

# **James Fraser STODDART**

## **List of Publications and Patents**

## COMMUNICATIONS, PAPERS AND REVIEWS

1. The analytical importance of the methoxy content of Acacia gum exudates (D.M.W. Anderson, G.M. Cree, M.A. Herbich, K.A. Karamalla, J.F. Stoddart), *Talanta* **1964**, *11*, 1559–1560.
2. An infrared method for the determination of small amounts of acetaldehyde in aqueous solution (D.M.W. Anderson, J.F. Stoddart) in Proceedings of S.A.C. Symposium, Nottingham, ed. P.W. Shallis (Heffer and Sons, Cambridge) 1965, 232–238.
3. The use of Biogel-P in the gel filtration of polysaccharides (D.M.W. Anderson, I.C.M. Dea, S. Rahman, J.F. Stoddart), *Chem. Commun.* **1965**, 145–146. [28]
4. Some observations on molecular weight estimations by molecular-sieve chromatography (D.M.W. Anderson, J.F. Stoddart), *Anal. Chim. Acta* **1966**, *34*, 401–406. [55]
5. The use of molecular-sieve chromatography in studies on Acacia senegal gum (gum arabic) (D.M.W. Anderson, J.F. Stoddart), *Carbohyd. Res.* **1966**, *2*, 104–114.
6. Some structural features of *Acacia senegal* gum (gum arabic) (D.M.W. Anderson, Sir Edmund Hirst, J.F. Stoddart), *J. Chem. Soc. (C)* **1966**, 1959–1966. [63]
7. Theories of molecular-sieve chromatography (D.M.W. Anderson, J.F. Stoddart), *Lab. Practice* **1967**, *16*, 841–846.
8. Some structural features of *Acacia arabica* gum (D.M.W. Anderson, Sir Edmund Hirst, J.F. Stoddart), *J. Chem. Soc. (C)* **1967**, 1476–1486. [40]
9. Analytical Chemistry (D.M.W. Anderson, T.B. Pierce, J.F. Stoddart, J.D. Wilson), *Ann. Reports Chem. Soc.* **1967**, *63*, 657–687. [0]
10. Isolation of two arabinoses from *Acacia nilotica* gum (R.C. Chalk, J.K.N. Jones, J.F. Stoddart, W.A. Szarek), *Canad. J. Chem.* **1968**, *46*, 2311–2313. [5]
11. Medium heterocyclic rings from carbohydrate precursors (J.F. Stoddart, W.A. Szarek), Abstracts of 156th Amer. Chem. Soc. Mtg., Atlantic City, September 1968, CARB 28; *Canad. J. Chem.* **1968**, *46*, 3061–3069. [20]
12. Some structural features of *Citrus limonia* gum (lemon gum) (J.K.N. Jones, J.F. Stoddart), *Carbohyd. Res.* **1968**, *8*, 29–42. [21]
13. Some structural features of the mucilage from the bark of *Ulmus fulva* (slippery elm mucilage) (R.J. Beveridge, J.K.N. Jones, J.F. Stoddart, W.A. Szarek), *Carbohyd. Res.* **1969**, *9*, 429–439. [14]
14. Conformational studies on 1,3-dioxepans. Part I. 1,3:2,5:4,6-Tri-*O*-methylene-D-mannitol and some related compounds (T.B. Grindley, J.F. Stoddart, W.A. Szarek), *J. Chem. Soc. (B)* **1969**, 172–175. [19]
15. Conformational studies on 1,3-dioxepans. Part II. 1,3:2,5:4,6-Tri-*O*-methylene-D-mannitol and some related compounds (T.B. Grindley, J.F. Stoddart, W.A. Szarek), *J. Chem. Soc. (B)* **1969**, 623–626. [12]
16. Isochronous and anisochronous *O*-methylene protons in 4,5:9,10-bis-cyclo-hexano-1,3,6,8-tetraoxacyclo-decanes (T.B. Grindley, J.F. Stoddart, W.A. Szarek), 52nd Chemical Institute of Canada Conference in Montreal, May 1969; *J. Am. Chem. Soc.* **1969**, *91*, 4722–4724. [13]
17. Large heterocyclic rings from carbohydrate precursors (J.K.N. Jones, J.F. Stoddart, W.A. Szarek), *Canad. J. Chem.* **1969**, *47*, 3213–3215. [9]
18. Conformational studies on 1,3-dioxepans. Part III. 1,6-Dideoxy-2,5-*O*-methylene-D-mannitol and some related compounds (J.F. Stoddart, W.A. Szarek), Abstracts of 158th Amer. Chem. Soc. Meeting, New York, 1969, CARB 24; *J. Chem. Soc. (B)* **1971**, 437–442. [18]
19. Stereochemistry (J.F. Stoddart), *Chem. Br.* **1971**, *9*, 250. [2]
20. Stereochemistry at Sheffield (J.F. Stoddart), *Chem. Br.* **1972**, *10*, 216. [1]
21. Stereochemistry (J.F. Stoddart) in MTP International Review of Science, Organic Chemistry, Series One, Volume 1, ed. W.D. Ollis (1973), 1–28.
22. Molecular structure and conformations of carbohydrates (J.F. Stoddart) in MTP International Review of Science, Organic Chemistry, Series One, Volume 7, ed. G.O. Aspinall, 1973, 1–30.
23. Stereochemistry at Sheffield (J.F. Stoddart), *Chem. Br.* **1973**, *11*, 362–363. [1]

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25. The conformational behaviour of 5,6,11,12,17,18-hexahydrotribenzo[*a,e,l*]-cyclododecane and its derivatives (D.J. Brickwood, W.D. Ollis, J.F. Stoddart), *J. Chem. Soc., Chem. Commun.* **1973**, 638–640. [8]
26. Synthesis of medium heterocyclic rings from 6-deoxy-D-allose (R.G.S. Ritchie, J.F. Stoddart, W.A. Szarek, D.M. Vyas), *Carbohyd. Res.* **1974**, *32*, 279–285. [8]
27. Stereospecific synthesis of the *trans-anti-trans*- and *trans-syn-trans*-isomers of dicyclohexyl-18-crown-6 (J.F. Stoddart, C.M. Wheatley), *J. Chem. Soc., Chem. Commun.* **1974**, 390–391. [22]
28. The conformational behaviour of some medium-sized ring systems (W.D. Ollis, J.F. Stoddart, I.O. Sutherland), *Tetrahedron* **1974**, *30*, 1903–1921. [60]
29. Synthesis of macrobicyclic polyethers with carbon bridgeheads (A.C. Coxon, J.F. Stoddart), *J. Chem. Soc., Chem. Commun.* **1974**, 537. [14]
30. Constitutional isomerism in bicyclic diacetals and the conformational behaviour of *cis*-fused 1,3,6,8-tetraoxabicyclo[5,3,0]decane (I.J. Burden, J.F. Stoddart), *J. Chem. Soc., Chem. Commun.* **1974**, 863–864. [7]
31. Configurational equilibria in 2,4-disubstituted- $\gamma$ -butyrolactones (S.A.M.T. Hussain, W.D. Ollis, C. Smith, J.F. Stoddart), *J. Chem. Soc., Chem. Commun.* **1974**, 873–874. [2]
32. Conformational studies on aza and thia derivatives of 12,13-dihydro-11*H*-dibenzo[*a,e*]cyclononene (W.D. Ollis, J.F. Stoddart), *Angew. Chem., Int. Ed. Engl.* **1974**, *13*, 727–729. [3]
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34. Conformational studies on oxa, thia, and aza derivatives of 7,8,13,14-tetrahydro-benzo[1,2]cyclonona[5,6,7-*de*]naphthalene and 8*H*,15*H*-7,16-dioxacyclodeca-[1,2,3-*de*:6,7,8-*d'e*] dinaphthalene (D.J. Brickwood, W.D. Ollis, J.F. Stoddart), *Angew. Chem., Int. Ed. Engl.* **1974**, *13*, 731–732. [2]
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36. The synthesis and conformational behaviour of *N,N',N''*-trimethyltrianthranilide (W.D. Ollis, J.A. Price, J.S. Stephanatou, J.F. Stoddart), *Angew. Chem., Int. Ed. Engl.* **1975**, *14*, 169. [18]
37. Isomerism in bicyclic diacetals. Part I. 1,3:2,4- and 1,4:2,3-di-*O*-methylene-erythritol (I.J. Burden, J.F. Stoddart), *J. Chem. Soc., Perkin Trans. 1* **1975**, 666–674. [24]
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52. Macrobicyclic polyethers with bridgehead carbon atoms (A.C. Coxon, J.F. Stoddart), *J. Chem. Soc., Perkin Trans. 1* **1977**, 767–785. [58]
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93. Formation and X-ray crystal structure of [Pt(H<sub>2</sub>NCH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>)<sub>2</sub>-18-crown-6]<sub>n</sub><sup>2+</sup>[PF<sub>6</sub>]<sub>2n</sub>. A hydrogen bonded stepped-chair copolymer (H.M. Colquhoun, J.F. Stoddart, D.J. Williams), *J. Chem. Soc., Chem. Commun.* **1981**, 851–852. [26]
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2. Editing of RSC Monographs in Supramolecular Chemistry, Calixarenes (C.D. Gutsche), Cambridge, 1989, 223 pp.

3. Editing of RSC Monographs in Supramolecular Chemistry, Cyclophanes (F. Diederich), Cambridge, 1991, 313 pp.
4. Editing of RSC Monographs in Supramolecular Chemistry, Crown Ethers and Cryptands (G.W. Gokel), Cambridge, 1991, 190 pp.
5. Editing of RSC Monographs in Supramolecular Chemistry, Container Molecules and their Guests (D.J. Cram, J.M. Cram), 1994, 223 pp.
6. Editing of RSC Monographs in Supramolecular Chemistry, Membranes and Molecular Assemblies: The Synkinetic Approach (J.-H. Fuhrhop, J. Köning), 1994, 227 pp.
7. Editing of RSC Monographs in Supramolecular Chemistry, Self-Assembly in Supramolecular Systems (L.F. Lindoy, I.M. Atkinson), 2000, 223 pp.
8. Editing with F. Vögtle and M. Shibasaki: Stimulating Concepts in Chemistry, Wiley-VCH, 2000, 396 pp.

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1. Metal Complexes (H.M. Colquhoun, D.F. Lewis, J.F. Stoddart).  
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2. Solubilized platinum compounds (J.F. Stoddart, D.R. Alston).  
Publication date: **1987**-09-29. Publication number: 4696918.
3. Cyclodextrin catenane compounds capable of forming inclusion complexes (C.P. Moore, T.J. Wear, J.F. Stoddart, D. Armspach).  
Publication date: **1995**-08-01. Publication number: 5438133.
4. Preparation of [2]pseudorotaxane derivatives as analytical reagents (N.D. Tinker, J.F. Stoddart, O.A. Matthews).  
Publication date: **1996**-12-12. Publication number: WO 9639402.
5. Electrically addressable volatile non-volatile molecular-based switching devices (J.R. Heath, C.P. Collier, G. Mattersteig, F.M. Raymo, J.F. Stoddart, E. Wong).  
Publication date: **2001**-03-06. Publication number: 6198655.
6. Noncovalent functionalization of nanotubes (J.F. Stoddart, A. Star).  
Publication date: **2005**-02-24. Publication number: 0043503.
7. Room temperature deposition of nanotube transistor networks (G. Gruner, J.F. Stoddart, K.S. Chichak).  
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8. Nano-devices having resealable seals for controlled release of molecules (J.I. Zink, J. Lu, F. Tamanoi, A. Nel, S. Angelos, J.F. Stoddart, Q. Chen, T. Xia, K. Patel, W. Dichtel).  
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9. Chemical framework compositions and methods of use (O.M. Yaghi, Q. Li, O. Miljanić, W. Zhang, J.F. Stoddart).  
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10. Nanoporous carbohydrate frameworks and the sequestration and detection of molecules using the same (J.J. Gassensmith, R.A. Smaldone, R.S. Forgan, J.F. Stoddart).  
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11. Crystalline bipyridinium radical complexes and uses thereof (J.F. Stoddart, A.C. Fahrenbach, J.C. Barnes, S. Sampath, A.N. Basuray).  
Issue date: 2015-09-01. Patent number: 9,120,799.
12. Tetracationic Cyclophanes and Their Use in the Sequestration of Polyaromatic Hydrocarbons by Way of Complexation (J.C. Barnes, A.N. Basuray, A.C. Fahrenbach, H. Li, S. Sampath, J.F. Stoddart)  
Issue date: 2016-03-22. Patent number 9,290,495

13. Compounds and Methods to Isolate Gold (D. Cao, M. Frascioni, Z. J.F. Stoddart)  
Issue date: 2016-07-26. Patent number 9,399,803
14. Supramolecular networks with electron transfer in two dimensions (A. Narayanan, A. Shveyd, J.F. Stoddart, S. Stupp, C.H. Sue, A. Tayi)  
Issue date: 2016-09-13. Patent number 9,443,636
15. Modular supramolecular approach for co-crystallization of donors and acceptors into ordered networks (A. Narayanan, A. Shveyd, J.F. Stoddart, S. Stupp, C. H. Sue, A. Tayi)  
Issue date: 2016-09-20. Patent number 9,449,731
16. Redox active triangular organic materials (M. Frascioni, Z. Liu, S. Schneebeli, J.F. Stoddart)  
Issue date: 2017-01-17. Patent number 9,546,169
17. A homochiral metal-organic framework with enantiopure pillar[5]arene active domains (J.F. Stoddart, N.L. Strutt)  
Issue date: 2017-11-14. Patent number 9,815,764
18. ExCage: Synthesis of viologen-like pyridinium-based cages for the selective capture of polycyclic aromatic hydrocarbons (J. Barnes, E. Dale, M. Juricek, J.F. Stoddart, N. Vermeulen)  
Issue date: 2017-11-28. Patent number 9,828,259
19. Methods of making diazaperopyrenium dications and uses thereof (A.N. Basuray, K. Hartlieb, H.P. Jacquot, S. Sampath, J.F. Stoddart)  
Issue date: 2017-11-28. Patent number 9,828,371
20. Supramolecular networks with electron transfer in two dimensions (A. Narayanan, A. Shveyd, J.F. Stoddart, S. Stupp, C.H. Sue, A. Tayi)  
Issue date: 2018-06-12. Patent number 9,997,271
21. Modular supramolecular approach for co-crystallization of donors and acceptors into ordered networks (A. Narayanan, A. Shveyd, J.F. Stoddart, S. Stupp, C.H. Sue, A. Tayi)  
Issue date: 2018-06-12. Patent number 9,997,272
22. Nanoporous carbohydrate frameworks and the sequestration and detection of molecules using the same (R.S. Forgan, J.J. Gassensmith, R.A. Smaldone, J.F. Stoddart)  
Issue date: 2018-11-13. Patent number 10,125,016
23. Electrochemical detection of carbon dioxide using a carbohydrate based coordination polymer (O. Farha, J. Gassensmith, N. Jeong, J.F. Stoddart)  
Issue date: 2019-03-12. Patent number 10,228,343
24. Carbohydrate-mediated purification of petrochemicals (K. Hartlieb, J. Holcroft, J. Stoddart)  
Issue date: 2019-03-26. Patent number 10,239,044
25. Viologen-based rotaxanes (M. Frascioni, J.F. Stoddart, J. Sun, Y. Wang)  
Issue date: 2019-04-16. Patent number 10,259,913

#### PROVISIONAL PATENT APPLICATIONS

1. **Serial No.:** 61/314,889  
**Inventors:** J. F. Stoddart, A. M. Z. Slawin, R. S. Forgan, R. A. Smaldone  
**Filing Date:** 2010-03-17  
**Title:** Nanoporous carbohydrate frameworks
2. **Serial No.:** 61/351,704  
**Inventors:** J. F. Stoddart, J. J. Gassensmith, R. S. Forgan, R. A. Smaldone  
**Filing Date:** 2010-06-04  
**Title:** Sequestration and detection of carbon dioxide by a metal organic framework
3. **Serial No.:** 61/314,897

- Inventors:** J. F. Stoddart, C.-H. Sue, S. Basu  
**Filing Date:** 201-03-17  
**Title:** A novel purification of CBPQT<sup>4+</sup> macrocycle
4. **Serial No.:** 61/488,605  
**Inventors:** S. I. Stupp, J. F. Stoddart, A. K. Shveyd, A. S. Tayi, C.-H. Sue  
**Filing Date:** 2011-05-20  
**Title:** Lock-arm supramolecular ordering
5. **Serial No.:** 61/498,262  
**Inventors:** S. I. Stupp, J. F. Stoddart, A. K. Shveyd, A. S. Tayi, C.-H. Sue  
**Filing Date:** 2011-06-17  
**Title:** Visible pleochroism in a supramolecular material
6. **Serial No.:** 61/498,277  
**Inventors:** S. I. Stupp, J. F. Stoddart, A. K. Shveyd, A. S. Tayi, C.-H. Sue  
**Filing Date:** 2011-06-17  
**Title:** Supramolecular design for ferroelectric charge crystals
7. **Serial No.:** 61/537,852  
**Inventors:** J. F. Stoddart, A. C. Fahrenbach, J. C. Barnes, S. Sampath, A. N. Basuray, H. Li  
**Filing Date:** 2011-09-22  
**Title:** Crystalline bipyridinium radical complexes and uses thereof
8. **Serial No.:** 61/550,748  
**Inventors:** J. F. Stoddart, S. Grunder, A. C. Whalley, C. Valente  
**Filing Date:** 2011-10-24  
**Title:** Molecular gauge blocks for building on the nanoscale
9. **Serial No.:** 61/740,958  
**Inventors:** J. F. Stoddart, J. C. Barnes, M. Juríček  
**Filing Date:** 2012-12-21  
**Title:** Tetracationic cyclophanes and their use in the sequestration of polyaromatic hydrocarbons by way of complexation
10. **Serial No.:** 61/814,066  
**Inventors:** J. F. Stoddart, Z. Liu, M. Frasconi, D. Cao  
**Filing Date:** 2013-04-19  
**Title:** Compounds and methods to isolate gold
11. **Serial No.:** 61/883,352  
**Inventors:** J. F. Stoddart, S. Sampath, A. N. Basuray, K. J. Hartlieb, H.-P. Jaquot de Rouville  
**Filing Date:** 2013-09-27  
**Title:** Methods of making diazaperopyrenium dications and uses thereof
12. **Serial No.:** 62/008,671  
**Inventors:** K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2014-06-06  
**Title:** Carbohydrate-mediated purification of petrochemicals
13. **Serial No.:** 62/045,517  
**Inventors:** O. K. Farha, J. J. Gassensmith, J. F. Stoddart, N. C. Jeong  
**Filing Date:** 2014-09-03  
**Title:** Electrochemical detection of carbon dioxide using a carbohydrate based coordination polymer

14. **Serial No.:** 62/045,531  
**Inventors:** J. F. Stoddart, M. Frasconi, S. T. Schneebeli, Z. Liu  
**Filing Date:** 2014-09-03  
**Title:** Redox active triangular organic materials
  
15. **Serial No.:** 62/045,511  
**Inventors:** J. F. Stoddart, J. C. Barnes, M. Juríček, E. J. Dale, N. A. Vermeulen  
**Filing Date:** 2014-09-03  
**Title:** ExCage: Synthesis of viologen-like pyridinium-based cages for the selective capture of polycyclic aromatic hydrocarbons
  
16. **Serial No.:** 62/045,514  
**Inventors:** J. F. Stoddart, N. L. Strutt  
**Disclosure Date:** 2014-09-03  
**Title:** A homochiral metal-organic framework with enantiopure pillar[5] arene active domains
  
17. **Serial No.:** 62/057,059  
**Inventors:** J. F. Stoddart, X. Hou, C. Ke  
**Filing Date:** 2014-09-29  
**Title:** Supramolecular encrypted fluorescent security ink compositions
  
18. **Serial No.:** 62/057,102  
**Inventors:** J. F. Stoddart, X. Hou, C. Ke, R. B. Pettman  
**Filing Date:** 2014-09-29  
**Title:** Supramolecular encrypted fluorescent security ink compositions
  
19. **Serial No.:** 62/135,339  
**Inventors:** J. F. Stoddart, D. Chen, A.-J. Avestro, J. Sun, Z. B. Erno  
**Filing Date:** 2015-03-19  
**Title:** Rigid naphthalenediimide triangle structures
  
20. **Serial No.:** 62/255,490  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2015-11-15  
**Title:** Uptake of pharmaceuticals within cyclodextrin-based porous materials
  
21. **Serial No.:** 62/278,200  
**Inventors:** Z. Liu, J.F. Stoddart  
**Filing Date:** 2016-01-13  
**Title:** Supramolecular assembly of rigid macrocycles through cooperative hydrogen bond interactions
  
22. **Serial No.:** 62/288,701  
**Inventors:** M. Frasconi, J.F. Stoddart, J. Sun, Y. Wang  
**Filing Date:** 2016-01-29  
**Title:** Viologen-based rotaxanes
  
23. **Serial No.:** 62/308,998  
**Inventors:** Z. Liu, S. Nalluri, J.F. Stoddart  
**Filing Date:** 2016-03-16  
**Title:** Rigid chiral redox-active isosceles triangles
  
24. **Serial No.:** 62/321,290  
**Inventors:** V. Dravid, D. Ferris, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2016-04-12  
**Title:** Flexible piezoelectric and antiferroelectric haloimidazole crystals



25. **Serial No.:** 62/382,994  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2016-09-02  
**Title:** Flexible piezoelectric and antiferroelectric haloimidazole crystals
26. **Serial No.:** 62/416,334  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2016-11-02  
**Title:** Loading and bioavailability of ibuprofen/CD-MOF formulations
27. **Serial No.:** 62/531,115  
**Inventors:** Z. Liu, J.F. Stoddart, J. Sun  
**Filing Date:** 2017-07-11  
**Title:** Mechanically interlocked air-stable radicals
28. **Serial No.:** 62/535,579  
**Inventors:** Z. Liu, S. Nalluri, H. Patel, J.F. Stoddart  
**Filing Date:** 2017-07-21  
**Title:** Lithiated cyclodextrin metal organic frameworks and methods of making and using the same
29. **Serial No.:** 62/580,860  
**Inventors:** H. Patel, J.F. Stoddart  
**Filing Date:** 2017-11-02  
**Title:** Troger's base-linked poly(crown ether)s
30. **Serial No.:** 62/619,561  
**Inventors:** S. Nalluri, J.F. Stoddart  
**Filing Date:** 2018-01-19  
**Title:** Rigid chiral photoluminescent isocetes triangular materials
31. **Serial No.:** 62/653,301  
**Inventors:** M. Nguyen, J.F. Stoddart  
**Filing Date:** 2018-04-05  
**Title:** Densely charged catenanes
32. **Serial No.:** 62/658,048  
**Inventors:** I. Roy, J.F. Stoddart  
**Filing Date:** 2018-04-16  
**Title:** Cyclophanes for live-cell imaging
33. **Serial No.:** 62/680,352  
**Inventors:** Z. Liu, J.F. Stoddart  
**Filing Date:** 2018-06-04  
**Title:** Mixed-valence crystal superstructures
34. **Serial No.:** 62/691,923  
**Inventors:** M. Nguyen, J.F. Stoddart  
**Filing Date:** 2018-06-29  
**Title:** Densely Charged Catenanes
35. **Serial No.:** 62/700,614  
**Inventors:** J. Choi, D.J. Kim, J.F. Stoddart, D.-J. Yoo  
**Filing Date:** 2018-07-19  
**Title:** Rechargeable Aluminum Organic Batteries

36. **Serial No.:** 62/799,229  
**Inventors:** I. Roy, J.F. Stoddart  
**Filing Date:** 2019-01-31  
**Title:** Supramolecular Photoprotection of a Photosensitizer for Safe Lysosomal Delivery and Anticancer Therapy

**PENDING US PATENT APPLICATIONS**

1. **Serial No.:** 13/658,973  
**Inventors:** J. F. Stoddart, S. Grunder, A. C. Whalley, C. Valente  
**Filing Date:** 2012-10-24  
**Title:** Molecular gauge blocks for building on the nanoscale
2. **Serial No.:** 14/733,875  
**Inventors:** J. F. Stoddart, K. J. Hartlieb, J. M. Holcroft  
**Filing Date:** 2015-06-08  
**Title:** Carbohydrate-mediated purification of petrochemicals
3. **Serial No.:** 14/867,826  
**Inventors:** X. Hou, C. Ke, J.F. Stoddart  
**Filing Date:** 2015-09-28  
**Title:** Supramolecular fluorescent dyes
4. **Serial No.:** 14/867,953  
**Inventors:** X. Hou, C. Ke, J.F. Stoddart  
**Filing Date:** 2015-09-28  
**Title:** Supramolecular encrypted fluorescent security ink compositions
5. **Serial No.:** 15/074,161  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2016-03-18  
**Title:** Rigid naphthalenediimide triangle structures
6. **Serial No.:** 15/218,280  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2016-07-25  
**Title:** Compounds and methods to isolate gold
7. **Serial No.:** 15/350,975  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2016-11-14  
**Title:** Uptake of pharmaceuticals within cyclodextrin-based porous materials
8. **Serial No.:** 16/032,212  
**Inventors:** Z. Liu, J.F. Stoddart, J. Sun  
**Filing Date:** 2018-07-11  
**Title:** Mechanically interlocked air-stable radicals
9. **Serial No.:** 16/069,940  
**Inventors:** Z. Liu, J.F. Stoddart  
**Filing Date:** 2018-07-13  
**Title:** Supramolecular assembly of rigid macrocycles through cooperative hydrogen bond interactions
10. **Serial No.:** 16/085,436  
**Inventors:** Z. Liu, S. Nalluri, J.F. Stoddart  
**Filing Date:** 2018-09-14

**Title:** Rigid chiral redox-active isocenes triangular materials

11. **Serial No.:** 16/093,256  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2018-10-12  
**Title:** Flexible piezoelectric and antiferroelectric haloimidazole crystals
12. **Serial No.:** 16/269,311  
**Inventors:** X. Hou, C. Ke, R. Pettman, J.F. Stoddart  
**Filing Date:** 2019-02-06  
**Title:** Supramolecular encrypted fluorescent security ink compositions

#### PCT APPLICATIONS

1. **Serial No.:** PCT/US2011/028866  
**Inventors:** J. J. Gassensmith, R. A. Smaldone, R. S. Forgan, J. F. Stoddart  
**Filing Date:** 2011-03-17  
**Title:** Nanoporous carbohydrate frameworks and the sequestration and detection of molecules using the same
2. **Serial No.:** PCT/US2012/038896  
**Inventors:** S. I. Stupp, J. F. Stoddart, A. K. Shveyd, A. S. Tayi, C.-H. Sue  
**Filing Date:** 2012-05-21  
**Title:** Modular supramolecular approach for co-crystallization of donors and acceptors into ordered networks
3. **Serial No.:** PCT/US2012/042978  
**Inventors:** S. I. Stupp, J. F. Stoddart, A. K. Shveyd, A. S. Tayi, C.-H. Sue  
**Filing Date:** 2012-06-18  
**Title:** Visible pleochroism in a supramolecular material
4. **Serial No.:** PCT/US2013/077144  
**Inventors:** J. F. Stoddart, J. C. Barnes, M. Juríček  
**Filing Date:** 2013-12-20  
**Title:** Tetracationic cyclophanes and their use in the sequestration of polyaromatic hydrocarbons by way of complexation
5. **Serial No.:** PCT/US2014/034697  
**Inventors:** J. F. Stoddart, Z. Liu, M. Frasconi, D. Cao  
**Filing Date:** 2014-04-18  
**Title:** Compounds and methods to isolate gold
6. **Serial No.:** PCT/US2015/034754  
**Inventors:** J. F. Stoddart, K. J. Hartlieb, J. M. Holcroft  
**Filing Date:** 2015-06-08  
**Title:** Carbohydrate-mediated purification of petrochemicals
7. **Serial No.:** PCT/US2015/052670  
**Inventors:** X. Hou, C. Ke, J.F. Stoddart  
**Filing Date:** 2015-09-28  
**Title:** Supramolecular fluorescent dyes
8. **Serial No.:** PCT/US2015/052694  
**Inventors:** X. Hou, C. Ke, R. Pettman, J.F. Stoddart  
**Filing Date:** 2015-09-28  
**Title:** Supramolecular encrypted fluorescent security ink compositions

9. **Serial No.:** PCT/US2016/023111  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2016-03-16  
**Title:** Rigid naphthalenediimide triangle structures
10. **Serial No.:** PCT/US2016/061963  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2016-11-15  
**Title:** Uptake of pharmaceuticals within cyclodextrin-based porous materials
11. **Serial No.:** PCT/US2017/013301  
**Inventors:** Z. Liu, J.F. Stoddart  
**Filing Date:** 2017-01-13  
**Title:** Supramolecular assembly of rigid macrocycles through cooperative hydrogen bond interactions
12. **Serial No.:** PCT/US2017/015299  
**Inventors:** M. Frasconi, J.F. Stoddart, J. Sun, Y. Wang  
**Filing Date:** 2017-01-27  
**Title:** Viologen-based rotaxanes
13. **Serial No.:** PCT/US2017/022668  
**Inventors:** Z. Liu, S. Nalluri, J.F. Stoddart  
**Filing Date:** 2017-03-16  
**Title:** Rigid chiral redox-active isosceles triangular materials
14. **Serial No.:** PCT/US2017/027170  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2017-04-12  
**Title:** Flexible piezoelectric and antiferroelectric haloimidazole crystals
15. **Serial No.:** PCT/US2018/041551  
**Inventors:** Z. Liu, J.F. Stoddart, J. Sun  
**Filing Date:** 2018-07-11  
**Title:** Mechanically interlocked air-stable radicals
16. **Serial No.:** PCT/US2018/043217  
**Inventors:** Z. Liu, S. Nalluri, H. Patel, J.F. Stoddart  
**Filing Date:** 2018-07-23  
**Title:** Lithiated cyclodextrin metal organic frameworks and methods of making and using the same
17. **Serial No.:** PCT/US2018/059046  
**Inventors:** H. Patel, J.F. Stoddart  
**Filing Date:** 2018-11-02  
**Title:** Troger's base-linked poly(crown ether)s
18. **Serial No.:** PCT/US2019/014415  
**Inventors:** S. Nalluri, J.F. Stoddart  
**Filing Date:** 2019-01-21  
**Title:** Rigid chiral photoluminescent isosceles triangular materials
19. **Serial No.:** PCT/US2019/026095  
**Inventors:** M. Nguyen, J.F. Stoddart  
**Filing Date:** 2019-04-05  
**Title:** Densely charged catenanes

20. **Serial No.:** PCT/US2019/027713  
**Inventors:** I. Roy, J.F. Stoddart  
**Filing Date:** 2019-04-16  
**Title:** Cyclophanes for live-cell imaging

**ISSUED FOREIGN PATENTS**

1. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2018-10-11. Country: Australia Patent number: 2014253728.
2. Carbohydrate-Mediated Purification of Petrochemicals (K. Hartlieb, J. Holcroft, J.F. Stoddart).  
Issue date: 2018-11-07. Country: EPO Patent number: EP 3077104.
3. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Armenia Patent number: EUR 024977.
4. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Azerbaijan Patent number: EUR 024977.
5. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Belarus Patent number: EUR 024977.
6. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Kazakhstan Patent number: EUR 024977.
7. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Kyrgyzstan Patent number: EUR 024977.
8. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Russia Patent number: EUR 024977.
9. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Tajikistan Patent number: EUR 024977.
10. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Turkmenistan Patent number: EUR 024977.
11. Compounds and Methods to Isolate Gold (D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart).  
Issue date: 2019-04-03. Country: Eurasia Patent number: EUR 024977.
12. Tetracationic Cyclophanes and Their Use in the Sequestration of Polyaromatic Hydrocarbons by Way of Complexation (J. Barnes, M. Juricek, J.F. Stoddart).  
Issue date: 2016-08-28. Country: Saudi Arabia Patent number: SA 5024.

**PENDING FOREIGN PATENT APPLICATIONS**

1. **Serial No.:** EP 13866011.3  
**Country:** EPO  
**Inventors:** J. F. Stoddart, J. C. Barnes, M. Juríček  
**Filing Date:** 2015-06-24  
**Title:** Tetracationic cyclophanes and their use in the sequestration of polyaromatic hydrocarbons by way of complexation
2. **Serial No.:** CA 2,909,203  
**Country:** Canada  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2015-10-08  
**Title:** Compounds and Methods to Isolate Gold
3. **Serial No.:** PH 1-2015-502366  
**Country:** Philippines  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart

- Filing Date:** 2015-10-02  
**Title:** Compounds and Methods to Isolate Gold
4. **Serial No.:** PERU 002159-2015/DIN  
**Country:** Peru  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2015-10-15  
**Title:** Compounds and Methods to Isolate Gold
  5. **Serial No.:** CN 201480023847.X  
**Country:** China  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2015-10-27  
**Title:** Compounds and Methods to Isolate Gold
  6. **Serial No.:** EP 14785085.3  
**Country:** EPO  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2015-11-04  
**Title:** Compounds and Methods to Isolate Gold
  7. **Serial No.:** UZ IAP20150425  
**Country:** Uzbekistan  
**Inventors:** D. Cao, M. Frasconi, Z. Liu, J.F. Stoddart  
**Filing Date:** 2015-11-04  
**Title:** Compounds and Methods to Isolate Gold
  8. **Serial No.:** CN 201780025678.7  
**Country:** China  
**Inventors:** Z. Liu, S. Nalluri, J.F. Stoddart  
**Filing Date:** 2017-03-16  
**Title:** Rigid Chiral Redox-Active Isosceles Triangular Materials
  9. **Serial No.:** SA 517382329  
**Country:** Saudi Arabia  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2017-09-17  
**Title:** Rigid Napthalenediimide Triangle Structures
  10. **Serial No.:** ARAB EMIRATES P60011  
**Country:** Arab Emirates  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2017-09-19  
**Title:** Rigid Napthalenediimide Triangle Structures
  11. **Serial No.:** EP16765820.2  
**Country:** EPO  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2017-10-27  
**Title:** Rigid Napthalenediimide Triangle Structures
  12. **Serial No.:** CN 201680028163.8  
**Country:** China  
**Inventors:** A.-J. Avestro, D. Chen, Z. Erno, J.F. Stoddart, J. Sun  
**Filing Date:** 2017-11-15

- Title:** Rigid Naphthalenediimide Triangle Structures
13. **Serial No.:** SA 518392119  
**Country:** Saudi Arabia  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** 2018-07-31  
**Title:** Uptake of Pharmaceuticals within Cyclodextrin-based Porous Materials
  14. **Serial No.:** CN 201780015076.3  
**Country:** China  
**Inventors:** M. Frasconi, J.F. Stoddart, J. Sun, Y. Wang  
**Filing Date:** 2018-09-04  
**Title:** Viologen-Based Rotaxanes
  15. **Serial No.:** SA 518400208  
**Country:** Saudi Arabia  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2018-10-10  
**Title:** Flexible Piezoelectric and Antiferroelectric Haloimidazole Crystals
  16. **Serial No.:** SA 518400208  
**Country:** Saudi Arabia  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2018-10-10  
**Title:** Flexible Piezoelectric and Antiferroelectric Haloimidazole Crystals
  17. **Serial No.:** EP 17783042.9  
**Country:** EPO  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2018-11-12  
**Title:** Flexible Piezoelectric and Antiferroelectric Haloimidazole Crystals
  18. **Serial No.:** CN 201780031574.7  
**Country:** China  
**Inventors:** V. Dravid, D. Ferris, D. Hong, K.A. Hujsak, M. Owczarek, A. Prokofjevs, J.F. Stoddart  
**Filing Date:** 2018-11-22  
**Title:** Flexible Piezoelectric and Antiferroelectric Haloimidazole Crystals
  19. **Serial No.:** TO BE PROVIDED  
**Country:** China  
**Inventors:** K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** TO BE PROVIDED  
**Title:** Carbohydrate-Mediated Purification of Petrochemicals
  20. **Serial No.:** CN201680072938.1  
**Country:** China  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** TO BE PROVIDED  
**Title:** Uptake of Pharmaceuticals within Cyclodextrin-based Porous Materials
  21. **Serial No.:** EP 16865255.0  
**Country:** EPO  
**Inventors:** D. Ferris, K. Hartlieb, J. Holcroft, J.F. Stoddart  
**Filing Date:** TO BE PROVIDED  
**Title:** Uptake of Pharmaceuticals within Cyclodextrin-based Porous Materials

22. **Serial No.:** TO BE ASSIGNED  
**Country:** Saudi Arabia  
**Inventors:** Z. Liu, S. Nalluri, J.F. Stoddart  
**Filing Date:** TO BE PROVIDED  
**Title:** Rigid Chiral Redox-Active Isosceles Triangular Materials