UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): October 17, 2018

AEGLEA BIOTHERAPEUTICS, INC.
(Exact name of registrant as specified in its charter)

Delaware	**001-37722**	**46-4312787**
(State or other jurisdiction of incorporation)	**(Commission File Number)**	**(IRS Employer Identification No.)**

901 S. MoPac Expressway
Barton Oaks Plaza One
Suite 250
Austin, TX **78746**
(Address of principal executive offices) **(Zip Code)**

(512) 942-2935
(Registrant's telephone number, including area code)

(Former name or former address, if changed since last report)

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§240.12b-2 of this chapter).

Emerging growth company ☒

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☒

Item 7.01 Regulation FD Disclosure.

On October 17, 2018, Aeglea BioTherapeutics, Inc. (the "Company") issued a press release announcing new interim clinical data and improvements in disease manifestations for its ongoing Phase 1/2 trial of Pegzilarginase in patients with Arginase 1 Deficiency, which will be presented in poster format at the American Society of Human Genetics (ASHG) Conference in San Diego, California, being held September 16-20, 2018. A copy of the press release, presentation poster and literature review poster are attached as Exhibits 99.1, 99.2 and 99.3 to this report, respectively. The presentation poster and literature review poster will also be available on the Company's website in the Events & Presentations section at www.aegleabio.com.

The information furnished with this report, including Exhibits 99.1, 99.2 and 99.3, shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934, as amended ("Exchange Act"), or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference into any other filing under the Securities Act of 1933, as amended, or the Exchange Act, except as expressly set forth by specific reference in such a filing.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit Number	Description
99.1	Press Release issued by Aeglea BioTherapeutics, Inc. on October 17, 2018
99.2	Presentation Poster
99.3	Literature Review Poster

SIGNATURE

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned hereunto duly authorized.

AEGLEA BIOTHERAPEUTICS, INC.

Date: October 17, 2018

By: /s/ Charles N. York II
Charles N. York II
Chief Financial Officer

Exhibit 99.1

Aeglea BioTherapeutics Announces New Positive Interim Clinical Data and Improvements in Disease Manifestations for Ongoing Phase 1/2 Trial of Pegzilarginase in Patients with Arginase 1 Deficiency

Pegzilarginase is Effective in Sustainably Lowering Plasma Arginine Levels

Clinically Significant Improvements After Eight Doses Included Effects on Mobility and Adaptive Behavior

Company to Host Clinical Update Conference Call Today at 8:30 a.m. ET

Austin, Texas, October 17, 2018 - Aeglea BioTherapeutics, Inc. (NASDAQ: AGLE), a clinical-stage biotechnology company that designs and develops innovative human enzyme therapeutics for patients with rare genetic diseases and cancer, today announced new positive interim clinical data at the 2018 American Society of Human Genetics (ASHG) Conference from its ongoing Phase 1/2 trial of pegzilarginase, its lead investigational therapy, in patients with the rare genetic disease Arginase 1 Deficiency (ARG1-D).

"Our clinical experience with ARG1-D and pegzilarginase has advanced rapidly given the accelerated enrollment over the last few months. The developing efficacy profile is compelling, particularly given the short period of repeat dosing," said Anthony G. Quinn, M.B Ch.B, Ph.D., president and chief executive officer of Aeglea. "We are pleased with the recently granted rare pediatric disease designation and we will continue to collaborate closely with the FDA and EMA on the design of our pivotal trial."

"The arginine control we've seen with pegzilarginase in this study is remarkable – it's well beyond what we have been able to achieve with the standard management of patients with Arginase 1 Deficiency," stated Dr. Andreas Schulze, professor of pediatrics and biochemistry at the University of Toronto and Section Head, Metabolic Genetics at the Hospital for Sick Children in Toronto. "I'm truly encouraged by the improvements I have seen in one of our younger patients in terms of communication and walking, and I'm excited about moving the development of pegzilarginase into a pivotal study for patients with this rare and challenging disorder."

Highlights of the ASHG presentation, entitled "Improvements in Arginase 1 Deficiency Related Disease Manifestations Following Plasma Arginine Reductions with Pegzilarginase: Early Phase 2 Results," include the following:

- 100% of patients (6 out of 6) who completed Part 2 (repeat dose) of the study achieved consistent levels of reduced arginine, which was also accompanied by marked and sustained decreases in guanidino compounds (GCs);
- Comprehensive baseline profiling of patients with ARG1-D demonstrated quantifiable abnormalities in mobility and/or adaptive behavior in 94% of patients (15 out of 16);
- Pegzilarginase was well tolerated; most treatment-related AEs were mild, and hypersensitivity reactions were manageable with standard measures and all patients continued study treatment;
- 67% of patients (4 out of 6) had clinically meaningful improvements in mobility and/or adaptive behavior after only eight weeks of repeat dosing with pegzilarginase;
- Encouraging investigator and assessor feedback on a range of disease manifestation with improvements in alertness, communication, posture and walking.

Conference Call & Webcast Details
Aeglea will hold a clinical update conference call today, Wednesday, October 17, 2018 at 8:30 a.m. ET. To access the live conference call via phone, please dial 1-877-709-8155 (toll free) within the United States, or 1-201-689-8881 internationally. A replay of the call will be available through October 24, 2018 by dialing 1-877-660-6853 within the United States or 1-201-612-7415 internationally. The conference ID is 13683373.

To access the live and archived webcast of the presentation, please visit the Presentations & Events section of the Aeglea BioTherapeutics investor relations website. Please connect to the website at least 15 minutes prior to the presentation to allow for any software download that may be necessary.

About Pegzilarginase in Arginase 1 Deficiency
Pegzilarginase is an enhanced human arginase that enzymatically depletes the amino acid arginine. Aeglea is developing pegzilarginase for the treatment of patients with Arginase 1 Deficiency, a rare debilitating disease presenting in childhood with persistent hyperargininemia, severe progressive neurological abnormalities and early mortality. Pegzilarginase is intended for use as an enzyme replacement therapy in patients to reduce elevated blood arginine levels. Aeglea's interim Phase 1/2 data demonstrated clinical improvements and rapid and sustained lowering of plasma arginine in Arginase 1 Deficiency patients.

About Aeglea BioTherapeutics
Aeglea is a clinical-stage biotechnology company that designs and develops innovative human enzyme therapeutics for patients with rare genetic diseases and cancer. The Company is developing pegzilarginase, its lead investigational therapy, for the treatment of Arginase 1 Deficiency, as monotherapy in arginine-dependent cancers and in combination with an immune checkpoint inhibitor for small cell lung cancer. In addition, Aeglea has an active research pipeline of other human enzyme-based approaches in both therapeutic areas. For more information, please visit http://aegleabio.com.

Safe Harbor / Forward Looking Statements
This press release contains "forward-looking" statements within the meaning of the safe harbor provisions of the U.S. Private Securities Litigation Reform Act of 1995. Forward-looking statements can be identified by words such as: "anticipate," "intend," "plan," "goal," "seek," "believe," "project," "estimate," "expect," "strategy," "future," "likely," "may," "should," "will" and similar references. These statements are subject to numerous risks and uncertainties that could cause actual results to differ materially from what we expect. Examples of forward-looking statements include, among others, the potential therapeutic benefits and economic value of our lead product candidate or other product candidates and our eligibility to receive a priority review voucher. Further information on potential risk factors that could affect our business and its financial results are detailed in our most recent Quarterly Report on Form 10-Q for the quarter ended June 30, 2018 filed with the Securities and Exchange Commission (SEC), and other reports as filed with the SEC. We undertake no obligation to publicly update any forward-looking statement, whether written or oral, that may be made from time to time, whether as a result of new information, future developments or otherwise.

Media Contact:
David Calusdian
Sharon Merrill Associates
617.542.5300
AGLE@investorrelations.com

Investor Contact:
Joey Perrone
Director, Finance & Investor Relations
Aeglea BioTherapeutics
investors@aegleabio.com

Exhibit 99.2

Improvements in Arginase 1 Deficiency Related Disease Manifestations Following Plasma Arginine Reductions With Pegzilarginase: early Phase 2 results

aeglea BIOTHERAPEUTICS

Poster # 1095W ‡

Zori RT[1], Diaz GA[2], Merritt II JL[3], Schulze A[4], Enns GM[5], McNutt MC[6], Leão-Teles E[7], Patki KC[8], Alters SE[8], Eckert S[8], Wooldridge JE[8], Batzios SP[9]

[1]University of Florida, Gainesville, FL, USA, [2]Icahn School of Medicine at Mt. Sinai, New York City, NY, USA, [3]University of Washington, Seattle, WA, USA, [4]University of Toronto and The Hospital for Sick Children, Toronto, ON, Canada, [5]Stanford University, Stanford, CA, [6]UT Southwestern Medical Center, Dallas, TX, USA, [7]Centro Hospitalar de São João, Porto, Portugal, [8]Aeglea BioTherapeutics, Austin, TX, USA, [9]Great Ormond Street Hospital NHS Trust, London, UK

Introduction

ARG1-D Causes Two Key Metabolic Defects

1. High levels of arginine and arginine-derived metabolites (e.g. GVA, ArgA, NAA, GAA)
2. Impairment of the Urea Cycle (Figure 1)

Key Disease Manifestations

- *Chronic hyperargininemia-related:* spasticity, loss of mobility, deficits in adaptive behavior, developmental delay, seizures
- *Episodic hyperammonemia-related:* food refusal, protein aversion, encephalopathy

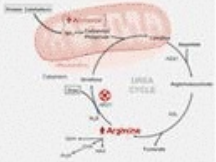


Figure 1. Metabolic Impact of ARG1-D

Disease Management Approach

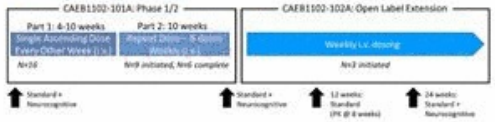
- Severe dietary protein restriction
- Ammonia scavengers – control hyperammonemia; reduction of flux through cycle

Pegzilarginase

- Pegzilarginase is an enhanced recombinant human arginase 1 that enzymatically degrades arginine

Methods

Figure 2. Study Schema



Standard assessments include safety, arginine, guanidino compounds, neuromotor (SSMFT, BBS, GMFM-66), PROMIS, adaptive behavior (ABAS), and pharmacokinetics. Single ascending doses in Part 1 ranged from 0.015 mg/kg to 0.20 mg/kg. Doses in Part 2 and the Open-Label Extension were based on plasma arginine control.

Results

Table 1. Patient Characteristics Show Substantial Disease Burden

Characteristic (N=16)	N (%)
PATIENT CHARACTERISTICS AND MEDICAL HISTORY	
Median Age (range)	15 years (5-31)
Female	11 (69%)
Developmental Delay	9 (56%)
History of Spasticity (≥Moderate)	9 (56%)
History of Seizures	7 (44%)
History of Hyperammonemia	7 (44%)
Ammonia Scavenger	15 (94%)

Assessment (N=16)	Median (range)	Abnormal/Deficit Baseline (%)
BASELINE ASSESSMENTS		
LABORATORY		
Arginine (µmol/L, pre-first-dose assessment)	389 (238 to 566)	100%
ALT (U/L)	34 (15 to 171)	44%
Ammonia (µmol/L)	38 (9 to 77)	44%
MOBILITY		
6MWT (m), N=15	349 (102 to 602)	87%
PROMIS Physical Function Mobility, N=14	38 (28.3 to 57.1)	57%
GMFM Part E (Score 0-72)	65.5 (5 to 72)	50%
Berg Balance (Score 0-56)	52.5 (7 to 56)	38%
ADAPTIVE BEHAVIOR		
ABAS, N=10	79.5 (49 to 90)	80%
GROWTH		
Height (CDC Centile)	4.4% (<0.1% to 56%)	81%

Median plasma arginine was based on the mean of all plasma arginine values prior to first dose for each patient. For other biochemical parameters, the assessment immediately prior to dosing was used. For laboratory assessments, abnormal is defined as being outside the reference range. For height centile, deficit was defined as <10%. For 6MWT, deficit is defined as below the age-adjusted range for normal individuals in Geiger 2001 and Enright 1998. One patient was non-ambulatory. For Berg Balance, deficit is defined as medium or high risk of fall (i.e., score <52). For GMFM Part E, deficit is defined as risk based on the minimal difference in Oeffinger 2008. For PROMIS, deficit is defined as T-Score <40. For ABAS, deficit is defined as standard score <85 on Practical, Social, Conceptual, or Composite. Minimal Clinically Important Difference (MCID, see Figure 5) for 6MWT was defined as a 3% change from baseline; for GMFM Part E, as a change of 1.8 to 4.0 points, depending on individual patient Gross Motor Function Classification System level; for BBS, as a 7 point change; for ABAS, as a change in GAC Standard Score of 7.5 points; and for PROMIS, as a change of 5 points.

References (PMIDs) PMIDs:17997338, 22642680, 25125564, 16908873, 15694174, 27038030, 28441951, 23663794, 19046185, 24268530, Zori et al SSIEM poster P-164 (2018), and De Deyn, P et al., (1997) Guanidino Compounds in Biology & Medicine II.

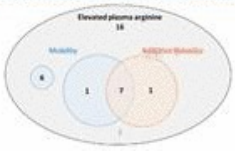
Support This study was funded by Aeglea BioTherapeutics, Inc.

Disclosures Andreas Schulze and George Diaz are consultants to, and Markey McNutt has received honoraria from, Aeglea BioTherapeutics, Inc.

Kiran Patki, Susan Alters, Stephen Eckert, and James Wooldridge are employees of, and have an equity interest in, Aeglea BioTherapeutics, Inc.

Results

Figure 3. Measurable Disease Manifestations

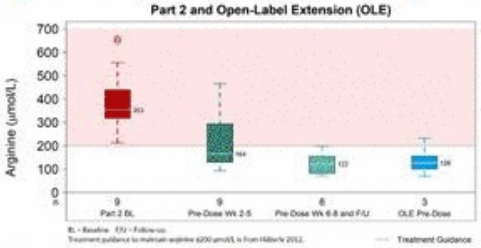


- All 16 patients (100%) had elevated baseline plasma arginine
- In patients with both assessments, 7/10 patients (70%) had deficits in both mobility and adaptive behavior

Safety

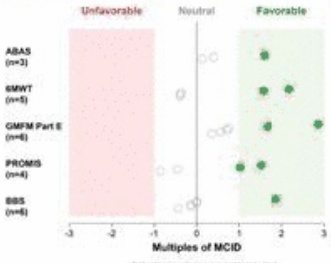
- >180 infusions administered
  - Low-titer, emergent ADAs were detected in 6/16 patients in Part 1
  - **All** patients in Part 2 had undetectable ADA by the 5th dose
- Treatment-related AEs ≥ 2 patients of at least moderate severity included:
  - Hypersensitivity (4 events in 3 patients; 3 considered by investigators as SAEs) managed with infusion rate adjustment and medication

Figure 4. Time-dependent Improvement in Plasma Arginine Control with Repeat Dosing



- 100% (6/6) patients who completed part 2 have achieved consistent levels of reduced arginine (below guideline; Figure 4)
- Arginine reduction was accompanied by marked and sustained decreases in plasma guanidino compounds (data not shown)

Figure 5. Improvements in Clinical Outcomes from Baseline after 8 Repeat Doses



- 67% (4/6) patients had improvement beyond the MCID in mobility and/or adaptive behavior after only 8 weeks of repeat dosing with pegzilarginase
  - **33%** of assessments favorably exceeded MCID, while **none** unfavorably exceeded MCID
  - **1/3** of adaptive behavior (ABAS-3) assessments favorably exceeded MCID with **2/3** trending toward improvement at 8 weeks

Table 2. Trial Observations from Site/Assessors

Patient	Observations from Site / Assessors
1	• Improved step quality and confidence while walking • Less resting spasticity than baseline • Improved ability to squat and ability to pick up an object up from the floor
2	• More relaxed demeanor and willingness to talk • Standing on 1 leg is typically very difficult, able to accomplish on first try
5	• Improved posture and increased confidence while walking • Noted to be more animated and alert • Asking more complex questions
6	• Able to converse much better • Can walk properly, not on tip toes
7	• Increased appetite, energy, and activity • More talkative • Prior to study drug, patient couldn't walk any distance without walker; walking ability has improved; walked into clinic without a walker • No leg cramps at all since starting study medication
9	• Leg cramps resolved • Walking with more speed and less labored • Lower extremity movements are more natural and less dependent upon walker

Conclusions

- Pegzilarginase was highly effective in sustainably lowering elevated plasma arginine, which is considered to be toxic and a key driver of ARG1-D manifestations
- Plasma arginine reductions were accompanied by improvements in mobility and adaptive behavior after only 8 weeks of repeat dosing
- Pegzilarginase was well tolerated; most treatment-related AEs were mild, and hypersensitivity reactions were manageable with standard measures and all patients continued study treatment
- Comprehensive baseline profiling of patients with ARG1-D demonstrated quantifiable abnormalities in mobility and/or adaptive behavior in 15/16 (94%) patients
- Improvements in arginine control and disease-related functional deficits after treatment with pegzilarginase support the advancement of pegzilarginase into a pivotal study

ABBREVIATIONS: ARG1-D Arginase 1 Deficiency, GC-Guanidino Compounds, UNA-of-keto-δ-guanidinovaleric acid, Argininosuccinic acid, NAA-N-acetyl arginine, GAA- guanidinoacetic acid, IV-intravenous, ppo-once weekly, 6MWT-6-Minute Walk Test, BBS – Berg Balance Scale, GMFM-Gross Motor Function Measure, PROMIS – Patient Reported Outcomes Measures Information System (Physical Function), ALT-alanine aminotransferase, PEG-polyethylene glycol, AE-adverse event, SAE-serious adverse event, ADA-anti-drug antibody, CUR-upper limit of normal, GMFT-quantitative N-methyltransferase, MCID – Minimal Clinically Important Difference

Exhibit 99.3

Clinical Features of Arginase 1 Deficiency: Review of a Literature Case Series

Diaz GA[1], Longo N[2], Schulze A[3], Bubb G[4], Eckert S[4], Patki KC[4], Wooldridge JE[4], Merritt II JL[5]

[1]Icahn School of Medicine at Mt. Sinai, New York City, NY, USA, [2] University of Utah, Salt Lake City UT, USA [3] University of Toronto and The Hospital for Sick Children, Toronto, ON, Canada, [4]Aeglea BioTherapeutics, Austin, TX, USA [5] University of Washington, Seattle, WA, USA

Poster #1124F

Introduction

- ARG1-D is a severe, autosomal recessive metabolic disease with progressive, heterogeneous manifestations including spasticity, impaired mobility, developmental delay, and early mortality
- Control of plasma arginine levels is inadequate and problematic with current disease management
- Persistent high plasma arginine levels are believed to be the key driver of disease progression (Waisbren, 2018)
- Hyperammonemia is less problematic than in other UCDs (De deyn 1997)
- Meaningful quantitative deficits in adaptive behavior, using standardized clinical measures, have recently been described in ARG1-D patients (Waisbren, 2018)

Figure 1. Metabolic Impact of ARG1-D

Methods

- 140 unique patient case reports (English language) from 1965 to current date have been reviewed and the data summarized
- Cases were considered unique based on assessment of the following parameters: country of origin, gender, current calculated age, age at diagnosis, age at presentation or age at onset where available

Results

Table 1. Patient Characteristics

Parameter	N	Description	Result
Age at time of report (years)	103	Median (range)	11 (<1 to 39)
Gender	125	Male (n,%)	73 (58%)

KEY FINDINGS

- ARG1-D typically manifests in early childhood but diagnosis is often delayed (*Figures 3A,3B*)
- Newborn screening has identified some cases (n=12)
- Disease management approaches, where cited, included severe protein restriction (n=97), EAA supplementation (n=42), and use of ammonia scavengers (n=60)
  - Despite disease management, plasma arginine remains markedly elevated (median 3.5 X ULN) with evidence of continued disease progression (*Table 2, Figure 2*)
- This analysis demonstrates significant morbidity and early mortality in ARG1-D patients (*Table 2, Figure 3A*)
  - Causes of death, when cited (n=20 including 3 with additional follow-up beyond literature report), included respiratory complications (n=6), liver complications (n=4), metabolic complications (n=2), hyperammonemia NOS (n=1), and other (n=4)

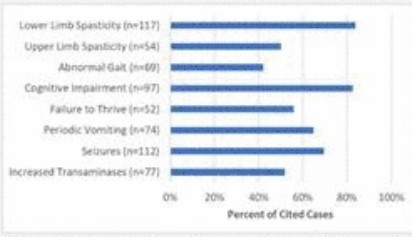
Results

Table 2. Clinical Biochemical Findings

Parameter	N	Median (Q1 to Q3)
Arginine (µmol/L)		
At any time (max known)	112	572 (437 to 754)
Under disease mgmt.	33	400 (290 to 478)
GVA (µmol/L)	27	4.72 (3.17 to 6.85)
ArgA (µmol/L)	27	3.05 (2.20 to 4.04)
ALT	27	71 (43 to 156)

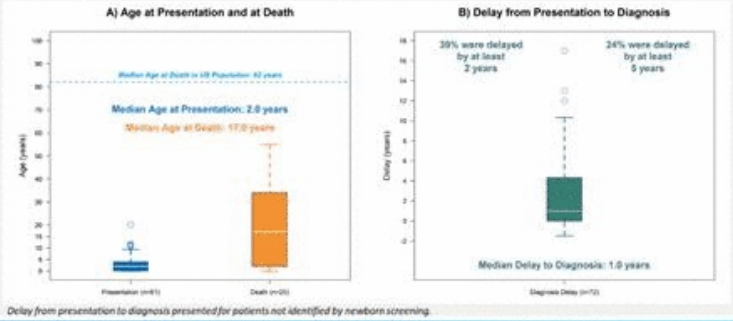
- Maximal arginine exceeds 4.5xULN (ULN=115 µmol/L) in >50% of ARG1-D patients
- Despite disease management (protein restriction, essential amino acids, and nitrogen scavengers), arginine values remain elevated beyond guidance value (200 µmol/L) for most patients
- GVA and ArgA were also elevated in patients (max in normal controls 0.2 µmol/L for both)

Figure 2. Reported Clinical Disease Manifestations



- Common manifestations include lower limb spasticity, abnormal gait, cognitive impairment, failure to thrive, developmental delay and hyperammonemic episodes
- All patients denoted with upper limb spasticity also had lower limb spasticity
- Biochemical hyperammonemia (≥1 prior value ≥100 µmol/L) noted in 55 / 92 (60%) cited cases

Figure 3. Age at Presentation, Delay to Diagnosis, Mortality



Delay from presentation to diagnosis presented for patients not identified by newborn screening.

Conclusions

- ARG1-D is a severe, heterogeneous disease with high levels of arginine resulting in key manifestations of impairments of mobility, adaptive behavior, cognitive function, and early mortality
- Plasma arginine and arginine-derived metabolites remain markedly elevated despite standard disease management with evidence of continued disease progression
- Although recent literature shows considerable deficits in adaptive behavior in ARG1-D patients, this has not been systematically captured using standardized testing (Waisbren, 2018)
- This analysis shows significant unmet medical need and supports the development of much needed new therapies in ARG1-D.

References :

Guanadino Compounds in Biology and Medicine II, De Deyn 1997; PMID:27038030; PMID: 22633632; PMID: 9378897; PMID: 24814679; PMID: 24997092; PMID: 28892883; PMID: 23559324; PMID: 21229317; PMID: 12640389; PMID: 19381865; PMID: 9106111; PMID: 28608518; PMID: 21802329; PMID: 15565656; PMID: 24258525; PMID: 29443755; PMID: 21310339; PMID: 22964440; PMID: 14605507; PMID: 19562505; PMID: 29768370; PMID: 20025860; PMID: 26169240; PMID: 29961243; PMID: 29961498