



(12) **United States Patent**
Jovanovich et al.

(10) **Patent No.:** **US 8,562,918 B2**
(45) **Date of Patent:** **Oct. 22, 2013**

(54) **UNIVERSAL SAMPLE PREPARATION SYSTEM AND USE IN AN INTEGRATED ANALYSIS SYSTEM**
(71) Applicant: **IntegenX Inc.**, Pleasanton, CA (US)
(72) Inventors: **Stevan B. Jovanovich**, Livermore, CA (US); **William D. Nielsen**, San Jose, CA (US); **David S. Cohen**, San Bruno, CA (US); **Michael Recknor**, Oakland, CA (US); **Mattias Vangbo**, Fremont, CA (US); **Ezra Van Gelder**, Palo Alto, CA (US); **Lars Majlof**, San Jose, CA (US); **Omar El-Sissi**, Fremont, CA (US)

(73) Assignee: **IntegenX Inc.**, Pleasanton, CA (US)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/717,585**
(22) Filed: **Dec. 17, 2012**

(65) **Prior Publication Data**
US 2013/0224846 A1 Aug. 29, 2013

Related U.S. Application Data
(62) Division of application No. 12/795,515, filed on Jun. 7, 2010, now Pat. No. 8,394,642.
(60) Provisional application No. 61/349,680, filed on May 28, 2010, provisional application No. 61/235,664, filed on Aug. 20, 2009, provisional application No. 61/184,759, filed on Jun. 5, 2009.

(51) **Int. Cl.**
G01N 15/06 (2006.01)
G01N 33/00 (2006.01)
G01N 33/48 (2006.01)

(52) **U.S. Cl.**
USPC **422/502**; 422/68.1; 422/50; 422/81; 436/63; 436/174; 436/180; 436/94

(58) **Field of Classification Search**
USPC 422/50, 68.1, 81, 502, 503; 436/43, 63, 436/94, 180, 174
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS

3,352,643 A 11/1967 Ando et al.
3,433,257 A 3/1969 Jensen
(Continued)

FOREIGN PATENT DOCUMENTS

EP 0459241 B1 12/1991
EP 0637999 A1 2/1995
(Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 12/026,510, filed Feb. 5, 2008, Jovanovich et al.
(Continued)

Primary Examiner — Brian J Sines

(57) **ABSTRACT**

The invention provides a system that can process a raw biological sample, perform a biochemical reaction and provide an analysis readout. For example, the system can extract DNA from a swab, amplify STR loci from the DNA, and analyze the amplified loci and STR markers in the sample. The system integrates these functions by using microfluidic components to connect what can be macrofluidic functions. In one embodiment the system includes a sample purification module, a reaction module, a post-reaction clean-up module, a capillary electrophoresis module and a computer. In certain embodiments, the system includes a disposable cartridge for performing analyte capture. The cartridge can comprise a fluidic manifold having macrofluidic chambers mated with microfluidic chips that route the liquids between chambers. The system fits within an enclosure of no more than 10 ft³. and can be a closed, portable, and/or a battery operated system. The system can be used to go from raw sample to analysis in less than 4 hours.

25 Claims, 80 Drawing Sheets

