE-547 from the market if the drug shows additional/more severe AEs in a real-world setting.

Commercial risk

The rate of uptake and/or pricing could limit sales of SAGE-547. SAGE-547 would be Sage's first commercial drug, and it is possible that uptake of the drug by physicians may be slower than expected. Further, the currently used therapies to treat SRSE are generic, which could affect pricing power in this market and could limit Sage's ability to price favorably and/or remain competitive.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Company Description

Sage Therapeutics is a Cambridge, MA-based biopharmaceutical company focused on the development and commercialization of medicines to treat life-threatening, rare CNS disorders. The company's proprietary chemical platform is based on novel chemical scaffolds of endogenous or synthetic neuroactive steroids that are allosteric modulators of $GABA_A$ and NMDA receptors. The company's lead product candidate is SAGE-547, an allosteric modulator of $GABA_A$ delivered via IV, which is currently in Phase 1/2 development for the treatment of super-refractory Status Epilepticus, or SRSE. The product has demonstrated promising early efficacy and safety in the setting of emergency-use INDs and the Phase 1/2 clinical trial (enrollment ongoing). Sage also has two pre-clinical candidates that are also allosteric modulators of $GABA_A$. These are being developed for use earlier in the progression of status epilepticus and are currently in IND enabling studies.

Upcoming Events

Figure 1: SAGE News Flow Highlights

Anticipated Newsflow Highlights

Program	Event	Expected Timing	Significance
SAGE 547	Data Update from Phase 1/2 Trial	2H14	High
	Potential Pivotal trial Start	2015	Low
	Potential Pivotal Data	2016	High
	Potential NDA/MAA Filings	2016	Low
SAGE 689	IND Filing	2H14	Low
SAGE 217	IND Filing	1H15	Low

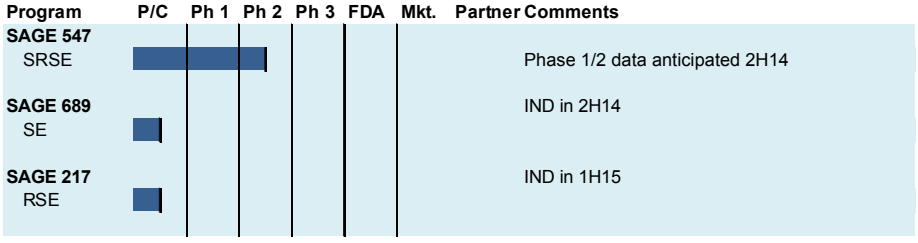
Source: Company reports and J.P. Morgan estimates.

For Sage in 2014, the key catalyst should be presentation of data from the ongoing Phase 1/2 trial, which is anticipated in 2H14, potentially at the American Neurological Association meeting (Oct. 12-14, Baltimore) or the American Epilepsy Society meeting (Dec. 5-9, Seattle). Sage also plans to file an IND for SAGE-689 in 2H14 and begin a Phase 1 trial with the compound shortly after, for potential data in 2015. For SAGE-217, IND filing is anticipated in 1H15.

Pipeline

Figure 2: SAGE Pipeline

Product Pipeline Highlights



Source: Company reports.

SAGE-547, the lead product candidate, is an allosteric modulator of the $GABA_A$ receptor and is administered via IV. The compound is currently being evaluated in a Phase 1/2 trial in patients with SRSE. Sage also has two additional preclinical follow-on candidates in its pipeline that are likewise allosteric modulators of the $GABA_A$ receptor. SAGE-689 is an IV agent currently in IND-enabling studies and will be developed for the adjunctive treatment of status epilepticus. SAGE-217 is also in IND-enabling studies for both an IV and oral dosing form. As an oral agent, the compound is being developed in the maintenance setting for status epilepticus, and potentially in the setting of orphan genetic seizure disorders. As an IV, it is being developed for the treatment of refractory status-epilepticus (RSE). Sage is also evaluating several pre-clinical candidates that are allosteric modulators of the NMDA receptor, which could be used to treat a variety of conditions such as depression, Alzheimer's disease, ADHD, and schizophrenia.

Doc Rounds: Physician Thoughts on SRSE and SAGE-547

Docs we spoke with were universally impressed with SAGE-547's safety and efficacy profile in initial patients.

We had the opportunity to speak with five clinicians and three scientists involved in research and treatment of SRSE. Below, we summarize our conversations with the five clinicians, several of whom were involved in the treatment of the initial patients treated with SAGE-547. Key takeaways include:

- Most docs we spoke with see 5-10 SRSE patients per year.
- While treatment paradigms in earlier lines of therapy (SE and RSE) are somewhat similar across institutions, treatment in the SRSE setting is highly variable across centers, and even what qualifies as SRSE is not well defined/standardized.
- The outlook for patients in a medically induced coma (burst suppression) via anesthetic agents who are unable to be weaned from these agents without recurrence of seizure is not good, with estimates ranging from 25-50% wean success rates in the SRSE setting.
- Docs were unilaterally impressed that all four of the initial patients treated with SAGE-547 were able to be weaned from anesthetic agents, especially given the duration of the medically induced coma in some of these patients (on the order of months) and the number of failed previous wean attempts.
- Docs who had used SAGE-547 noted that process-wise, it was very easy to use and there were no clear systemic effects from the drug (and patients were being very closely monitored given ICU/medically induced coma).

If the efficacy/safety profile in a larger trial looks similar, docs indicated that they would use this drug earlier rather than later in SRSE, and potentially off label in RSE.

- Most docs noted that if this works in a super-refractory setting, it is likely to be used in earlier lines of therapy also given 1) the desire to limit a patient's exposure to high dose anesthetics and 2) ICU docs are used to experimenting/going off label given the serious condition of patients.

Below we provide more detailed notes from each conversation.

Physician 1

Background: Neurologist at an academic center, sub-specialty trained in critical-care, neuro and epilepsy. Spends most of his time in critical care, but also some time in epilepsy and some general neurology. Treated eIND Patient 3, and is now involved in Phase 1/2 trial.

How many SRSE patients do you treat per year, and how are you treating? Sees 4 or 5 cases per year. In the earlier lines of SE, there are evidence-based guidelines for treatment, but as you progress through those and patients don't respond, you inevitably move to less evidence-based treatments. So typically SRSE treatment is just whatever teams have experience with. At his center, docs tend to try various combinations of propofol, ketamine, midazolam, and phenobarbital.

Typical success rate and QoL post SRSE? On first wean attempt (RSE), they typically have a 50% response rate… in a truly SRSE patient, success rate is lower, probably ~25%. If wean is successful and patients are able to be brought out of the coma, their QoL depends on the cause of the status epilepticus. In some cases (e.g. medication withdrawal), the patient wakes up and is relatively normal, but if TBI, patients come back more slowly, so it really depends.

Thoughts on SAGE-547 and/or MOA? Thinks it makes sense… it is being used as a seizure abortive agent rather than an anti-epileptic. The mechanism fits the disease as it targets $GABA_A$ receptors, but at a different site than benzodiazepines.

Experience with SAGE-547? The drug was easy to administer, with no obvious side effects. Patient had viral encephalopathy and quickly went into refractory SE and was placed in the coma. Spent several weeks trying different combinations of drugs – tried most of what was available – and tried hypothermia. Administered 547 over 4 days, and the EEG had some response, though 547 did not definitively stop SRSE at the time, but a week or so after the drug, SRSE did resolve (so it is hard to know if it was specifically due to 547). After coming out of SRSE, the patient had a handful of electrographic seizures, but when he did wake up, he improved very quickly.

What would you consider a successful outcome from Phase 1/2? If the patients are all relatively similar (and true SRSE patients), then he'd be convinced by a 50% signal. In truly SRSE patients, beating a coin flip is good, as mortality approaches 70-80% in these patients.

Physician 2

Background: Neuro intensivist and neurologist at a tertiary center. Primary interest is critically ill neurological patients. Treated eIND Patient 1.

How many SRSE patients do you treat per year, and how are you treating? Hard to say because definitions of the disease aren't standardized, but using the entry criteria in Sage's Phase 1/2 trial, probably see 10 patients per year, and probably 5 of those would be healthy enough to participate in a trial.

Typical success rate and QoL post SRSE? Success rate and ultimate outcome depends on underlying etiology, but generally think ~50% of patients make it, but less and less after each successive burst suppression wean-fail. Another question is how many people can actually tolerate the treatment (burst suppression/

polypharmacy) for an extended period of time and the read-through on that to QoL post SRSE.

Thoughts on SAGE-547 and/or MOA? If this compound proves to have efficacy, it will really compete with/complement early anesthetics (docs will want to use it sooner rather than later). **Experience with SAGE-547?** Patient was a young man just out of college, presented with seizures of unknown etiology and over the course of 3 or 4 months was treated with a milieu of anti-epileptics and general anesthesia... had 8-9 wean attempts that were unsuccessful on a variety of anesthetics. The main one was pentobarbital, though over time he became increasingly tolerant and extremely high doses were needed to maintain burst suppression. Typically need 70mg/kg to induce burst suppression – patient was at 300mg/kg by the time SAGE-547 treatment was initiated. Started 547 (omitted the bolus dose and instead slowly uptitrated); after two days of exposure the patient was rapidly weaned off barbiturates and within five days started to wake up. Currently the patient is cognitively intact. Drug appeared to be relatively benign on safety, no systemic side effects observed. **What would you consider a successful outcome from Phase 1/2?** Think the bar for efficacy is lower because the side effect profile is so much better than current agents. Even a glimpse of a benefit would be promising. So in the context of the ~50% failure rate with current therapies, could see the same rate with this drug and be okay with it given side effect profile. And if patients come out of status for a few days on 547 but ultimately relapse – that is still a powerful signal... the relapse just indicates the pathology is difficult to treat. In fact, at one point going through the IRB, there was a question as to whether it would be ethical to stop 547 treatment after five days if the patient relapses. Would like to continue to see the relative lack of AEs, though; even one or two AEs could give pause.

Physician 3

Background: Professor of Neurology, trained in neurology and clinical neurophysiology. Part of team that treated eIND Patient 1, now on Sage's Scientific Advisory Board.

How many SRSE patients do you treat per year, and how are you treating? See 4-12 SRSE patients per year, of various etiologies. It is generally thought that 1/3 of SE patients have known epilepsy, 1/3 develop it after a head injury/infection, and 1/3 have no known cause. Treat with various anesthetics/AEDs at increasing doses, changing the strategy post each failed wean.

Typical success rate and QoL post SRSE? Typically on the first wean attempt, only ~50% of patients are successfully taken off anesthetics, after that, think the success rate on subsequent weans is probably less than 20%. Post wean, a patient tends to relapse within the first 1-2 hours if they are going to, and thinks a 6-hour time point is well past the relapse phase…but would like to see successful wean last from 6-24 hours in the trial, at a minimum. After SRSE, there is a broad range of outcomes – many don't do well neurologically, but it's a function of many things, including what caused the status.

Thoughts on SAGE-547 and/or MOA? There is no question that if this is approved in a highly refractory setting, there will be a push to use it earlier. ICU docs are used to going off label, trying crazy things. The only thing that would impede that is if it is crazily priced.

Experience with SAGE-547? Was involved in treating the patient who had been in status for almost 90 days at the time of administration of 547, after which his status eventually resolved. Presented the case at a big medical meeting last year and there was a tremendous amount of interest.

What would you consider a successful outcome from Phase 1/2? If there is no safety signal and a moderate percentage of patients are able to be successfully weaned, that would be a positive result. There is a lot of enthusiasm around this drug amongst physicians…think clinicians generally feel that if it could improve the out come by 20% in these patients, that would be meaningful. Given the range of outcome expected post SRSE, and the various confounding factors, don't think there will be a reasonable possibility to define functional outcome measures in SRSE trials.

Physician 4

Background: Pediatric neurologist, Director of the pediatric neurocritical program at an academic institution. Treated eIND Patient 2 (first pediatric patient).

How many SRSE patients do you treat per year, and how are you treating? See ~30 cases of SE per year, probably 4-5 cases of SRSE. Treat with either medazolam, lorazepam, penytoin, or phenobarbital at increasing doses and varied combinations on each wean-fail.

Experience with SAGE-547? Treated an 11-year-old girl who presented with auto-immune epilepsy out of the blue. The patient had presented with acute onset seizures at a different center where they were unable to control her seizures; she had been in a medically induced coma for ~2 weeks when she was transferred to him. Tried several therapies, including non-anesthetic therapies such as hypermagnesium, hypothermia, and ketogenic diets, all of which had failed. Pt was 8-9 weeks into therapy when 547 was brought on board, and wean on day 5 of 547 was successful. Given the number of therapies (including all of the treatments for her underlying condition) can't say for sure it was 547, could be cumulative drug effects, or something else… just hard to know with n=1. This drug didn't have any side effects that other steroids do… saw no evidence of systemic effects, biochemical, hemodynamic, etc.

What would you consider a successful outcome from Phase 1/2? Would need to see that it doesn't cause any complications. In a 10pt open label trial... don't need to see that it can improve outcome, that is an unrealistic goal and patients will have a lot of comorbidities (e.g., infections, TBI). Want to see that it shortens the duration of exposure to other anticonvulsants, or that it is augmenting (improving) their effects.

Physician 5

Background: Co-director of the Neuro-intensive care unit at an academic center. PI in current Phase 1/2 trial.

How many SRSE patients do you treat per year, and how are you treating? SE is relatively common at his center; probably sees 30-40 patients per year that would qualify as SRSE per Sage's Phase 1/2 trial criteria. Treats with standard agents, such as continuous IV benzodiazepines, midazolam, or lorazepam. With each failed wean, increases dose, switches agents, or starts adding non-anesthetic AEDs. Add a 2nd and 3rd agent if still unable to wean, but once you reach 3 agents, get diminishing

returns with each addition. With the understanding that seizures will eventually stop at some point (in a worst case the cerebral cortex burns out and the patient won't wake up), so tend to be aggressive with treatment and keep going and going until something happens (e.g., life ending complication, stop seizures, or families give up).

Typical success rate and QoL post SRSE? Success rate of weans depends on underlying cause… e.g., TBI patients typically don't do well in terms of successful weans and subsequent outcome. If the brain is normal, however, they should have higher response rates and a relatively normal outcome.

What would you consider a successful outcome from Phase 1/2? Number 1 thing is want to see that it isn't harmful, no deaths or SAEs; or that if there are, they aren't more serious than the disease itself. On efficacy, if there is a hint or a trend in the right direction that it shortens the duration of status, that would be sufficient to endorse a much larger Phase 3 trial.

Status Epilepticus

Background on Seizures and Status Epilepticus

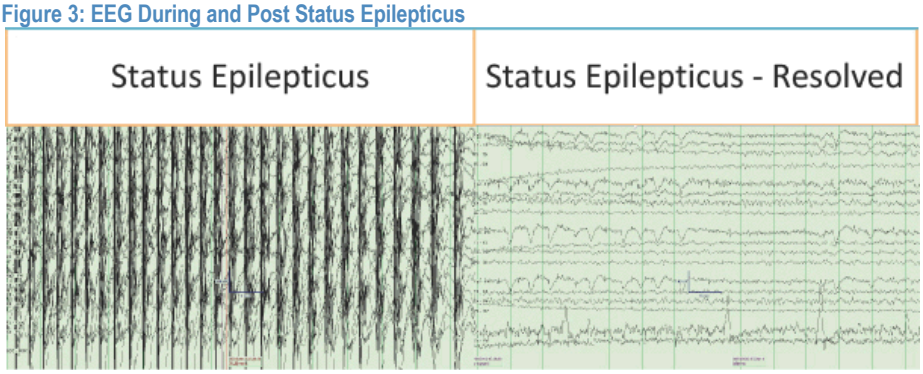
Status epilepticus (SE) is a state of persistent seizure, defined as a seizure lasting longer than 5 minutes.

A seizure is a single event of neurologic dysfunction wherein the abnormal excessive/synchronous firing of neurons in the brain produces clinical changes in motor control, sensory perception, behavior, or autonomic function. The abnormal neuronal firing is caused by an imbalance between excitation and inhibition of electrical signals, leading to surges of electrical activity, or action potentials, in the brain. Thus, in addition to the physical manifestations of a seizure, the abnormal electrical activity within the brain can also be observed on an electroencephalogram, or an EEG.

Most seizures resolve within a minute or two due to the innate mechanisms in the brain designed to halt errant neuronal firing. In some cases, however, these mechanisms aren't effective, and a seizure persists. The longer a seizure lasts, the less likely spontaneous termination becomes and the more difficult it is to control with anti-epileptic medications. Most importantly, the longer the seizure the greater the degree of potentially permanent neuronal damage that occurs; other consequences of persistent seizure activity include cardiac dysrhythmia, metabolic derangements, autonomic dysfunction, neurogenic pulmonary edema, hyperthermia, rhabdomyolysis, and pulmonary aspiration. Status epilepticus (SE) is defined as a seizure lasting longer than 5 minutes. What causes a single seizure to evolve into SE is not clearly defined and is likely multi-factorial and variable between patients.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Figure 3: EEG During and Post Status Epilepticus



Source: Company Presentation.

SE is a life threatening medical emergency, and the goal of treatment is to stop the seizure as quickly as possible.

Current treatment

SE is a life-threatening, medical emergency, and the goal of treatment is to emergently stop both clinical and electrographic seizure activity. Pharmacologic therapy for SE by nature proceeds in stages, and subsequent stages of SE are defined based on treatment failures.

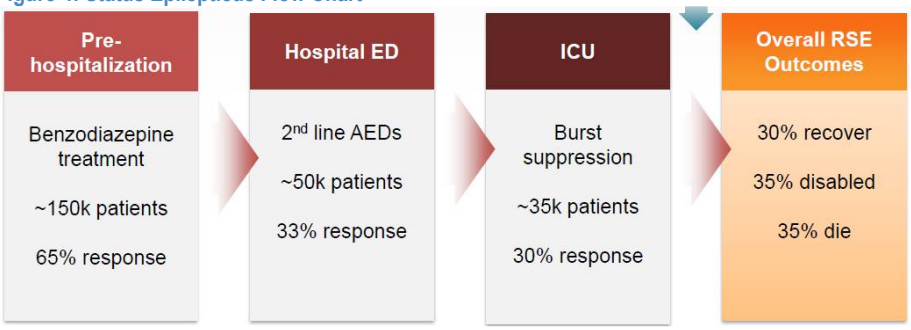
Emergent initial therapy, or first line therapy, for SE is IV benzodiazepines (BDZs), such as lorazepam, midazolam, and diazepam. Sage estimates that ~65% of SE patients respond to this 1L therapy. Urgent control AED treatment, or second line therapy, is more varied but generally involves IV fosphenytoin/phenytoin, valproate sodium, phenobarbital, levetiracetam, or continuous infusion midazolam. Guidelines published by the Neurocritical Care Society note that all patients presenting with SE will require 1st and 2nd line therapy. If the patient responds to the 1L BDZs and the SE completely resolves, the goal of 2L treatment is to rapidly achieve therapeutic levels of anti-epileptic drugs with continued dosing for maintenance therapy. In patients who don't respond to 1L treatment, the obvious goal of 2L is to stop the SE. Generally, ~50% of patients respond to second line therapy.

If a patient doesn't respond to first and second line therapy for SE, they are said to have refractory SE, or RSE, and are placed into a medically induced coma to give the brain time to rest/reset. If a patient is not able to be brought out of the coma without recurrence of seizure, they are deemed super-refractory, or SRSE.

If a patient fails 1st and 2nd line therapy they have then progressed to refractory status epilepticus (RSE) and proceed onto third line therapy. The goal of third line therapy is cessation of electrographic seizures (burst suppression) by being placed in a medically induced coma. The goal of burst suppression is to give the neuronal tissue time to restore function and reset to pre-seizure levels. This is achieved via a continuous IV infusion of midazolam, propofol, or pentobarbital. Typically, burst suppression is maintained for 24-48 hours, after which the patient is gradually weaned off the continuous IV AED treatment to determine if neuronal activity has in fact returned to normal levels. Depending on the source, 30-50% of patients typically respond to 3L therapy, and if they do not, patients are deemed super-refractory (SRSE) and placed back into a medically induced coma.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Figure 4: Status Epilepticus Flow Chart



Source: Company Presentation.

There are currently no approved therapies in SRSE, and no clear treatment guidelines on how to manage these patients. Treatment revolves around increasing doses of anesthetic/anti-epileptic medications.

There are currently no approved therapies for the treatment of SRSE, and treatment strategies often involve changing the AED used for continuous infusion, or adding another agent followed by subsequent wean attempts. There are no randomized, clinical trials in this setting to guide treatment; this therapy is based on clinical reports and opinions. In addition to combinations/variations of anesthetic medications, non-anesthetic approaches are also often used and include magnesium infusions (relatively safe, though limited efficacy), ketogenic diets (case reports provide some evidence of effect), and hypothermia (case studies have shown efficacy, though with significant potential AE burden), among other methods.

Figure 5: Non-Anesthetic Therapies Used in the Treatment of SRSE

Treatment	Dose recommended[a]/ physical parameter	Range of doses used (from the literature review)	Major adverse effects	Contraindications
Magnesium	Infusion to increase serum level to 3.5 mmol/l[b]	Bolus: 4 g Infusion: 2–6 g/h	High dose: hypotension, arrhythmia, neuromuscular block	Kidney failure
Pyridoxine	30 mg/kg (children) 100–200 mg/day (adults)	2–300 mg/day	Bradycardia, hypothermia, apnoea, sensory neuropathy	Hypersensitivity
Hypothermia	32–35°C (for <48 h) by endovascular cooling	30–36°C	Coagulation disorders, venous thrombosis, hypotension, shivering, acid–base and electrolyte disturbances, infections, cardiac arrhythmia, ileus, bowel ischaemia	Coagulopathy. Caution in immunodepression.
VNS	Up to 1.25 mA	0.25–1.75 mA	Bradycardia, asystole, coughing, hoarseness, Horner's syndrome	History of previous neck surgery or prior cervical vagotomy
Ketogenic diet	4:1 ketogenic ratio (see text)	1:1 to 4:1 ketogenic ratio	Constipation, acidosis, hypoglycaemia, hypercholesterolaemia.	Pyruvate carboxylase and β-oxidation deficiencies, propofol anaesthesia, porphyria.
Electroconvulsive therapy	Daily sessions for 3–8 days	3 daily sessions—6 sessions over 2 weeks	Intracranial pressure increases, cardiac arrhythmias, hypo/hypertension	Brain space-occupying lesions, recent history of myocardial infarction, cerebral vascular disease.
Steroids	Prednisolone 1 g/day intravenous for 3 days followed by 1 mg/kg/day (see text)	Various	Gastrointestinal ulceration, Cushingoid syndrome, fluid and sodium retention, psychiatric disturbance	Infection, severe hypertension or diabetes mellitus
Immunoglobulins	Intravenous immunoglobulins 0.4 g/kg/day for 5 days (see text)	Various	Coagulation disorders, hypertension	Coagulopathy, selective deficiency of IgA

a Recommended on the basis of experience and/or the literature review.

b The regimen recommended by Visser *et al.*, 2011.

VNS =vagal nerve stimulation; IgA = immunoglobulin A.

Source: Shorvon and Ferlisi. Brain (2011) 134 (10): 2802-2818.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

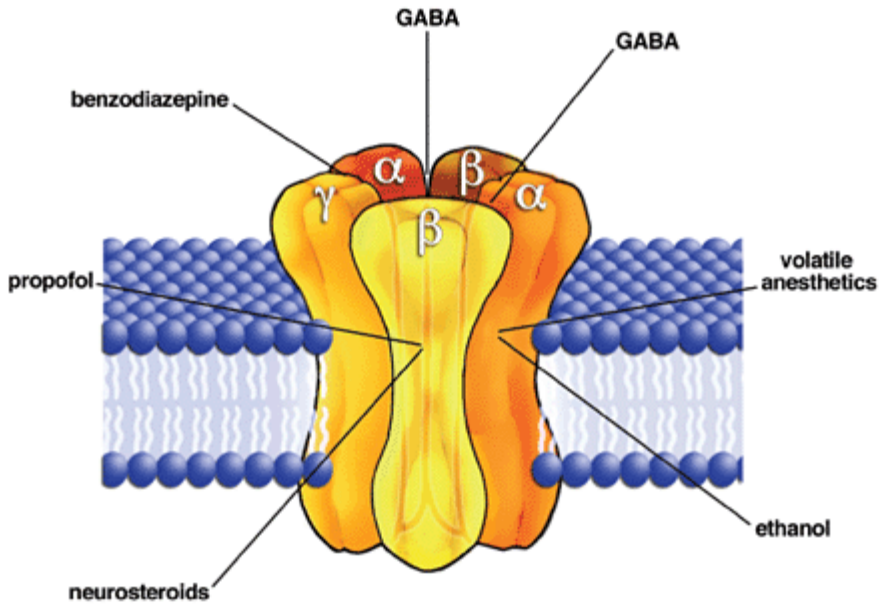
The $GABA_A$ Receptor and Its Role in Treating SE

Neurons are the work horses of the central nervous system, responsible for transmitting information throughout the body. Signals pass from one neuron to the next via synapses, or narrow gaps between the two neurons across which the signal is propagated. The signal-passing neuron, or the pre-synaptic neuron, can transmit a signal to the post-synaptic neuron via a chemical (neurotransmitter) or electrical (ions) signal. Receptors at the synapse on the post-synaptic neuron receive the signal, which can either be excitatory or inhibitory. The major neurotransmitters used in the brain are glutamate, gamma-amino-butyric acid (GABA), acetylcholine (ACh), norepinephrine, dopamine, serotonin, and histamine; glutamate is the major excitatory neurotransmitter while GABA is the major inhibitory neurotransmitter.

GABA is the major inhibitory neurotransmitter in the brain, and, as such, one of its receptors, $GABA_A$, is the target for several medications used to treat SRSE, including benzodiazepines, some general anesthetics, and anticonvulsants.

GABA binds to two receptors types, $GABA_A$ (ligand-gated chloride channels also modulated by benzodiazepines and barbiturates) and $GABA_B$ (G protein-coupled receptors). Under normal conditions, activation of $GABA_A$ receptors leads to hyperpolarization of the cell membrane and inhibition of neuronal activity. As such, $GABA_A$ is the target for several clinically important medications, including benzodiazepines, some general anesthetics, and anticonvulsants. Indeed, all of the medications mentioned above used to treat SE work through $GABA_A$.

Figure 6: Synaptic $GABA_A$ Receptor with Binding Sites for Various Agents Indicated



Source: Lovinger. *Communication Networks in the Brain.*National Institute on Alcohol Abuse and Alcoholism. 2008.

The $GABA_A$ receptor is composed of five subunits that form a Cl^- selective channel. Nineteen potential subunits have been identified, which allows for the expression of ~20-30 differed $GABA_A$ receptor isoforms, each having a distinct expression pattern. The subunits that make up a given isoform confer distinct biophysical and pharmacological properties. Receptors containing the γ2 subunit, with an α and β

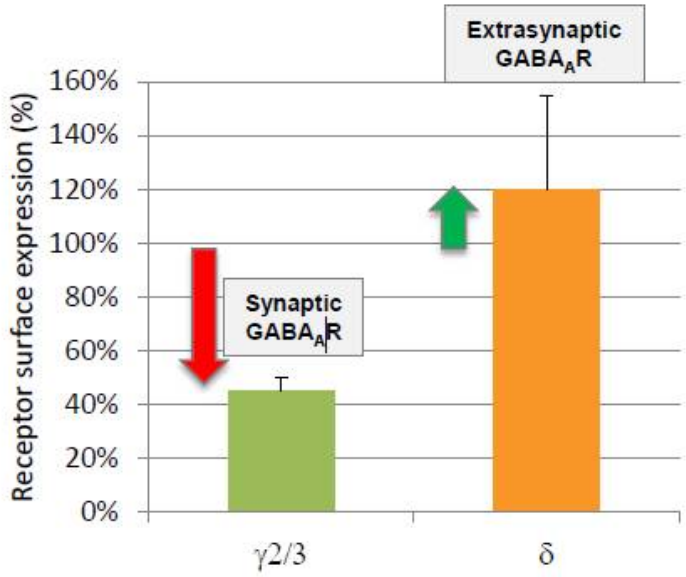
Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

subunit, are typically located at the post-synaptic interface, where they mediate a transient "phasic" response, whereas receptors made of the δ, in combination with an α4 or α6 and a β subunit are located outside of the synapse where they mediate a persistent "tonic" form of inhibition in response to ambient levels of GABA. Benzodiazepines interact primarily with synaptic $GABA_A$ receptors (in a binding pocket located between the α1 and γ2 subunits) with little or no activity at extra-synaptic receptors.

Benzodiazepines bind to $GABA_A$ receptors at the synapse, but during SE these receptors are internalized, leading to the progressive tolerance to these medications. However, the surface density of extrasynaptic receptors – to which benzodiazepines do not bind – remains constant during SE.

It is known that the receptors present on the surface of neurons are in a dynamic state under normal circumstances to fine-tune neuronal activity. Within minutes of the onset of SE, however, massive changes in gene expression occur, and the receptor trafficking intensifies. Subunit specific trafficking of $GABA_A$ receptors has been demonstrated in SE models, showing that the surface expression of the γ2 subunit is reduced, while the expression of the δ subunit remains relatively constant. In other words, the density of synaptic $GABA_A$ receptors decreases during SE as the receptors are trafficked away from the membrane, while the density of the extra-synaptic receptors appears to remain relatively constant.

Figure 7: Extrasynaptic $GABA_A$ Receptors Are Not Downregulated During SE



Source: Company Presentation.

Thus, while BDZs are initially effective in treating seizures, tolerance to BDZs ultimately develops, requiring higher and higher doses of anesthetic agents to maintain activity, but AEs at higher doses are limiting. This tolerance to commonly used agents is driven in part by the decreased expression of synaptic $GABA_A$, and could help explain the development of SE and RSE. On the contrary, extra-synaptic $GABA_A$ receptor density is not down-regulated during SE, and thus Sage believes these receptors are an attractive target for the treatment of BDZ resistant seizures.

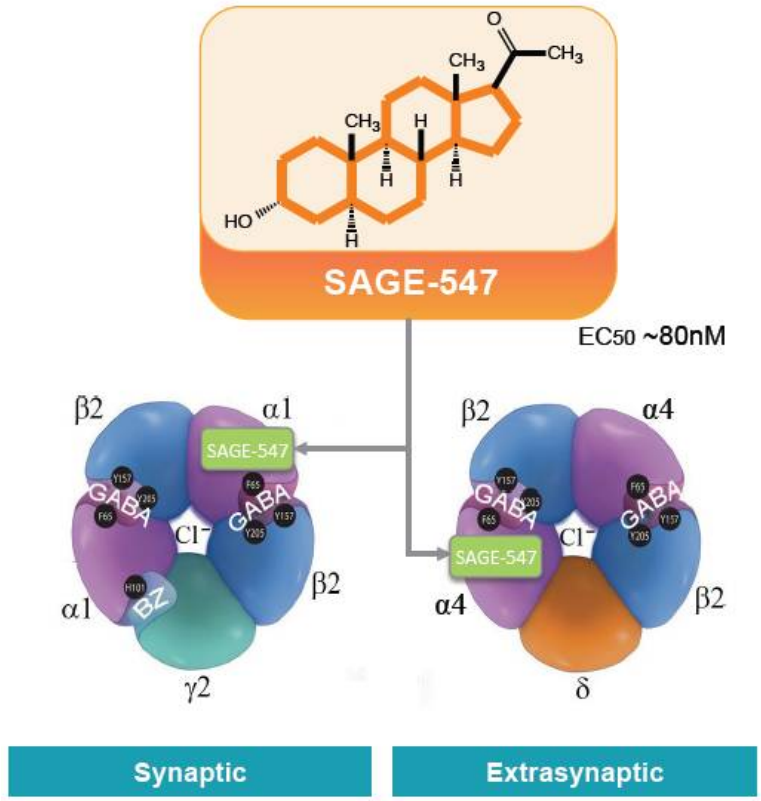
Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

SAGE-547

SAGE-547 binds to synaptic and extrasynaptic receptors and has the potential to treat SRSE that has become resistant to treatment with benzodiazepines.

Sage's lead product candidate is SAGE-547, an allosteric modulator of the $GABA_A$ receptor. SAGE-547 is a proprietary formulation of allopregnanolone, a neurosteroid, which is a known metabolite of progesterone and is formed in the CNS. Like allopregnanalone, 547 is a potent, positive allosteric modulator of *both* synaptic and extrasynaptic $GABA_A$ receptors binding to the α1 and α4 subunits, respectively. With activity at both the synaptic and extra-synaptic receptors, 547 has the potential to treat SRSE that as become resistant to other medications that bind only to the synaptic receptor.

Figure 8: SAGE-547 Binds to Synaptic and Extrasynaptic $GABA_A$ Receptors



Source: Company Presentation.

Early safety and efficacy data has been promising, both from use of the drug in the setting of emergency-use INDs and the initial patients enrolled in a Phase 1/2 trial. Enrollment in this study is ongoing, with data presentation expected in 2H14. Sage has received orphan drug designation and fast-track designation for SAGE-547 as a treatment for SE.

Clinical Data

To date, 547 has been evaluated in 10 patients with SRSE. Six of the patients were treated under emergency-use INDs at independent centers, and were of ages ranging from 17 months to 28 years. Each case of SRSE arose from a presumed different underlying etiology, and all patients had been placed in a long-term medically

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

induced coma. Of these 6 patients, 5 achieved resolution of SRSE during the course of treatment or soon after. Additionally, Sage initiated a Phase 1/2 trial in January 2014, and 4 patients have been enrolled and treated to date. All r of these patients met the key efficacy endpoint and were successfully weaned off anesthetic while 547 was being administered. Importantly, no drug-related AEs have been reported to date in these patients. More detail about each patient is provided below.

Early safety and efficacy data generated from the use of SAGE-547 in emergency IND settings and Phase 1/2 trial has been compelling, with a 90% response rate, and no drug-related AEs reported to date.

Emergency Use IND Patients

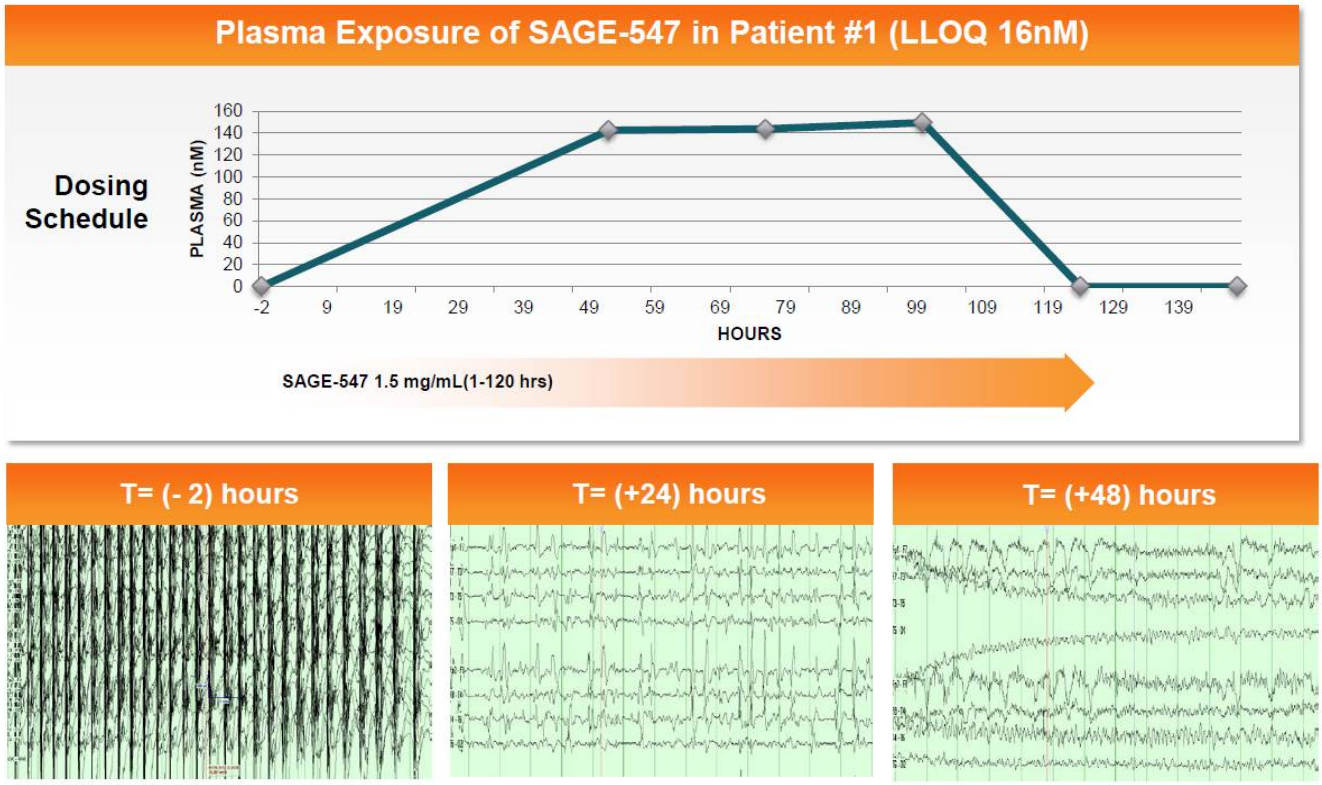
Figure 9: eIND Patient Summary

Patient	#1	#2	#3	#4	#5	#6
Age / Sex	23 / Male	11 / Female	28 / Male	2 / Female	17 months / Male	14 / Female
ICU Duration	>90 days	>60 days	>60 days	>30 days	>30 days	>30 days
Failed MultipleWeaning Attempts	Yes	Yes	Yes	Yes	Yes	Yes
Etiology	Unknown	Autoimmune (anti-Thyroid/ anti-GAD)	Unknown	Presumed Metabolic Disorder	Presumed Metabolic Disorder	Progressive Myoclonic Epileptic Encephalopathy
Drug-related SAEs	None	None	None	None	None	None
Steady-State Plasma Levels > 80nM	Yes	Yes	Yes	Yes	No	Yes
SE Resolved	Yes	Yes	Yes	Yes	No	Yes
Time from Discontinuation of SAGE-547 to Resolution of SRSE	Concurrent	Concurrent	3 days	Concurrent	N/A	3 days

Source: Company Presentation.

Patient 1. The first eIND patient was a 23-year-old male with SRSE of unknown etiology who had been previously healthy. Burst suppression was achieved with anesthetic agents, though repeated attempts at weaning were unsuccessful; the patient had been treated with ~20 regimens (both standard and alternative) prior to starting 547. 547 treatment was initiated on day 92 of SRSE, at which time the patient was also being treated with lacosamide, phenobarbital, clonazepam, levatiracitam, bromides, and ketogenic diet. After initiating 547 treatment, the patient's EEG normalized over the following 48-72 hours, and he was successfully weaned off of anesthetics. Subsequently, the patient continued to improve and was eventually discharged to a rehab facility, and ultimately home.

Figure 10: Correlation of SAGE-547 Plasma Levels with EEG Normalization in Patient 1



Source: Company Presentation.

Patient 2. Patient 2 was a previously healthy 11-year-old female with SRSE likely of autoimmune origin. The patient had been treated with several previous lines of therapy, including pentobarbital alone and in combination with various standard and alternative therapies, including ketamine, hypothermia, magnesium, and ketogenic diet along with drugs targeting the presumed underlying etiology. 547 treatment was initiated on day 52, at which time the patient was also being treated with a continuous pentobarbital infusion and was being treated with felbamate, phenytoin, phenobarbital and a ketogenic diet. On day 2 of 547 treatment, a pentobarbital taper was initiated, and on day 5 weaning was successful and 547 treatment was stopped. Post 547, the patient continued to have non-SE brief, focal seizures, though the seizure burden significantly reduced to 2-3/day. One week post 547 the patient was awake and following commands; recovery is ongoing and the patient is expected to restart school in fall 2014.

Patient 3. This previously healthy 28-year-old male was admitted to the ICU after a generalized seizure at home, and over 2 weeks his EEG progressed to SE. Burst suppression was induced via a combination of pentobarbital and ketamine, and several weaning attempts had failed. At the time 547 treatment was to be initiated, the patient had been in the ICU >60 days and was also being treated with phenytoin, lacosamide, valproate, pregabalin, pyridoxine, magnesium, IV immunoglobulin and steroids. Immediately prior to 547 start, the patient developed sepsis, likely due to ongoing anesthesia and intubation. Pentobarbital was withdrawn and 547 was initiated; over the 5-day 547 infusion, the EEG improved and continued to do so

post-547. Ultimately, the patient's seizures were able to be controlled with a combination of oral anti-seizure meds, and he was transferred to a step-down unit.

Patient 4. Patient 4 was a 2-year-old female with a 2-month history of epilepsy, and presented with SE of unknown etiology. She had been treated with several lines of previous therapy, including pyridoxine, methylprednisolone, benzodiazepine, propofol and midazolam. At the time of 547 initiation, the patient was being treated with pentobarbital, midazolam, phenobarbital, levetiraceta and dopamine. Within 24 hours, she was successfully weaned off of midazolam, and pentobarbital was reduced. At the end of 547 treatment, SE had been resolved, though the patient was found to have significant brain atrophy thought to be due to her underlying condition (though no definitive diagnosis).

Patient 5. This previously healthy 17–month-old patient initially presented with complex febrile seizures progressing to RSE of unclear origin. Seizures continued despite increasing doses of midazolam, phenobarbital, levetiracetam and lorazepam and a maintenance dose of levetiracetam 50 mg/kg twice a day. He continued to have seizures through additional treatments, including midazolam infusion and addition of a pentobarbital infusion, as well as solumedrol 30 mg/kg/day for five carnitine, coenzyme Q10 and riboflavin. 547 was initiated and administered for 5 days, though plasma levels achieved were substantially below the 150nM target, which Sage believes was due to the higher metabolic rate in this very young child vs. that seen in older children/adults (dosing was based on an extrapolation of adult dosing). During 547 administration, a midazolam wean was attempted, the patient experienced recurrence of seizures, thus midazolam was re-titrated to control seizures.

Patient 6. Patient 6 was a 14-year-old female with a history of progressive myoclonic epileptic encephalopathy and previous episodes of RSE that had responded to pentobarbital or midazolam. The patient presented again and was treated with several lines of therapy, including IV midazolam, along with maximal doses of ethosuximide, levetiracetam, clobazam and ketogenic diet and had failed multiple midazolam weans. Burst suppression was achieved with pentobarbital combined with midazolam, though she continued to have intractable focal myoclonic seizures. 547 was administered for 5 days, with initial failed wean attempt. One day after 547 treatment completion, she was successfully weaned off both pentobarbital and midazolam. Three days post 547, SRSE had resolved, her EEG had resolved, and she was beginning to respond to simple commands.

Phase 1/2 Trial

A Phase 1/2 trial is currently ongoing, with the goal of enrolling 10 SRSE patients.

Sage initiated a Phase 1/2 trial in January 2014, and enrollment in the trial is currently ongoing. To date, 10 trial sites are open, and Sage intends to open an additional 10 sites with the goal of enrolling a total of at least 10 SRSE patients. This open label study is enrolling SE patients who have failed therapy with 1L and 2L therapies and have failed general IV anesthesia administered over 24h (1 failed wean). Patients with anoxic brain injury or end organ damage of any major organ will be excluded, as these conditions could make recovery from SE or the underlying condition unlikely.

The trial consists of a 1-day screening period, 4-day treatment period, a 1-day dose-taper period, a 2-day acute follow-up period, and a 3-week extended follow-up period. On day 1 of treatment, patients will be given a 1-hour loading dose followed

by maintenance infusion. After 48 hours of 547 treatment, a wean from the continuous IV AED (3L agent) will be attempted. Currently, if a patient fails the wean attempt, they have failed the efficacy endpoint. However, Sage has applied for a protocol amendment that would allow for 547 dose escalation and re-treatment, followed by an initial wean attempt.

Figure 11:Phase 1/2 Trial Design Summary

Source: Company Presentation.

Four patients have been enrolled and treated to date, all of whom met the key efficacy endpoint and were able to be weaned from anesthetic during SAGE-547 administration.

The primary endpoint of the trial is to evaluate the safety and tolerability of 547 in SRSE patients as measured by adverse events, EEG, physical examinations, neurological examinations, vital signs, clinical laboratory measures, electrocardiograms and concomitant medication usage. Key secondary efficacy endpoints include the need to place the patient back into a medically induced coma for seizure control while on 547, as well as the duration of the observed response. As of the S-1 filing, four patients had been enrolled and treated in the trial. Each case of SRSE arose from a presumed different etiology, and patients ranged from age 14 to 65 (the FDA agreed to enroll a non-adult patient on a single-use basis). All four patients met the key efficacy endpoint and were able to be weaned from anesthetic during 547 administration, and three of the four were subsequently weaned from 547 without having to reinstate general anesthesia.

Figure 12:Phase 1/2 Patient Summary

Patient	#1	#2	#3	#4
Age / Sex	65 / Male	14*/ Female	33 / Female	36 / Male
ICU Duration	12 days	11 days	21 days	4 days
Failed One or More Weaning Attempts	Yes	Yes	Yes	Yes
Etiology	Subdural Hematoma	Landau-Kleffner Syndrome	HIV / Toxoplasmosis	Seizure Disorder/ Pneumonia
Drug-related Serious Adverse Event	None	None	None	None
Steady-State Plasma Levels > 80nM	Yes	Yes	Yes	Data pending
Key Efficacy Endpoint Met	Yes	Yes	Yes	Yes

Source: Company Presentation.

During the 3-week follow-up period, Patient 1 was discharged to a rehabilitation facility to continue recovery. Patient 3 remained in the hospital for treatment of severe ongoing medical conditions. Patient 4 was still in the follow-up period at the time of the S-1, and at the time continued to recover without the recurrence of SE. Patient 2 experienced a recurrence of SE upon 547 withdrawal and required reinstitution of general anesthesia. As with the eIND cases, no drug-related AEs have occurred in these patients to date.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Next Steps

Data from the ongoing Phase 1/2 trial is anticipated in 2H14.

The Phase 1/2 trial continues to enroll patients, with the goal of enrolling ~10 patients in total. Additionally, Sage has filed for a protocol amendment to the trial to allow for a higher dose and re-treatment, such that if a patient fails the first wean attempt while on 547, the dose can be escalated and a second wean attempt can be made. Sage plans to report data from the trial in 2H14, potentially at the American Neurological Association meeting (Oct. 12-14, Baltimore) or the American Epilepsy Society meeting (Dec. 5-9, Seattle).

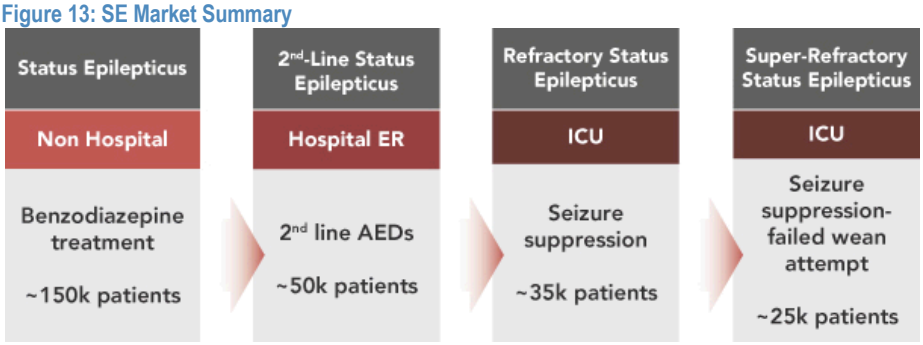
Sage has also initiated an expanded access program in parallel with the ongoing Phase 1/2 trial, to allow patients who don't fit the trial entry criteria access to the drug.

Market opportunity

As estimated 150,000 cases of SE occur each year in the US, with ~25,000 of those patients progressing to SRSE.

Sage estimates that there are ~150,000 cases of SE in the US each year, of which ~50,000 patients progress to hospital admittance and 2L AEDs. Approximately 35,000 of these patients ultimately progress to RSE and are placed into a medically induced coma in the ICU; ~25,000 patients ultimately are SRSE and would be eligible for treatment with SAGE-547.

Figure 13: SE Market Summary



Source: Company Presentation.

We assume launch in 2017 at $50K/administration, reaching peak penetration of 75% in SRSE and 25% in RSE in 2022, giving peak US sales of ~$900M.

We assume a pivotal trial starts early 2015, with data and IND filing in 2016. SAGE-547 has been granted fast-track designation from the FDA, and we assume NDA approval and launch in the second half of 2017. We assume a launch price of $50,000 per administration and assume a gross-to-net adjustment of ~15% given the use in the hospital setting. In SRSE, we assume 547 ultimately reaches a peak market share of 75% in 2022 (5 years post launch). We also assume some off-label use in the RSE setting based on doctor feedback that 1) if data continues to look as positive as it has, docs would use this as early in treatment as possible depending on price, and 2) docs repeatedly noted that the definitions around RSE and SRSE are often not very clearly defined in clinical practice. We assume 547 reaches peak penetration of 25% in 2022 in RSE. Under these assumptions, we model peak US revenues of ~$1BM for SAGE-547. In the EU, Sage believes SE incidence numbers are roughly the same in the G7 as in the US. In the EU, we model launch 1 year later than in the US (2018) and assume that at peak, EU SAGE-547 sales are ~55% those of the US, of which we assume sage receives an average 25% royalty.

Figure 14: SAGE-547 Revenue Build

		2016	2017	2018	2019	2020	2021	2022
US Status Epilepticus								
Status Epilepticus	*0.50%*	151,504	152,261	153,023	153,788	154,557	155,329	156,106
SE Pts on 547		-	-	-	-	-	-	-
547 Share		*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
2L SE alopreg naïve pts	*33%*	50,501	50,754	51,008	51,263	51,519	51,776	52,035
2L Pts on 547		-	-	-	-	-	-	-
547 Share		*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*	*0.00%*
RSE alopreg naïve pts	*70%*	35,351	35,528	35,705	35,884	36,063	36,244	36,425
RSE Pts on 547		-	-	**893**	**1,794**	**3,606**	**7,249**	**9,106**
547 Share		*0.00%*	*0.00%*	*2.50%*	*5.00%*	*10.00%*	*20.00%*	*25.00%*
SRSE alopreg naïve pts	*71%*	25,251	25,377	24,611	23,837	22,153	18,640	16,911
SRSE Pts on 547		-	**1,269**	**3,692**	**7,151**	**9,969**	**11,184**	**12,684**
547 Share		*0.00%*	*5.00%*	*15.00%*	*30.00%*	*45.00%*	*60.00%*	*75.00%*
Total Patients on 547		-	1,269	4,584	8,945	13,575	18,432	21,790
% of Total SE pts on SAGE-547		*0.0%*	*0.8%*	*3.0%*	*5.8%*	*8.8%*	*11.9%*	*14.0%*
Gross WAC	*2%*	$50,000	$51,000	$52,020	$53,060	$54,122	$55,204	$56,308
Net WAC	*18%*	$41,000	$41,820	$42,656	$43,510	$44,380	$45,267	$46,173
Total US Revenue ($m)		**$0.00**	**$26.53**	**$195.55**	**$389.21**	**$602.46**	**$834.39**	**$1,006.09**
SE Rev		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2L SE		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
RSE		$0.00	$0.00	$38.08	$78.06	$160.05	$328.13	$420.46
SRSE		$0.00	$53.06	$157.47	$311.14	$442.42	$506.26	$585.64

Source: J.P. Morgan and Company estimates.

To the best of our knowledge, there are currently no other therapies in development for the treatment of SRSE. Marinus Pharmaceuticals is currently developing a synthetic analogue of allopregnanolone, though not currently in SRSE.

Competitive Landscape

Based on our conversations with KOLs in the field, as well a clinicaltrials.gov search, we are not aware of any products in development for the treatment of SE, RSE, or SRSE. We do note that another company, Marinus Pharmaceuticals (MRNS, not covered), is currently developing a synthetic analogue of allopregnanolone (ganaxolone) for the treatment of epilepsy behaviors in Fragile X Syndrome as well as other orphan and non-orphan CNS disorders.

Currently, ganaxolone is being evaluated in a Phase 2b trial in patients with drug-resistant focal onset seizures. Data from this trial, which could be pivotal, is anticipated in 2H15. Proof-of-concept trials are also ongoing in Fragile X-associated disorder and PCDH19 female pediatric epilepsy, which should produce data in mid-2015 and 1H15, respectively. While trials in SE/RSE/SRSE are not currently ongoing, the company does list SRSE as potential additional indication where ganaxolone could have efficacy in it's recently filed S-1 (the company went public in July). We note that ganaxolone is currently dosed orally, which would not be suitable for the treatment of RSE/SRSE, and to date Marinus has not reported an IV formulation of ganaxolone.

Intellectual Property

We assume SAGE-547 exclusivity of 7.5 and 10 years in the US and EU, respectively, driven by orphan exclusivity, though pending patents could take IP to 2033.

Sage does not yet have any issued patents in its portfolio; applications are currently in the early stages of prosecution. The patent applications fall into three categories covering SAGE-547, $GABA_A$ receptor modulators (including species and genus claims to SAGE-689), and NMDA receptor modulators. In addition to patents, Sage also relies on trade secrets and know-how. As these patents have not yet issued, we currently model SAGE-547 exclusivity for 7 years in the US and 10 years in the EU, driven by orphan drug exclusivity.

- **SAGE-547.** Sage owns two patent families related to SAGE-547. These families cover compositions containing allopregnanolone and a cyclodextrin, which can be used for the treatment of CNS disorders such as traumatic brain injury and SE (Jan 2033 expiry if issued) and methods of treating seizure disorders, such as SE, by administering allopregnanolone using particular dosing regimens or multiple dosage phases (Aug 2033 expiry if issued).

- **$GABA_A$ receptor modulators and SAGE-689.** Sage has also exclusively licensed (from Washington University) 7 patent families directed to certain GABA receptor modulating compound and methods of using the compounds (e.g. in anesthesia and or treatment of GABA related disorders). One of the families (co-owned by Sage) discloses and claims SAGE-689, and would expire in Dec 2033. The remainder of the patents in the remaining families, if issued, would expire between 2032 and 2034. Sage also owns 9 patent families directed to additional GABA receptor modulating compounds and methods of using these compounds in anesthesia or treatment of GABA-related disorders. Patents within these families would expire from October 2032 to August 2034. Within these patents, Sage also has genus and species claims to the majority of compounds in their $GABA_A$ receptor modulator collection, including SAGE-217.

- **NMDA.** On the NMDA front, Sage owns three families of patent applications directed towards NMDA receptor modulators. Two are directed towards NMDA receptor modulating compounds that can be used to treat NMDA-related disorders such as CNS related conditions. The other is directed toward using a naturally occurring compound as a biomarker in patients who would benefit from treatment with an NMDA receptor modulator. Patents within these families, if issued, would expire between Sept 2032 and March 2034.

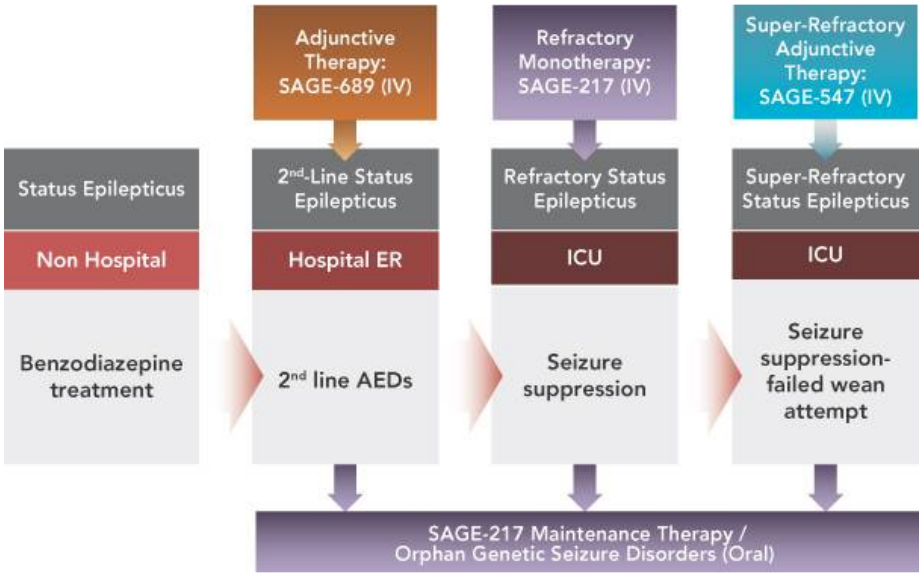
Pipeline Candidates

Sage has 2 pre-clinical pipeline candidates that are also allosteric modulators of $GABA_A$ at synaptic and extra synaptic receptors.

Sage's proprietary chemistry platform – which is based on a scaffold of chemically modified, endogenous neuroactive steroids – has produced two additional follow-on candidates that are also allosteric modulators of the $GABA_A$ receptor. SAGE-689 is an IV agent currently in IND-enabling studies that will be developed for the adjunctive treatment of status epilepticus. SAGE-217 is also in IND-enabling studies in both an IV and oral dosing form. As an oral agent, the compound is being developed in the maintenance setting for status epilepticus, and potentially in the setting of orphan genetic seizure disorders. In the IV formulation, it is being developed for the treatment of refractory status epilepticus.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Figure 15: Sage's SE Product Candidates



Source: Company Presentation.

SAGE-689

SAGE-689 is currently being developed as an adjunctive therapy for the treatment of Status Epilepticus. An IND is expected to be filed in 2H14.

SAGE-689 is being developed as an adjunctive, acute dose therapy in the setting of SE, in patients whose seizures were did not resolve after treatment with BDZ in a non-hospital setting. More specifically, Sage is developing the compound so that it will have an optimal profile as a second-line therapy, prior to a patient being placed into a medically induced coma. SAGE-689 has a wide therapeutic window that allows for modulation of the receptor without inducing deep anesthesia. Further, the compound has a short half–life, leading to rapid onset and loss of activity, which would be ideal in this setting given patients could be either discharged or transferred to the ICU for further treatment without residual drug effects. Sage is also developing an intramuscular injection formulation for 689.

Pre-clinical summary

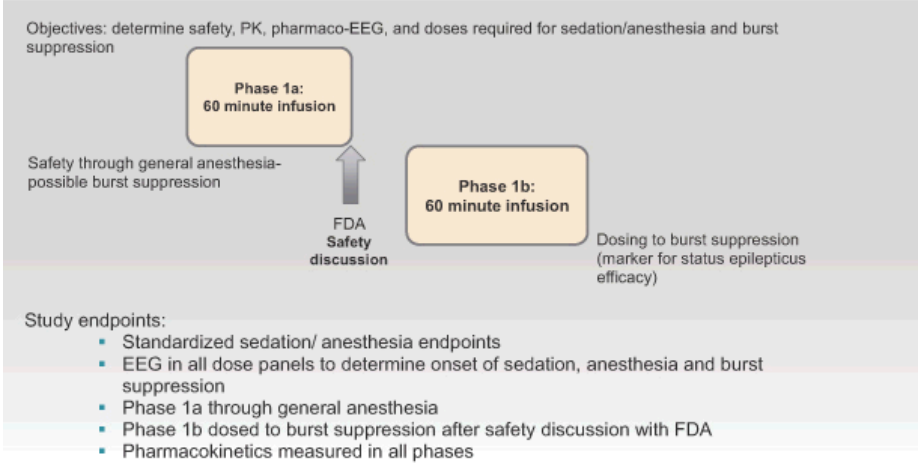
In pre-clinical animal studies, SAGE-689 has been shown to have anti-convulsant, anxiolytic and sedative properties. In an SE animal model where BDZs have been shown to be ineffective in cessation of seizure, a single IV bolus dose of 689 (5mg/kg and 15 mg/kg) administered up to 60 minutes post SE induction completely stops seizure activity. Additionally, 689 prevented recurrence of seizure activity (as measured by EEG activity) for up to three hours after treatment. All of these effects appeared to be dose dependent.

689 was also shown to be an effective sedative/hypnotic agent, with similar fast acting/rapidly reversible profile in both rat and dog animal models. Single IV injections produced light sedation at low doses, and general anesthesia at higher doses. In a comparative study against propofol, 689 had a more manageable profile for achieving varying levels of sedation; progressively deeper sedation was achieved, which was easier to control with broader plasma exposures vs. propofol. On a safety front, 689 exhibited less severe cardiovascular and respiratory effects than propofol, displaying a therapeutic index for moderate sedation of [3]11-22x (compared to 3-4x for propofol). Importantly no apnea was observed in the study.

Next Steps

Sage plans to file an IND and start a Phase 1 trial for SAGE-689 in 2H14, with potential data in 1H15. The trial will evaluate safety, PK, pharmaco-EEG, and doses required for sedation, anesthesia, and burst suppression.

Figure 16: SAGE-689 Phase 1 Trial Design



Source: Company Presentation.

Intellectual Property

In addition to the GABA platform IP, which covers SAGE-689, the compound is also specifically claimed in a patent application filed in Dec. 2013 by Washington University. Sage has exclusive license to commercialize 689 from Washington University, and assuming this patent is issued, it will provide protection into 2033.

SAGE-217

SAGE-217 is currently being developed for the induction of burst suppression in RSE (IV) and as a maintenance therapy post SE (oral). IND is expected to be filed in 1H15.

SAGE-217 is being developed as an IV monotherapy for the treatment of RSE, for the induction of a medically induced coma. The compound has the ability to induce deep anesthesia and produce EEG-confirmed burst suppression. 217 has a long half-life, which should prevent rapid fluctuations of blood levels and also lead to an "auto-taper" on cessation of dosing. An oral formulation is also being developed for use in a maintenance setting after SE, RSE or SRSE resolution, with the goal of preventing recurrence. Sage believes 217 may also be used in the broader epilepsy population to prevent recurrence of seizures as well as a treatment of orphan genetic seizure disorders (e.g., Rett syndrome and Dravet syndrome).

Pre-clinical summary

SAGE-217 has been shown to have a pharmacokinetic profile that will allow for once-a-day dosing as an oral agent, and a very low infusion dose when administered via IV. In pre-clinical animal studies in pharmaco-resistant models, 217 has shown good anti-seizure activity in a dose dependent fashion. In rodent models, IV administration of 217 has produced complete cessation of seizures at 3mg/kg and 5mg/kg, and has also halted recurrence (as measured by EEG) for up to 3 hours after treatment. Pre-clinical safety studies are ongoing.

Next Steps

Sage plans to file an IND for SAGE-217 in 1H15.

NMDA

Sage's chemistry platform also includes allosteric modulation of NMDA receptors. Sage has developed a large pool of NMDA allosteric modulators that it believes has the potential to treat cognitive dysfunction diseases such as depression, Alzheimer's disease, ADHD and schizophrenia. While focus remains on SAGE-547 and the follow-on compounds in the near term, Sage eventually plans to develop these NMDA compounds with a focus on the indications where it can independently develop and commercialize.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Financial Outlook

Sage Therapeutics is a developmental-stage biotechnology company with upcoming clinical data (Phase 1/2 data in 2H14) and the potential for approval and launch in 2017 (assuming NDA and MAA filings in 2016). Currently, we do not model profitability until 2018. Sage has worldwide rights to SAGE-547, though for modeling purposes, we assume the company out licenses ex-US rights and receives a royalty on sales (we currently assume EU only).

OpEx expectations. Below we briefly highlight our assumptions for Sage's key operating spend line items.

- **COGS**. Given allopregnanolone is a small molecule, we anticipate COGS at peak will be <10%, inclusive of the low-single-digit royalties owed to various licensors.
- **R&D trends**. We assume R&D will continue to ramp as Sage executes the Phase 1/2 trial, a pivotal trial, and brings the follow-on compounds into the clinic. In the outer years, we assume the company will continue to invest in R&D on additional products given its technology platform and eventual commercial infrastructure.
- **SG&A trends**. We anticipate Sage will begin to build commercial infrastructure in 2016, ahead of the launch of SAGE-547, which we assume will occur in 2017. Our model reflects a field force of ~75 reps.

Sage's current cash position should be sufficient through at least 2015.

Sage ended 1Q14 with ~$55 million in cash

SAGE ended 1Q14 with ~$55M in cash, and subsequently raised ~$84M in an initial public offering of common stock in July (J.P. Morgan acted as a joint book-runner). We estimate SAGE ends 2014 with ~$108M in cash and believe the company will have sufficient capital through at least 2015.

Share count

We estimate Sage currently has ~27 million fully diluted shares outstanding (including ~26 million common shares and 1.5 million stock options post offering).

Figure 17: SAGE Key Financial Metrics

Key Financial Metrics	2013A	2014E	2015E	2016E	2017E	2018E
In $ M						
December financial year-end						
Cash	8.1	108.8	167.8	157.6	53.4	89.7
Debt						
CFOp + CapEx (burn)	(17.5)	(36.3)	(61.0)	(110.2)	(104.2)	36.3
Expected financing		-	-	-	-	-
Revenue	-	-	-	-	26.5	197.7
EPS	(2.15)	(2.49)	(2.26)	(3.53)	(3.06)	0.82
Consensus EPS						
Average shares outstanding	4.70	15.01	27.49	31.77	34.98	37.98
Fully diluted shares outstanding	8.49	16.51	28.99	33.27	36.48	39.48

Source: Company reports and J.P. Morgan estimates.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Valuation

We are initiating coverage of SAGE with an Overweight rating and a December 2015 price target of $42 per share.

Our December 2015 price target of $42 per share is based on a blended average of our proprietary probability-adjusted scenario analysis (50%) and a risk-adjusted NPV model (50%).

Figure 18: SAGE Valuation Summary

SAGE Valuation Summary			
Discount rate	14%		
4Q15 Fully Diluted Shares (m)	29.0		
Main value drivers	Prob of approval	Peak WW sales est (avg. scenario)	Avg peak yr
SAGE-547- Status Epilepticus - US	60%	$ 1,032	2022
SAGE-547- Status Epilepticus - G7	50%	$ 582	2024
Valuation methodology	Value / share	Weighting	Adj. value/ share
DCF			
P/E 2016			
Real options scenario analysis	$ 42.58	50%	21.29
Risk adjusted NPV analysis	$ 41.55	50%	20.78
Total			$ 42.06
Catalyst/liquidity discount			0%
YE15 Price Target			**$ 42**

Source: J.P. Morgan estimates.

Risk-adjusted NPV analysis (50% weighting)

In our risk-adjusted NPV analysis, we estimate SAGE-547 revenues and associated expenses (including taxes) over the expected patent life of the product. We complete this exercise for conservative, moderate, and aggressive sales scenarios and then assign a range of probabilities to each of these outcomes as well as to the possibility that the product is ineffective and generates zero value (which is conservatively 40% in our model). In this case, we also include a scenario with IP protection to 2033 (should patents issue). We apply a discount rate of 13.5%, based on SAGE's weighted average cost of capital (WACC) of 3.6% (derived from Bloomberg). We believe this is appropriate given the applied probability adjustments.

Figure 19: SAGE-547 rNPV Analysis

SAGE-547- Status Epilepticus - US					
	Peak Sales/Royalty	**NPV**	NPV/Share	Probability	/alue/Share
Not Approved	-	-	-	40%	-
IP to 2033		2,040.7	70.4	15%	10.6
Aggressive	1,585.8	1,751.9	60.4	15%	9.1
Base	1,057.2	1,089.2	37.6	25%	9.4
Disappointing	528.6	494.0	17.0	5%	0.9
Total				**100%**	**29.87**
SAGE-547- Status Epilepticus - G7					
	Peak Sales/Royalty	**NPV**	NPV/Share	Probability	/alue/Share
Not Approved	-	-	-	50%	-
IP to 2033	608.1	315.1	10.9	10%	1.1
Aggressive	1,192.1	413.2	14.3	15%	2.1
Base	596.1	206.6	7.1	15%	1.1
Disappointing	149.0	51.6	1.8	10%	0.2
Total				**100%**	**4.47**

Source: J.P. Morgan estimates.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Proprietary real options scenario analysis (50% weighting)

Using this model, we estimate the value of the company's development programs by assigning a range of probabilities to six different commercial scenarios (ranging from an ineffective product that generates zero value to a breakthrough treatment option) and analyze them over several possible peak sales years. We also evaluate a range of price-to-peak sales multiples for a small molecule asset (from 3-5x for an unpartnered small molecule drug and a 6-8x multiple on royalty revenues). Additionally, we again apply the company's WACC-derived discount rate of 13.5%.

Multiple-based scenario analysis for SAGE-547

Below, we demonstrate our analysis for SAGE-547 for SRSE in the US, SAGE's key value driver. We assume a 60% probability that SAGE-547 reaches the market for SRSE in the US and a 50% probability it reaches the market in Europe; we assume sales peak in 2022 and 2024, respectively, for each region. Below is our calculated value contribution from SAGE-547 for SRSE for a range of multiples if the drug generates peak sales of ~$1B in the US and ~$500 million in Europe.

Figure 20: SAGE-547 Scenario Analysis

Product:	**SAGE 547**		Peak year	2021			2022			2023			Average
Indication:	**SE**		Discount period	6.0			7.0			8.0			prob-adj
Market:	**US**												value
Ownership:	**Unpartnered**		Price/sales mult.	3	4	5	3	4	5	3	4	5	/share
	Prob.	Peak sales (millions)	Peak royalties (millions, 100%)	Value/share									
Ineffective	40%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Disappointment	5%	309	$ 309	$ 14.98	$ 19.98	$ 24.97	$ 13.20	$ 17.60	$ 22.00	$ 11.63	$ 15.51	$ 19.38	0.88
Below average	25%	619	$ 619	$ 29.97	$ 39.95	$ 49.94	$ 26.40	$ 35.20	$ 44.00	$ 23.26	$ 31.01	$ 38.77	8.85
Average	20%	1,032	$ 1,032	$ 49.94	$ 66.59	$ 83.24	$ 44.00	$ 58.67	$ 73.34	$ 38.77	$ 51.69	$ 64.61	11.80
Above average	5%	1,289	$ 1,289	$ 62.43	$ 83.24	$104.05	$ 55.00	$ 73.34	$ 91.67	$ 48.46	$ 64.61	$ 80.77	3.69
Breakthrough	5%	1,547	$ 1,547	$ 74.91	$ 99.88	$124.86	$ 66.00	$ 88.00	$110.00	$ 58.15	$ 77.54	$ 96.92	4.42
Total	**100%**												**$ 29.64**
Product:	**SAGE 547**		Peak year	2023			2024			2025			Average
Indication:	**SE**		Discount period	8.0			9.0			10.0			prob-adj
Market:	**G7**												value
Ownership:	**Partnered**		Price/sales mult.	6	7	8	6	7	8	6	7	8	/share
	Prob.	Peak sales (millions)	Peak royalties (millions, 100%)	Value/share									
Ineffective	50%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Disappointment	5%	233	$ 58	$ 4.37	$ 5.10	$ 5.83	$ 3.85	$ 4.49	$ 5.14	$ 3.39	$ 3.96	$ 4.52	0.23
Below average	15%	436	$ 109	$ 8.20	$ 9.56	$ 10.93	$ 7.22	$ 8.43	$ 9.63	$ 6.36	$ 7.42	$ 8.48	1.27
Average	20%	582	$ 145	$ 10.93	$ 12.75	$ 14.57	$ 9.63	$ 11.23	$ 12.84	$ 8.48	$ 9.90	$ 11.31	2.26
Above average	5%	872	$ 218	$ 16.39	$ 19.13	$ 21.86	$ 14.44	$ 16.85	$ 19.26	$ 12.73	$ 14.85	$ 16.97	0.85
Breakthrough	5%	1,163	$ 291	$ 21.86	$ 25.50	$ 29.14	$ 19.26	$ 22.47	$ 25.68	$ 16.97	$ 19.80	$ 22.62	1.13
Total	**100%**												**$ 5.73**

Source: J.P. Morgan estimates.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Management

Below we highlight key executives at Sage Therapeutics

Jeffrey Jonas, M.D., CEO

Dr. Jonas joined Sage in 2013, prior to which he served as the President of the Regenerative Medicine Division at Shire and was previously Senior Vice President of Research and Development, Pharmaceuticals at Shire. Before Shire, he served as the Executive Vice President of ISIS Pharmaceuticals, and before ISIS was the Chief Medical Officer and Executive Vice President at Forest Laboratories. Dr. Jonas has also held senior-level positions at Upjohn Laboratories, and he founded AVAX Technologies, where he served as President and CEO, and SCEPTOR Industries, where he served as Chairman, President and CTO.

Stephen Kanes, M.D., Ph.D, CMO

Dr. Kanes joined Sage in 2013. Before joining Sage Dr. Kanes was a practicing psychiatrist and also previously served as the Executive Director/Therapeutic Area Clinical Director for Inflammation, Neuroscience, and Respiratory GMED division of Astra Zeneca. While at Astra Zeneca, Dr. Kanes also served as the Medial Science Director for the neuroscience established brands and emerging anesthesia Group Product Team, as well as held other positions of increasing responsibility in the Neuroscience Discovery Medicine, early and late development groups. Before joining AZN, Dr. Kanes was a faculty member in the Psychiatry Department at the University of Pennsylvania School of Medicine.

Albert Robichaud, Ph.D, CSO

Dr. Robichaud is the Chief Scientific Officer of Sage and joined the company in 2011. Prior to joining Sage, he was the Vice President of Chemistry and Pharmacokinetic Sciences at Lundbeck USA, and before that Dr. Robichaud was Senior Director and Head of the Neuroscience Discovery Chemistry department of Wyeth Research.

Kimi Iguchi, CFO

Ms. Iguchi joined Sage in 2013 and serves as the Chief Financial Officer. Before joining Sage, Ms. Iguchi served as the Chief Operating Officer, North America, at Santhera Pharmaceuticals, prior to which she served as the Vice President of Finance at Cyberkinetics Neurotechnology Systems. Before Cyberkinetics, Ms. Iguchi was the Senior Director of Financial Reporting and Analysis at Millennium Pharmaceuticals, prior to which she was the Senior Manager External Reporting at Biogen.

Thomas D. Anderson, CCSO

Mr. Anderson is the Chief Commercial Strategy Officer at Sage and joined the company in 2014. Before joining Sage, he served as Senior Vice President Corporate Strategy and Commercial Assessment at Shire and was the General Manager for several psychiatry and neurology products at Shire. He also led Shire's specialty pharmaceutical's commercial operations, business information and strategic marketing functions. Before joining Shire, Mr. Anderson worked at Johnson & Johnson, where he held several senior-level roles in marketing, marketing research, sales and sales management, operations and engineering. He also served as President

and Chief Executive Officer at Ranir Corporation (dental products) and Executive Vice President and Chief Operating Officer of Lander Co. (healthcare-related consumer packaged goods).

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

Models

Figure 21: SAGE Income Statement

Sage Therapeutics Income Statement

Cory Kasimov
cory.w.kasimov@jpmorgan.com
212.622.5266

	2013A	1Q14A	2Q14E	3Q14E	4Q14E	2014E	2015E	2016E	2017E	2018E
US 547 Revenues						-	-	-	26.5	195.5
EU 547 Revenues						-	-	-	-	2.2
Total Product Revnue						-	-	-	26.5	197.7
License & Milestone	-					-	-	-	-	-
Contract, Grant & Collaboration	-					-	-	-	-	-
Total Revenues	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**26.5**	**197.7**
COGS	-					-	-	-	3.4	21.5
R&D	14.4	4.2	6.0	8.5	11.0	29.67	48.3	56.0	67.5	79.5
SG&A	3.9	1.6	1.6	1.9	2.2	7.3	14.0	56.2	62.7	64.4
Collaboration Expense	-					-	-	-	-	-
Total Operating Expenses	**18.3**	**5.8**	**7.6**	**10.4**	**13.2**	**37.0**	**62.3**	**112.2**	**133.6**	**165.4**
Operating Income	**(18.3)**	**(5.8)**	**(7.6)**	**(10.4)**	**(13.2)**	**(37.0)**	**(62.3)**	**(112.2)**	**(107.1)**	**32.4**
Net interest & other income	(0.0)	-	-	-	-	-	-	-	-	-
Accretion of redeemable conv. pref stock	(0.0)	(0.3)				(0.3)				
Income Tax (benefit)	-		-	-	-	-	-	-	-	-
GAAP Net Income	**(18.3)**	**(6.1)**	**(7.6)**	**(10.4)**	**(13.2)**	**(37.3)**	**(62.3)**	**(112.2)**	**(107.1)**	**32.4**
Non-GAAP Net Income	**(18.3)**	**(6.0)**	**(7.4)**	**(10.2)**	**(13.0)**	**(36.6)**	**(61.4)**	**(110.5)**	**(104.6)**	**35.9**
GAAP Basic EPS	(3.89)	(1.17)	(1.22)	(0.46)	(0.51)	(2.49)	(2.26)	(3.53)	(3.06)	0.85
GAAP Diluted EPS	**(2.15)**	**(1.17)**	**(1.22)**	**(0.46)**	**(0.51)**	**(2.49)**	**(2.26)**	**(3.53)**	**(3.06)**	**0.82**
Non-GAAP Basic EPS	#DIV/0!	(1.14)	(1.19)	(0.45)	(0.50)	(2.43)	(2.23)	(3.48)	(2.99)	0.94
Non-GAAP Diluted EPS	**(2.15)**	**(1.14)**	**(1.19)**	**(0.45)**	**(0.50)**	**(2.43)**	**(2.23)**	**(3.48)**	**(2.99)**	**0.91**
Basic Shares Outstanding	4.7	5.2	6.2	22.8	25.8	15.0	27.5	31.8	35.0	38.0
Shares added		5.2	1.0	16.6	1.0	23.8	2.0	2.0	2.0	2.0
Diluted Shares Outstanding	8.5	5.2	6.2	22.8	25.8	15.0	27.5	31.8	35.0	39.5
Margin Analysis:										
Gross margin	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*87%*	*89%*
Operating margin	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*16.36%*
Net margin	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*16.36%*
Tax Rate	***0.0%***	***0%***	***0%***	***0%***	***0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***	***0.0%***
Cost Analysis:										
COGS as % of tot. prod. sales	*NM*	*NM*	*NM*	*NM*	*NM*	*0.00%*	*15%*	*15%*	*13%*	*11%*
R&D as % of tot. revenue	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*254.41%*	*40.20%*
SG&A as % of tot. revenue	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*236.23%*	*32.55%*
Year-over-year growth:										
Total revenue	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*645.30%*
R&D Expense	*98.60%*	*61.56%*	*NM*	*NM*	*NM*	*106.68%*	*62.61%*	*16.06%*	*20.54%*	*17.78%*
SG&A Expense	*63.28%*	*100.62%*	*NM*	*NM*	*NM*	*86.56%*	*91.34%*	*301.43%*	*11.52%*	*2.70%*
Total operating expenses	*89.79%*	*70.85%*	*NM*	*NM*	*NM*	*102.36%*	*68.29%*	*80.24%*	*19.09%*	*23.77%*
Operating income	*NM*	*NM*	*NM*	*NM*	*NM*	*102.36%*	*68.29%*	*80.24%*	*-4.55%*	*-130.21%*
Net income	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*	*NM*
EPS	*NM*	*NM*	*NM*	*NM*	*NM*	*15.40%*	*-8.87%*	*55.93%*	*-13.31%*	*-126.77%*
Basic Shares	*33.44%*	*16.34%*	*NM*	*NM*	*NM*	*219.41%*	*83.06%*	*15.59%*	*10.11%*	*8.58%*
Diluted Shares	*NM*	*NM*	*NM*	*NM*	*NM*	*#DIV/0!*	*#DIV/0!*	*15.05%*	*13.16%*	*7.41%*

Source: J.P. Morgan estimates.

Figure 22: SAGE Balance Sheet

Sage Therapeutics Balance Sheet ($ millions)

Cory W. Kasimov
cory.w.kasimov@jpmchase.com
212.622.5216

	2013A	2014E	2015E	2016E	2017E	2018E
Assets						
Cash and cash equivalents	$ 8.1	$ 108.8	$ 167.8	$ 157.6	$ 53.4	$ 89.7
Prepaid Expenses	$ 0.3	$ 0.4	$ 0.4	$ 0.5	$ 0.5	$ 0.5
Total Current Assets	**8.4**	**109.2**	**168.2**	**158.1**	**53.9**	**90.2**
PPE, Net	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0					
Total Assets	**8.53**	**109.26**	**168.27**	**158.17**	**54.01**	**90.35**
Liabilities & Equity						
Accrued expenses	0.3	0.3	0.3	0.3	0.3	0.3
Accounts payable	2.0	2.2	2.4	2.6	2.9	3.2
Total Current Liabilities	**2.3**	**2.5**	**2.7**	**3.0**	**3.2**	**3.5**
Others	0.0	0.0	0.0	0.0	0.0	0.0
Total Liabilities	**2.36**	**2.56**	**2.78**	**3.02**	**3.28**	**3.57**
Preferred stock	37.7					
Common Stock	-					
Additional Paid in capital	0.1	137.1	257.1	357.1	357.1	357.1
Accumulated Deficit	(31.7)	(30.4)	(91.6)	(202.0)	(306.4)	(270.4)
Total Shareholders' Equity	**6.2**	**106.7**	**165.5**	**155.2**	**50.7**	**86.8**
Total Liabilities & Equity	**8.53**	**109.26**	**168.27**	**158.17**	**54.01**	**90.35**

Source: J.P. Morgan estimates.

Figure 23: SAGE Cash Flow Statement

Sage Therapeutics Cash Flow Statement ($ millions)

Cory W. Kasimov
cory.w.kasimov@jpmchase.com
212.622.5216

	2013A	2014E	2015E	2016E	2017E	2018E
Cash Flow from Operations						
Net Income	$ (18.3)	$ (37.3)	$ (62.3)	$ (112.2)	$ (107.1)	$ 32.4
Adjustments to reconcile net loss to net operating cash						
Depreciation & Amortization	0.0	0.1	0.1	0.1	0.1	0.1
Share-based compensation expense	0.1	0.8	0.9	1.7	2.5	3.5
Others	0.1					
Changes in operating assets and liabilities						
Prepaid expenses and other assets	(0.3)	0.0	0.0	0.0	0.0	0.0
Accounts payable	0.7	0.2	0.2	0.2	0.3	0.3
Accrued expenses	0.2					
Cash Flow from Operations	**$ (17.5)**	**$ (36.3)**	**$ (61.0)**	**$ (110.2)**	**$ (104.2)**	**$ 36.3**
Purchase of PPE	(0.00)					
Other	-					
Cash Flow from Investing	**$ (0.0)**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Issuance of common stock, net of costs	0.1	137.0	120.0	100.0	-	-
Proceeds from issuance of preferred stock	22.7					
Cash Flow from Financing	**$ 22.8**	**$ 137.0**	**$ 120.0**	**$ 100.0**	**$ -**	**$ -**
Total Change in Cash	5.3	100.7	59.0	(10.2)	(104.2)	36.3
Beginning Cash Balance	2.8	8.1	108.8	167.8	157.6	53.4
Ending Balance: Cash and Investments	**$ 8.1**	**$ 108.8**	**$ 167.8**	**$ 157.6**	**$ 53.4**	**$ 89.7**

Source: J.P. Morgan estimates.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

J.P.Morgan

Sage Therapeutics: Summary of Financials

Income Statement - Annual	FY13A	FY14E	FY15E	FY16E	Income Statement - Quarterly	1Q14A	2Q14E	3Q14E	4Q14E
Revenues	0	0	0	-	Revenues	0A	0	0	0
Cost of products sold	0	0	0	-	Cost of products sold	0A	0	0	0
Gross profit	-	-	-	-	Gross profit	-	-	-	-
SG&A	(4)	(7)	(14)	-	SG&A	(2)A	(2)	(2)	(2)
R&D	(14)	(30)	(48)	-	R&D	(4)A	(6)	(9)	(11)
Operating income	(18)	(37)	(62)	-	Operating income	(6)A	(8)	(10)	(13)
EBITDA	(18)	(37)	(62)	-	EBITDA	(6)A	(8)	(10)	(13)
Net interest (income) / expense	-	-	-	-	Net interest (income) / expense	-	-	-	-
Other income / (expense)	(0)	0	0	-	Other income / (expense)	0A	0	0	0
Income taxes	0	0	0	-	Income taxes	0A	0	0	0
Net income - GAAP	(18)	(37)	(62)	-	Net income - GAAP	(6)A	(8)	(10)	(13)
Net income - recurring	(18)	(37)	(62)	-	Net income - recurring	(6)A	(8)	(10)	(13)
Diluted shares outstanding	8	15	27	-	Diluted shares outstanding	5A	6	23	26
EPS - excluding non-recurring	(2.15)	(2.49)	(2.26)	-	EPS - excluding non-recurring	(1.17)A	(1.22)	(0.46)	(0.51)
EPS - recurring	(2.15)	(2.49)	(2.26)	-	EPS - recurring	(1.17)A	(1.22)	(0.46)	(0.51)

Balance Sheet and Cash Flow Data	FY13A	FY14E	FY15E	FY16E	Ratio Analysis	FY13A	FY14E	FY15E	FY16E
Cash and cash equivalents	8	109	168	-	Sales growth	-	-	-	-
Accounts receivable	-	-	-	-	EBIT growth	89.8%	102.4%	68.3%	-
Inventories	-	-	-	-	EPS growth - recurring	(21.3%)	15.4%	(8.9%)	-
Other current assets	0	0	0	-					
Current assets	8	109	168	-	Gross margin	-	-	-	-
PP&E	0	0	0	-	EBIT margin	-	-	-	-
Total assets	9	109	168	-	EBITDA margin	-	-	-	-
					Tax rate	0.0%	0.0%	0.0%	-
Total debt	0	0	0	-	Net margin	-	-	-	-
Total liabilities	2	3	3	-					
Shareholders' equity	6	107	165	-	Net Debt / EBITDA	42.3%	293.2%	269.0%	-
					Net Debt / Capital (book)	494.2%	6159.1%	8662.6%	-
Net income (including charges)	(18)	(37)	(62)	-					
D&A	0	0	0	-	Return on assets (ROA)	(317.3%)	(63.4%)	(44.9%)	-
Change in working capital	1	0	0	-	Return on equity (ROE)	(472.0%)	(66.1%)	(45.7%)	-
Other	0	1	1	-					
Cash flow from operations	(18)	(36)	(61)	-	Enterprise value / sales	-	-	-	-
					Enterprise value / EBITDA	NM	NM	NM	-
Capex	(0)	0	0	-	Free cash flow yield	(6.2%)	(7.2%)	(6.6%)	-
Free cash flow	(18)	(36)	(61)	-					
Cash flow from investing activities	(0)	0	0	-					
Cash flow from financing activities	23	137	120	-					
Dividends	-	-	-	-					
Dividend yield	-	-	-	-					

Source: Company reports and J.P. Morgan estimates.
Note: $ in millions (except per-share data).Fiscal year ends Dec

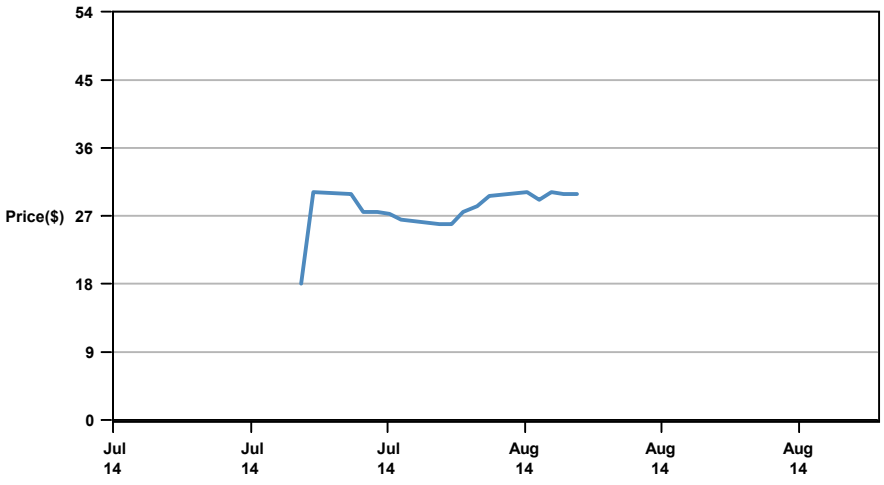
Analyst Certification: The research analyst(s) denoted by an "AC" on the cover of this report certifies (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect his or her personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report. For all Korea-based research analysts listed on the front cover, they also certify, as per KOFIA requirements, that their analysis was made in good faith and that the views reflect their own opinion, without undue influence or intervention.

Important Disclosures

- **Market Maker:** JPMS makes a market in the stock of Sage Therapeutics.
- **Lead or Co-manager:** J.P. Morgan acted as lead or co-manager in a public offering of equity and/or debt securities for Sage Therapeutics within the past 12 months.
- **Client:** J.P. Morgan currently has, or had within the past 12 months, the following company(ies) as clients: Sage Therapeutics.
- **Client/Investment Banking:** J.P. Morgan currently has, or had within the past 12 months, the following company(ies) as investment banking clients: Sage Therapeutics.
- **Investment Banking (past 12 months):** J.P. Morgan received in the past 12 months compensation from investment banking Sage Therapeutics.
- **Investment Banking (next 3 months):** J.P. Morgan expects to receive, or intends to seek, compensation for investment banking services in the next three months from Sage Therapeutics.

Company-Specific Disclosures: Important disclosures, including price charts, are available for compendium reports and all J.P. Morgan–covered companies by visiting https://jpmm.com/research/disclosures, calling 1-800-477-0406, or e-mailing research.disclosure.inquiries@jpmorgan.com with your request. J.P. Morgan's Strategy, Technical, and Quantitative Research teams may screen companies not covered by J.P. Morgan. For important disclosures for these companies, please call 1-800-477-0406 or e-mail research.disclosure.inquiries@jpmorgan.com.

Sage Therapeutics (SAGE, SAGE US) Price Chart



Source: Bloomberg and J.P. Morgan; price data adjusted for stock splits and dividends.

The chart(s) show J.P. Morgan's continuing coverage of the stocks; the current analysts may or may not have covered it over the entire period.
J.P. Morgan ratings or designations: OW = Overweight, N= Neutral, UW = Underweight, NR = Not Rated

Explanation of Equity Research Ratings, Designations and Analyst(s) Coverage Universe:
J.P. Morgan uses the following rating system: Overweight [Over the next six to twelve months, we expect this stock will outperform the average total return of the stocks in the analyst's (or the analyst's team's) coverage universe.] Neutral [Over the next six to twelve months, we expect this stock will perform in line with the average total return of the stocks in the analyst's (or the analyst's team's)

coverage universe.] Underweight [Over the next six to twelve months, we expect this stock will underperform the average total return of the stocks in the analyst's (or the analyst's team's) coverage universe.] Not Rated (NR): J.P. Morgan has removed the rating and, if applicable, the price target, for this stock because of either a lack of a sufficient fundamental basis or for legal, regulatory or policy reasons. The previous rating and, if applicable, the price target, no longer should be relied upon. An NR designation is not a recommendation or a rating. In our Asia (ex-Australia) and U.K. small- and mid-cap equity research, each stock's expected total return is compared to the expected total return of a benchmark country market index, not to those analysts' coverage universe. If it does not appear in the Important Disclosures section of this report, the certifying analyst's coverage universe can be found on J.P. Morgan's research website, www.jpmorganmarkets.com.

Coverage Universe: Kasimov, Cory W: ACADIA Pharmaceuticals (ACAD), Aegerion Pharmaceuticals (AEGR), Alkermes, Inc. (ALKS), Arena Pharmaceuticals, Inc. (ARNA), Ariad Pharmaceuticals (ARIA), Array BioPharma (ARRY), BioCryst Pharmaceuticals (BCRX), BioMarin Pharmaceuticals (BMRN), Clovis Oncology (CLVS), Dendreon (DNDN), Emergent BioSolutions (EBS), Exelixis, Inc (EXEL), Geron Corp (GERN), Halozyme Therapeutics (HALO), ImmunoGen (IMGN), Incyte Corporation (INCY), Infinity Pharmaceuticals (INFI), Isis Pharmaceuticals (ISIS), Keryx Biopharmaceuticals (KERX), Lexicon Pharmaceuticals (LXRX), MannKind Corporation (MNKD), Nektar Therapeutics (NKTR), Orexigen Therapeutics (OREX), Pharmacyclics, Inc. (PCYC), Rigel Pharmaceuticals (RIGL), Sangamo BioSciences (SGMO), Seattle Genetics (SGEN), The Medicines Company (MDCO), Ultragenyx (RARE), VIVUS, Inc (VVUS), ZIOPHARM Oncology (ZIOP), ZS Pharma (ZSPH), bluebird bio (BLUE)

J.P. Morgan Equity Research Ratings Distribution, as of June 30, 2014

	Overweight (buy)	Neutral (hold)	Underweight (sell)
J.P. Morgan Global Equity Research Coverage	45%	43%	11%
IB clients*	55%	49%	34%
JPMS Equity Research Coverage	46%	47%	7%
IB clients*	75%	66%	54%

*Percentage of investment banking clients in each rating category.
For purposes only of FINRA/NYSE ratings distribution rules, our Overweight rating falls into a buy rating category; our Neutral rating falls into a hold rating category; and our Underweight rating falls into a sell rating category. Please note that stocks with an NR designation are not included in the table above.

Equity Valuation and Risks: For valuation methodology and risks associated with covered companies or price targets for covered companies, please see the most recent company-specific research report at http://www.jpmorganmarkets.com, contact the primary analyst or your J.P. Morgan representative, or email research.disclosure.inquiries@jpmorgan.com.

Equity Analysts' Compensation: The equity research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors, and overall firm revenues.

Other Disclosures

J.P. Morgan ("JPM") is the global brand name for J.P. Morgan Securities LLC ("JPMS") and its affiliates worldwide. J.P. Morgan Cazenove is a marketing name for the U.K. investment banking businesses and EMEA cash equities and equity research businesses of JPMorgan Chase & Co. and its subsidiaries.

All research reports made available to clients are simultaneously available on our client website, J.P. Morgan Markets. Not all research content is redistributed, e-mailed or made available to third-party aggregators. For all research reports available on a particular stock, please contact your sales representative.

Options related research: If the information contained herein regards options related research, such information is available only to persons who have received the proper option risk disclosure documents. For a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options, please contact your J.P. Morgan Representative or visit the OCC's website at http://www.optionsclearing.com/publications/risks/riskstoc.pdf

Legal Entities Disclosures
U.S.: JPMS is a member of NYSE, FINRA, SIPC and the NFA. JPMorgan Chase Bank, N.A. is a member of FDIC. **U.K**.: JPMorgan Chase N.A., London Branch, is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and to limited regulation by the Prudential Regulation Authority. Details about the extent of our regulation by the Prudential Regulation Authority are available from J.P. Morgan on request. J.P. Morgan Securities plc (JPMS plc) is a member of the London Stock Exchange and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. Registered in England & Wales No. 2711006. Registered Office 25 Bank Street, London, E14 5JP. **South Africa**: J.P. Morgan Equities South Africa Proprietary Limited is a member of the Johannesburg Securities Exchange and is regulated by the Financial Services Board. **Hong Kong**: J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong and/or J.P. Morgan Broking (Hong Kong) Limited (CE number AAB027) is regulated by the Securities and Futures Commission in Hong Kong. **Korea**: J.P. Morgan Securities (Far East) Ltd, Seoul Branch, is regulated by the Korea Financial Supervisory Service. **Australia**: J.P. Morgan Australia Limited (JPMAL) (ABN 52 002 888 011/AFS Licence No: 238188) is regulated by ASIC and J.P. Morgan Securities Australia Limited (JPMSAL) (ABN 61 003 245 234/AFS Licence No: 238066) is regulated by ASIC and is a Market, Clearing and Settlement Participant of ASX Limited and CHI-X. **Taiwan**: J.P.Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and regulated by the Taiwan Securities and Futures Bureau. **India:** J.P. Morgan India Private Limited

(Corporate Identity Number - U67120MH1992FTC068724), having its registered office at J.P. Morgan Tower, Off. C.S.T. Road, Kalina, Santacruz - East, Mumbai – 400098, is a member of the National Stock Exchange of India Limited (SEBI Registration Number - INB 230675231/INF 230675231/INE 230675231) and Bombay Stock Exchange Limited (SEBI Registration Number - INB 010675237/INF 010675237) and is regulated by Securities and Exchange Board of India. Telephone: 91-22-6157 3000, Facsimile: 91-22-6157 3990 and Website: www.jpmipl.com. For non local research reports, this material is not distributed in India by J.P. Morgan India Private Limited. **Thailand**: This material is issued and distributed in Thailand by JPMorgan Securities (Thailand) Ltd., which is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission and its registered address is 3rd Floor, 20 North Sathorn Road, Silom, Bangrak, Bangkok 10500. **Indonesia**: PT J.P. Morgan Securities Indonesia is a member of the Indonesia Stock Exchange and is regulated by the OJK a.k.a. BAPEPAM LK. **Philippines**: J.P. Morgan Securities Philippines Inc. is a Trading Participant of the Philippine Stock Exchange and a member of the Securities Clearing Corporation of the Philippines and the Securities Investor Protection Fund. It is regulated by the Securities and Exchange Commission. **Brazil**: Banco J.P. Morgan S.A. is regulated by the Comissao de Valores Mobiliarios (CVM) and by the Central Bank of Brazil. **Mexico**: J.P. Morgan Casa de Bolsa, S.A. de C.V., J.P. Morgan Grupo Financiero is a member of the Mexican Stock Exchange and authorized to act as a broker dealer by the National Banking and Securities Exchange Commission. **Singapore**: This material is issued and distributed in Singapore by or through J.P. Morgan Securities Singapore Private Limited (JPMSS) [MCI (P) 199/03/2014 and Co. Reg. No.: 199405335R] which is a member of the Singapore Exchange Securities Trading Limited and is regulated by the Monetary Authority of Singapore (MAS) and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) which is regulated by the MAS. This material is provided in Singapore only to accredited investors, expert investors and institutional investors, as defined in Section 4A of the Securities and Futures Act, Cap. 289. Recipients of this document are to contact JPMSS or JPMCB Singapore in respect of any matters arising from, or in connection with, the document. **Japan**: JPMorgan Securities Japan Co., Ltd. is regulated by the Financial Services Agency in Japan. **Malaysia**: This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-X) which is a Participating Organization of Bursa Malaysia Berhad and a holder of Capital Markets Services License issued by the Securities Commission in Malaysia. **Pakistan**: J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Saudi Arabia**: J.P. Morgan Saudi Arabia Ltd. is authorized by the Capital Market Authority of the Kingdom of Saudi Arabia (CMA) to carry out dealing as an agent, arranging, advising and custody, with respect to securities business under licence number 35-07079 and its registered address is at 8th Floor, Al-Faisaliyah Tower, King Fahad Road, P.O. Box 51907, Riyadh 11553, Kingdom of Saudi Arabia. **Dubai**: JPMorgan Chase Bank, N.A., Dubai Branch is regulated by the Dubai Financial Services Authority (DFSA) and its registered address is Dubai International Financial Centre - Building 3, Level 7, PO Box 506551, Dubai, UAE.

Country and Region Specific Disclosures

U.K. and European Economic Area (EEA): Unless specified to the contrary, issued and approved for distribution in the U.K. and the EEA by JPMS plc. Investment research issued by JPMS plc has been prepared in accordance with JPMS plc's policies for managing conflicts of interest arising as a result of publication and distribution of investment research. Many European regulators require a firm to establish, implement and maintain such a policy. This report has been issued in the U.K. only to persons of a kind described in Article 19 (5), 38, 47 and 49 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this document relates is only available to relevant persons and will be engaged in only with relevant persons. In other EEA countries, the report has been issued to persons regarded as professional investors (or equivalent) in their home jurisdiction. **Australia:** This material is issued and distributed by JPMSAL in Australia to "wholesale clients" only. This material does not take into account the specific investment objectives, financial situation or particular needs of the recipient. The recipient of this material must not distribute it to any third party or outside Australia without the prior written consent of JPMSAL. For the purposes of this paragraph the term "wholesale client" has the meaning given in section 761G of the Corporations Act 2001. **Germany:** This material is distributed in Germany by J.P. Morgan Securities plc, Frankfurt Branch and J.P.Morgan Chase Bank, N.A., Frankfurt Branch which are regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht. **Hong Kong:** The 1% ownership disclosure as of the previous month end satisfies the requirements under Paragraph 16.5(a) of the Hong Kong Code of Conduct for Persons Licensed by or Registered with the Securities and Futures Commission. (For research published within the first ten days of the month, the disclosure may be based on the month end data from two months prior.) J.P. Morgan Broking (Hong Kong) Limited is the liquidity provider/market maker for derivative warrants, callable bull bear contracts and stock options listed on the Stock Exchange of Hong Kong Limited. An updated list can be found on HKEx website: http://www.hkex.com.hk. **Japan:** There is a risk that a loss may occur due to a change in the price of the shares in the case of share trading, and that a loss may occur due to the exchange rate in the case of foreign share trading. In the case of share trading, JPMorgan Securities Japan Co., Ltd., will be receiving a brokerage fee and consumption tax (shouhizei) calculated by multiplying the executed price by the commission rate which was individually agreed between JPMorgan Securities Japan Co., Ltd., and the customer in advance. Financial Instruments Firms: JPMorgan Securities Japan Co., Ltd., Kanto Local Finance Bureau (kinsho) No. 82 Participating Association / Japan Securities Dealers Association, The Financial Futures Association of Japan, Type II Financial Instruments Firms Association and Japan Investment Advisers Association. **Korea:** This report may have been edited or contributed to from time to time by affiliates of J.P. Morgan Securities (Far East) Ltd, Seoul Branch. **Singapore:** JPMSS and/or its affiliates may have a holding in any of the securities discussed in this report; for securities where the holding is 1% or greater, the specific holding is disclosed in the Important Disclosures section above. **India:** For private circulation only, not for sale. **Pakistan:** For private circulation only, not for sale. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money. JPMSAL does not issue or distribute this material to members of "the public" as determined in accordance with section 3 of the Securities Act 1978. The recipient of this material must not distribute it to any third party or outside New Zealand without the prior written consent of JPMSAL. **Canada:** The information contained herein is not, and under no circumstances is to be construed as, a prospectus, an advertisement, a public offering, an offer to sell securities described herein, or solicitation of an offer to buy securities described herein, in Canada or any province or territory thereof. Any offer or sale of the securities described herein in Canada will be made only under an exemption from the requirements to file a prospectus with the relevant Canadian securities regulators and only by a dealer properly registered under applicable securities laws or, alternatively, pursuant to an exemption from the dealer registration requirement in the relevant province or territory of Canada in which such offer or sale is made. The information contained herein is under no circumstances to be construed as investment advice in any province or territory of Canada and is not tailored to the needs of the recipient. To the extent that the information contained herein references securities of an issuer incorporated, formed or created under the laws of Canada or a province or territory of Canada, any trades in such securities must be conducted through a dealer registered in Canada. No securities commission or similar regulatory authority in Canada has reviewed or in any way passed judgment upon these materials, the information contained herein or the merits of the securities described herein, and any representation to the contrary is an offence. **Dubai:** This report has been issued to persons regarded as professional clients as defined under the DFSA rules. **Brazil**: Ombudsman J.P. Morgan: 0800-7700847 / ouvidoria.jp.morgan@jpmorgan.com.

Cory Kasimov
(1-212) 622-5266
cory.w.kasimov@jpmorgan.com

J.P.Morgan

General: Additional information is available upon request. Information has been obtained from sources believed to be reliable but JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively J.P. Morgan) do not warrant its completeness or accuracy except with respect to any disclosures relative to JPMS and/or its affiliates and the analyst's involvement with the issuer that is the subject of the research. All pricing is as of the close of market for the securities discussed, unless otherwise stated. Opinions and estimates constitute our judgment as of the date of this material and are subject to change without notice. Past performance is not indicative of future results. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipient of this report must make its own independent decisions regarding any securities or financial instruments mentioned herein. JPMS distributes in the U.S. research published by non-U.S. affiliates and accepts responsibility for its contents. Periodic updates may be provided on companies/industries based on company specific developments or announcements, market conditions or any other publicly available information. Clients should contact analysts and execute transactions through a J.P. Morgan subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

"Other Disclosures" last revised June 21, 2014.