



(51) International Patent Classification:

C12P 7/58 (2006.01) *C12P 17/04* (2006.01)
C12P 7/42 (2006.01) *C12N 9/04* (2006.01)

(21) International Application Number:

PCT/US2015/021848

(22) International Filing Date:

20 March 2015 (20.03.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

14/222,453 21 March 2014 (21.03.2014) US

(71) Applicant: **SYNTHETIC GENOMICS, INC.** [US/US];
11149 North Torrey Pines Road, Suite 100, La Jolla, CA
92037 (US).

(72) Inventors: **KAMBOURAKIS, Spiros**; 4885 Kensington
Drive, San Diego, CA 92116 (US). **GRIFFIN, Benjamin,
M.**; 12562 Maestro Court, San Diego, CA 92130 (US).
MARTIN, Kevin, V.; 246 Barbara Avenue, Solana Beach,
CA 92075 (US).

(74) Agents: **HAILE, Lisa, A.** et al.; Dla Piper LLP (US), 4365
Executive Drive, Suite 1100, San Diego, CA 92121-2133
(US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- with sequence listing part of description (Rule 5.2(a))

(88) Date of publication of the international search report:

12 November 2015

(54) Title: COMPOSITIONS AND METHODS FOR PRODUCING CHEMICALS AND DERIVATIVES THEREOF

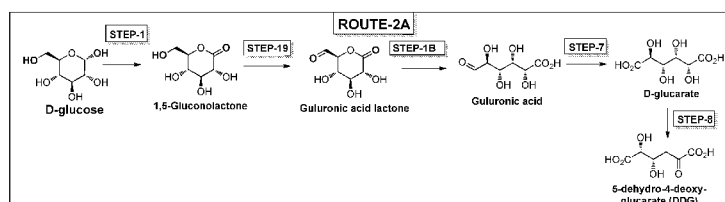


FIG. 2C

(57) Abstract: The present invention provides methods for producing a product of one or more enzymatic pathways. The pathways used in the methods of the invention involve one or more conversion steps such as, for example, an enzymatic conversion of gulturonic acid into D-glucarate (Step 7); an enzymatic conversion of 5-ketogluconate (5-KGA) into L-Iduronic acid (Step 15); an enzymatic conversion of L-Iduronic acid into Idaric acid (Step 7b); and an enzymatic conversion of 5-ketogluconate into 4,6-dihydroxy 2,5-diketo hexanoate (2,5-DDH) (Step 16). In some embodiments the methods of the invention produce 2,5-furandicarboxylic acid (FDCA) as a product. The methods include both enzymatic and chemical conversions as steps. Various pathways are also provided for converting glucose into 5-dehydro-4-deoxy-glucarate (DDG), and for converting glucose into 2,5-furandicarboxylic acid (FDCA). The methods also involve the use of engineered enzymes that perform reactions with high specificity and efficiency. Additional products that can be produced include metabolic products such as, but not limited to, gulturonic acid, L-iduronic acid, idaric acid, glucaric acid. Any of the products can be produced using glucose as a substrate or using any intermediate in any of the methods or pathways of the invention.