US009408831B2

(12) **United States Patent**
Zeldis

(10) **Patent No.: US 9,408,831 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **METHODS FOR TREATING RESPIRATORY VIRAL INFECTION**

(75) Inventor: **Jerome B. Zeldis**, Princeton, NJ (US)

(73) Assignee: **Celgene Corporation**, Summit, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 684 days.

(21) Appl. No.: **13/639,848**

(22) PCT Filed: **Apr. 5, 2011**

(86) PCT No.: **PCT/US2011/031190**

§ 371 (c)(1),
(2), (4) Date: **Jan. 4, 2013**

(87) PCT Pub. No.: **WO2011/127019**

PCT Pub. Date: **Oct. 13, 2011**

(65) **Prior Publication Data**

US 2013/0136770 A1 May 30, 2013

Related U.S. Application Data

(60) Provisional application No. 61/321,802, filed on Apr. 7, 2010, provisional application No. 61/435,726, filed on Jan. 24, 2011.

(51) **Int. Cl.**

A61K 31/4035	(2006.01)
A61K 45/06	(2006.01)
A61K 31/454	(2006.01)

(52) **U.S. Cl.**

CPC ***A61K 31/4035*** (2013.01); ***A61K 31/454*** (2013.01); ***A61K 45/06*** (2013.01)

(58) **Field of Classification Search**

CPC .. A61K 31/4035; A61K 31/454; A61K 45/06
USPC 514/416, 417; 424/278.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,436,971	B2 *	8/2002	DeMarsh	A61K 31/277 514/285
2001/0041739	A1	11/2001	Demarsh et al.	
2004/0167199	A1 *	8/2004	Muller	A61K 31/4035 514/417
2010/0272706	A1 *	10/2010	Mercer	A61K 31/407 424/130.1

FOREIGN PATENT DOCUMENTS

WO	2001/003681 A2	1/2001
WO	WO 2006/065814	6/2006
WO	WO 2010/095041	8/2010

OTHER PUBLICATIONS

Ikemura et al., "Type 4 Phosphodiesterase Inhibitors Attenuate Respiratory Syncytial Virus-Induced Airway Hyper-Responsiveness and Lung Eisinophila," J. Pharm. and Experim. Ther., Williams and Wilkins Co., 294(2):701-706 (2000).

Ohta et al., "In Vivo Anti-Influenza Virus Activity of an Immunomodulatory Acidic Polysaccharide Isolated from Cordyceps Militaris Grown on Germinated Soybeans," J. Agric. and Food Chem., 55(25):10194-10199 (2007).

* cited by examiner

Primary Examiner — Jennifer M Kim
(74) *Attorney, Agent, or Firm* — Jones Day

(57) **ABSTRACT**

Provided herein are methods for modulating immune responses to a respiratory viral infection (e.g., influenza, rhinovirus, coronavirus, or paramyxovirus) in a subject, wherein the methods comprise administering to the subject a compound (e.g., a PDE4 modulator or an immunomodulatory compound), or a pharmaceutically acceptable salt, solvate, hydrate, or stereoisomer thereof. Also provided herein are methods for treating, preventing, ameliorating, and/or delaying the onset of one or more symptoms associated with or resulting from a respiratory viral infection (e.g., influenza, rhinovirus, coronavirus, or paramyxovirus) in a subject, wherein the methods comprise administering to the subject a compound (e.g., a PDE4 modulator or an immunomodulatory compound), or a pharmaceutically acceptable salt, solvate, hydrate, or stereoisomer thereof.

24 Claims, 9 Drawing Sheets