



**ITU Kaleidoscope 2011**

The fully networked human?  
Innovations for future networks and services

# **Dreaming of future CNS Implantable Medical Micro-devices: Following the Innovation Patent-trail and appraising relevant Ethical Issues**

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**Cape Town, South Africa  
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# Background

- ❑ ICT is envisaged to exert an important **impact on brain performance**, by its employment for improving several cerebral processes, through **miniaturized** and radically **improved brain-machine** interfaces.
- ❑ Beyond **drug-mediated** approaches, **brain implants** and **brain gene transfer** aiming to restore central nervous system functions, altered by disease or trauma, constitute the **cutting-edge** of CNS restorative R&D.
- ❑ Indeed, advances enabling **interventions** on the brain, are raising the possibility of:
  - ❑ Restoring **neural functions** for **therapeutic** purposes.
  - ❑ **Monitoring** and **controlling** these functions.
  - ❑ **Modifying** and **enhancing** them.

# Aim of the presentation

The purpose of this presentation is to contribute to the discussion about:

- First, the **physical advantages**.
- And second the consequent **industrial applicability** expectations,

of emerging Central Nervous System (CNS) **implantable electronic micro-device** technologies, as they appear in the **number** and the **quality** of relevant **Patent Applications** filed.

# Industrial Property (IP) Legislation

- **Industrial Property** (IP) legislation **regulates** the protection of innovation, and **facilitates** the cooperation of Industry and Academia.
- However, **IP-Documents** (Patents, filed applications etc.) are often disregarded:
  - First, as a valuable source of **technical knowledge**;
  - Second as a powerful **prediction instrument**; for the **future trends** of Research and Development.

# Searching Brain-implants perspectives

- Brain implants electrically
  - **stimulate** (e.g. deep brain and Vagus nerve stimulation),
  - **block** (e.g. intra-abdominal vagal blocking)
  - and/or **record** signals

from single neurons or groups of neurons in the brain, provided that their function is at least **partially identified**.

# The Search Instruments

- All major relevant classes have been searched, by employing the on-line **esp@cenet search - engine** of the European Patent Office.
- Several hundreds **Patent - documents** have been retrieved and evaluated.
- Promising IP-documents of specific areas have been also assessed for aspects of potential **Ethical** and **Social** importance.



**Esp@cenet**  
Patent search

# Following the innovation trail

- It is not realistic enough to predict in advance the specific **physical** settings and the **technical** details expected to appear after **half a century**.
- However, it seems quite feasible **to attempt** to follow the **innovation trail** defined by some outstandingly innovative patents.

US2011130615 (A1) MULTI-MODALITY NEUROMODULATION OF BRAIN TARGETS (including Vagus Nerve Stimulation)

US 20110130615A1

(19) **United States**  
(12) **Patent Application Publication** (10) **Pub. No.:** US 2011/0130615 A1  
(43) **Pub. Date:** Jun. 2, 2011

(54) **MULTI-MODALITY NEUROMODULATION OF BRAIN TARGETS** (57) **ABSTRACT**

(76) **Inventor:** David J. Mishelevich, Playa del Rey, CA (US)

(21) **Appl. No.:** 12/958,411

(22) **Filed:** Dec. 2, 2010

**Related U.S. Application Data**

(60) **Provisional application No. 61/266,112, filed on Dec. 2, 2009.**

**Publication Classification**

(51) **Int. Cl.**  
A61N 2/00 (2006.01)  
A61N 1/36 (2006.01)

(52) **U.S. Cl.** ..... 600/9; 607/45; 607/3

Disclosed are methods and systems and methods for deep or superficial deep-brain stimulation using multiple therapeutic modalities. These impact multiple points in a neural circuit or one or multiple points in multiple neural circuits to produce Long-Term Potentiation (LTP) or Long-Term Depression (LTD) to treat indications such as neurologic and psychiatric conditions. Modality examples are implanted deep-brain stimulators (DBS), Transcranial Magnetic Stimulation (TMS), transcranial Direct Current Stimulation (DCS), implanted optical stimulation, focused ultrasound, RF stimulation, vagus nerve stimulation, other implant stimulation, functional stimulation, and drugs. Some targets may be up-regulated and others down-regulated. Coordinated control is provided, as applicable, for control of the direction of the energy emission, intensity, session duration, frequency, pulse-train duration, phase, and numbers of sessions, if and as applicable, for neuromodulation of neural targets. Use of ancillary monitoring or imaging to provide feedback may be applied.

**TARGET**  
OFC  
Dorsal Anterior Cingulate Gyrus (US)  
Subgenual Cingulate (US)  
Insula US (US) (US)  
Nucleus Accumbens (US)  
Caudate Nucleus (US)  
Amygdala (US)  
Hippocampus (US)

**DEPRESSION**  
D[US]  
D[US]  
US (US) (US)  
US (US)  
US (US)  
US (US)



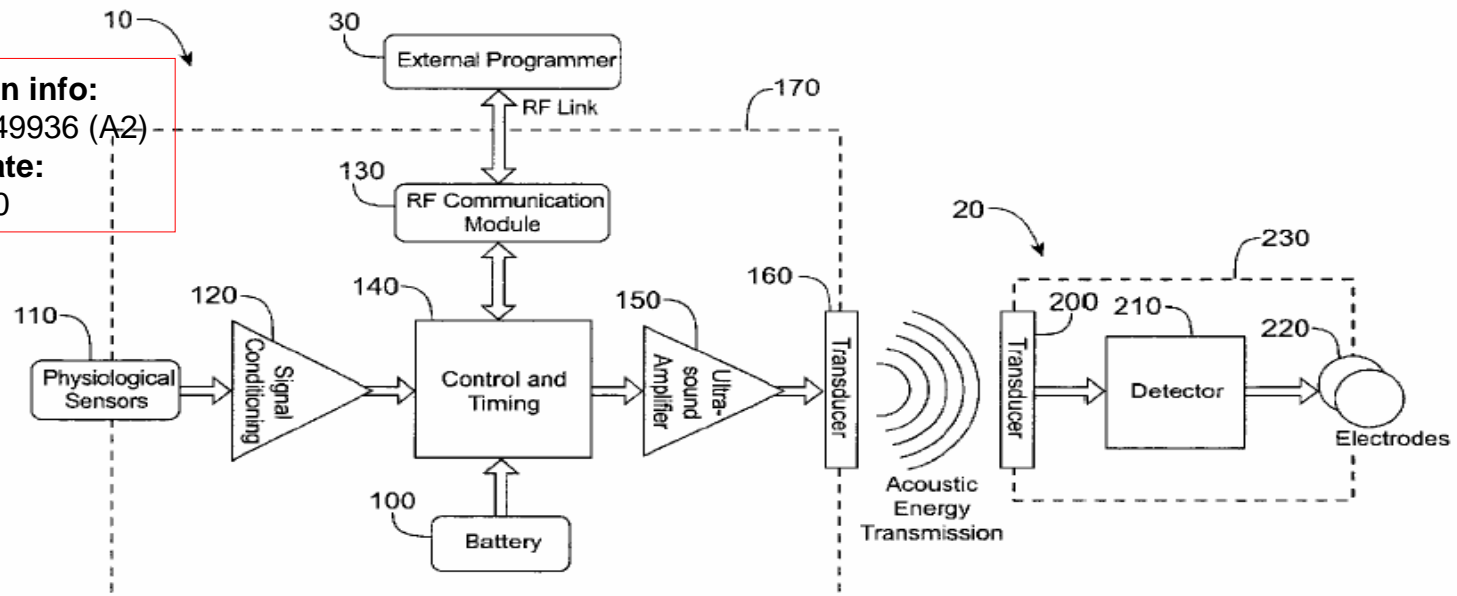
# The employed inference method

We can extrapolate our “guesstimate” towards the decades to come by:

- ❑ Combining premature hints often embedded in patent documents and aiming to extend the claimed legal and technical protection.
- ❑ Starting from already existing or effortlessly predictable important needs and demands, related to healthcare.

(54) Title: SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS TISSUE STIMULATION

Publication info:  
WO2007149936 (A2)  
Priority date:  
2006-06-20





# Searching for hints...

- The **“innovation path”** has pinpointed about a dozen of industrial property documents that may include **hints**, about the emerging **“dream technologies”**, to appear during the next few decades.
- These documents and their **future perspectives** are perhaps worth of a short discussion at Jules Verne’s Corner.



## Espacenet search results on 23-10-2011 11:39

Results page 1

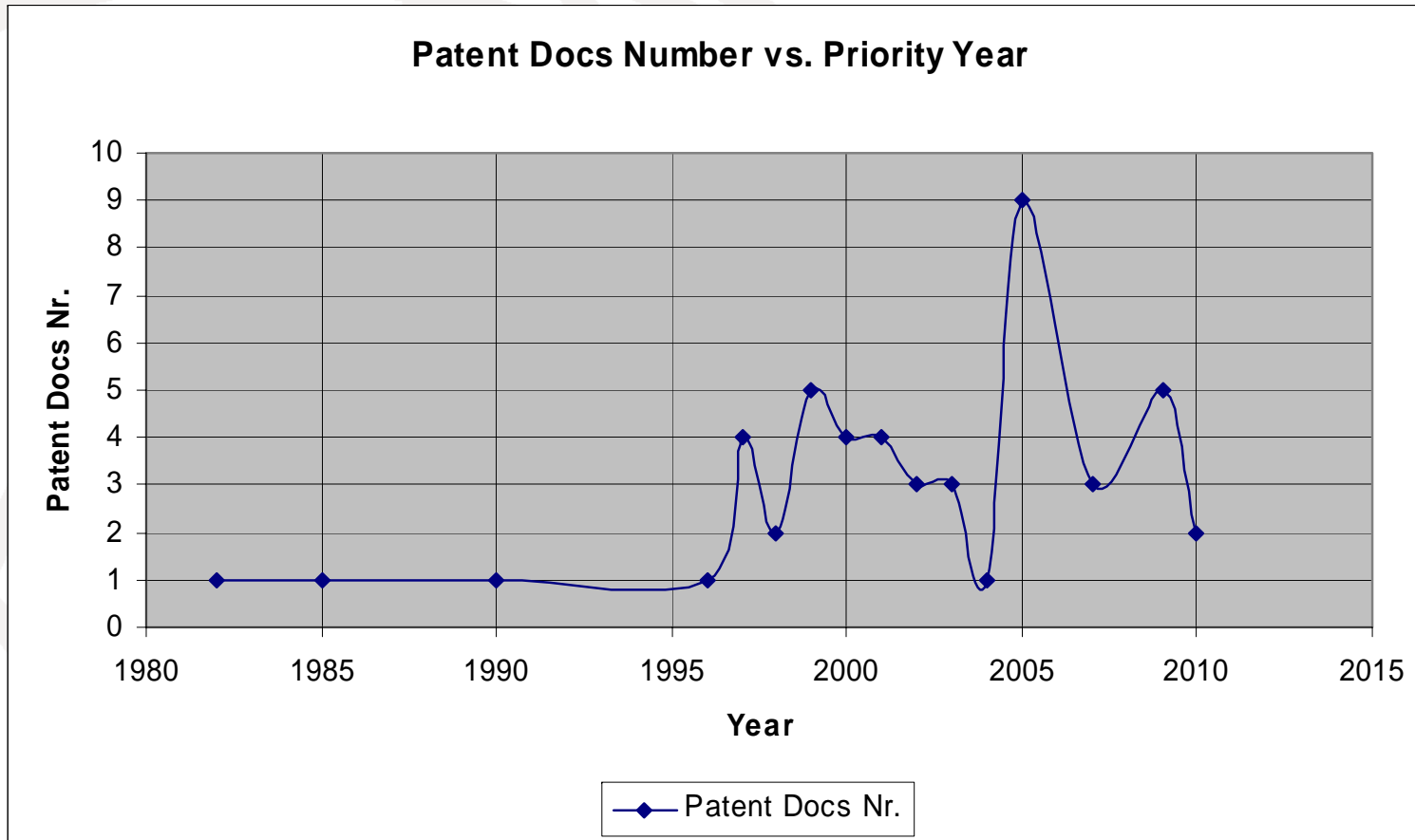
Approximately 19 results found in the Worldwide database  
implant artificial vision in the title or abstract

Publication	Title	Page
WO2011120540 (A1)	RETINAL IMPLANT AND VISUAL PROSTHESIS...	2
US2010229384 (A1)	Flexible Electrode Array for Artifici...	3
US2011002464 (A1)	Intraocular Implant	4
CN201303989 (Y)	Artificial teeth implant	5
US2007123981 (A1)	Bag-in-the-lens intraocular lens with...	6
WO2006113411 (A1)	OCULAR INLAY WITH LOCATOR	7
US2006106432 (A1)	Artificial vision system	8
WO2004075729 (A2)	TELEDIOPTIC LENS SYSTEM AND METHOD FO...	9
US2004088026 (A1)	Multi-phasic microphotodiode retinal ...	10
US2004034415 (A1)	Methods of implanting an intraocular ...	11
MXPA02011547 (A)	METHODS OF PRE SELECTING A POLYMERIZA...	12
WO03043529 (A2)	FLEXIBLE ELECTRODE ARRAY FOR ARTIFICI...	13
US2002087202 (A1)	Multi-phasic microphotodiode retinal ...	14
WO0067678 (A2)	INTRAOCULAR LENS WITH ACCOMMODATIVE P...	15
US6230057 (B1)	Multi-phasic microphotodiode retinal ...	16

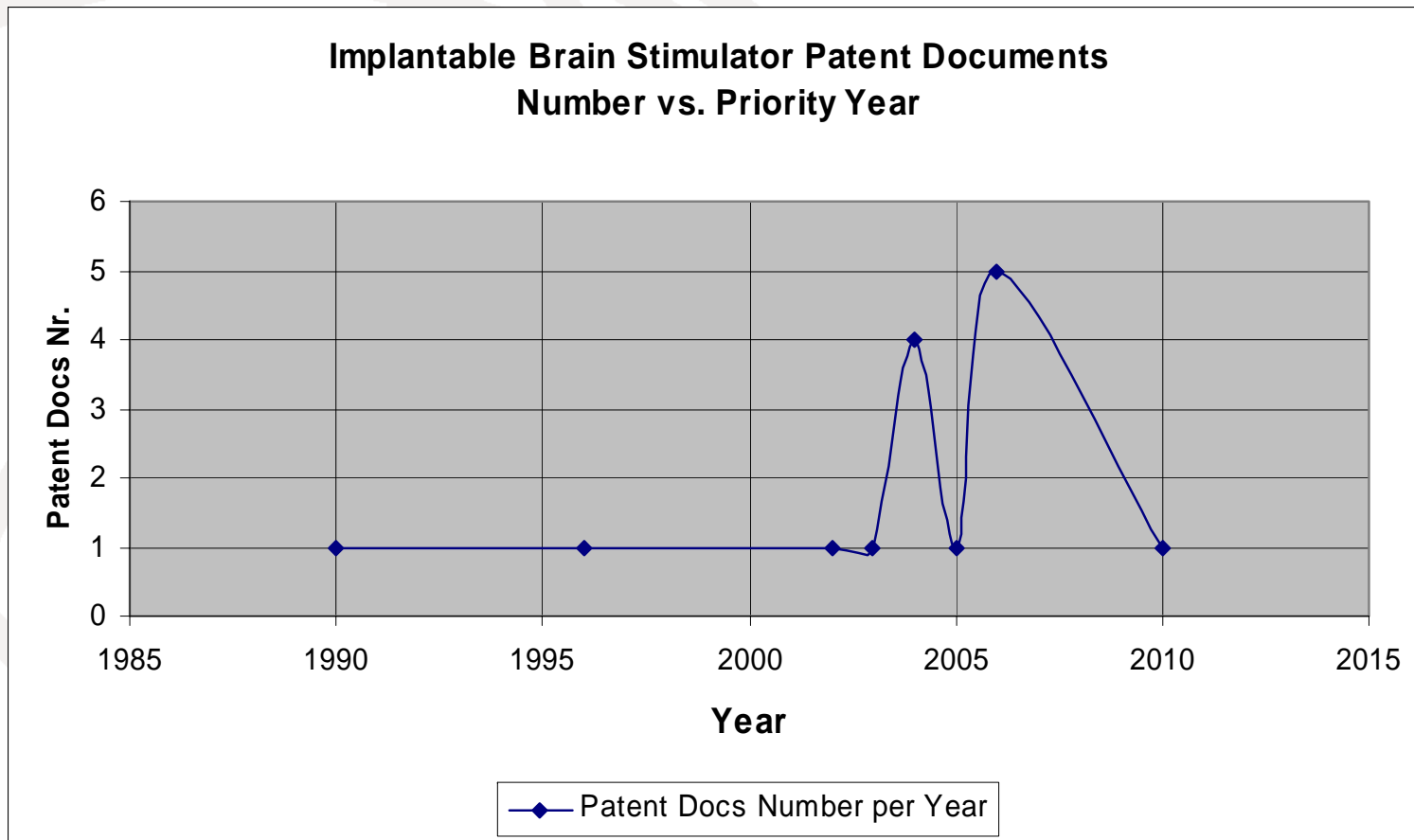
# Indicative promising documents retrieved

<b>Publication Number</b>	<b>Publication Date</b>	<b>Document Title</b>
US2011130615	2011-06-02	MULTI - MODALITY NEUROMODULATION OF BRAIN TARGETS
WO2007149936	2006-06-20	SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS TISSUE STIMULATION
US2011166620	2011-07-07	SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS BRAIN STIMULATION
US2011166621	2011-07-07	SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS SPINE STIMULATION
US2009254146	2009-10-08	DEEP BRAIN STIMULATION IMPLANT WITH MICRO-COIL ARRAY
DE102008040573	2010-01-28	IMPLANT, PREFERABLY BRAIN PACEMAKER USEFUL FOR TREATING PARKINSON'S DISEASE, COMPRISES AN IMPLANT BASE BODY, ANCHOR GROUPS ON THE SURFACE OF THE IMPLANT BASE BODY, AND APTAMERS, WHICH ARE BONDED TO THE ANCHOR GROUPS
US20070239235	2007-10-11	RED LIGHT IMPLANT FOR TREATING PARKINSON'S DISEASE
WO2005102458	2005-11-03	AIRWAY IMPLANT DEVICES AND METHODS OF USE
WO2011120540	2011-10-06	RETINAL IMPLANT AND VISUAL PROSTHESIS INCORPORATING SUCH AN IMPLANT
US20100229384	2010-09-16	FLEXIBLE ELECTRODE ARRAY FOR ARTIFICIAL VISION


# Implantable Neural Stimulator Patent Documents Number vs. Priority Year



# Implantable Brain Stimulator Patent Documents Number vs. Priority Year



# Brain and spine implantable leadless stimulation

  
 US 20110166620A1

(19) **United States**  
 (12) **Patent Application Publication** (10) **Pub. No.:** US 2011/0166620 A1  
 Cowan et al. (43) **Pub. Date:** Jul. 7, 2011

(54) **SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS BRAIN STIMULATION** Publication Classification

(75) **Inventors:** Mark W. Cowan, Fremont, CA (US); Richard E. Riley, Palo Alto, CA (US); Axel F. Brisken, Fremont, CA (US); Debra S. Echt, Woodside, CA (US)

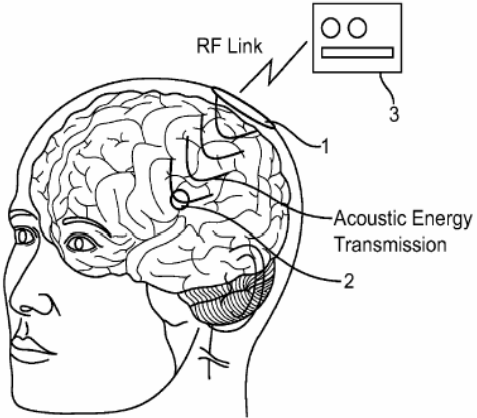
(73) **Assignee:** EBR Systems, Inc., Sunnyvale, CA (US)

(21) **Appl. No.:** 13/007,432  
 (22) **Filed:** Jan. 14, 2011


**Related U.S. Application Data**

(62) Division of application No. 11/764,602, filed on Jun. 18, 2007, now Pat. No. 7,894,904.  
 (60) Provisional application No. 60/805,320, filed on Jun. 20, 2006.

(51) **Int. Cl.** A61N 1/36 (2006.01)  
 (52) **U.S. Cl.** 607/45  
 (57) **ABSTRACT**  
 Systems and methods are disclosed to stimulate brain tissue to treat medical conditions such as movement disorders, pain and epilepsy. The disclosed invention uses electrical stimulation of the brain tissue, where vibrational energy from a source is received by an implanted device and converted to electrical energy and the converted electrical energy is used by implanted electrodes to stimulate the pre-determined brain site. The vibrational energy is generated by a controller-transmitter, which could be either implanted or located externally. The vibrational energy is received by a receiver-stimulator, which could be located under the skull, within the brain, on the dura, or in the cranial space close to the brain. As a therapeutic treatment, the implantable receiver-stimulator stimulates the brain sites that are effective in altering brain activity.



**SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS BRAIN STIMULATION**

  
 US 20110166621A1

(19) **United States**  
 (12) **Patent Application Publication** (10) **Pub. No.:** US 2011/0166621 A1  
 Cowan et al. (43) **Pub. Date:** Jul. 7, 2011

(54) **SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS SPINE STIMULATION** Publication Classification

(75) **Inventors:** Mark W. Cowan, Fremont, CA (US); Richard E. Riley, Palo Alto, CA (US); Axel F. Brisken, Fremont, CA (US); Debra S. Echt, Woodside, CA (US)

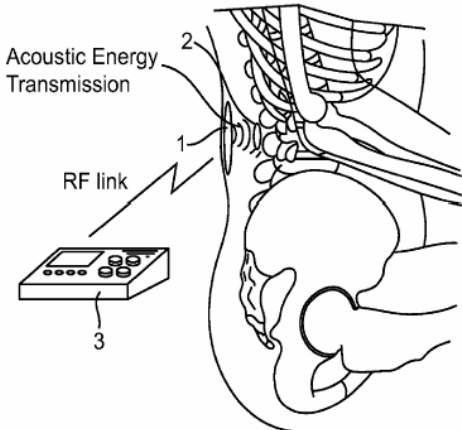
(73) **Assignee:** EBR Systems, Inc., Sunnyvale, CA (US)

(21) **Appl. No.:** 13/007,419  
 (22) **Filed:** Jan. 14, 2011

**Related U.S. Application Data**

(62) Division of application No. 11/764,574, filed on Jun. 18, 2007, now Pat. No. 7,899,542.  
 (60) Provisional application No. 60/805,315, filed on Jun. 20, 2006.

(51) **Int. Cl.** A61N 1/36 (2006.01)  
 (52) **U.S. Cl.** 607/46  
 (57) **ABSTRACT**  
 Systems and methods are disclosed to stimulate spine tissue to treat medical conditions such as pain and spinal injury. The invention uses electrical stimulation of the spine, where vibrational energy from a source is received by an implanted device and converted to electrical energy and the converted electrical energy is used by implanted electrodes to stimulate the pre-determined brain site. The vibrational energy is generated by a controller-transmitter, which could be located either externally or implanted. The vibrational energy is received by a receiver-stimulator, which could be located in the various regions on around the spine. The implantable receiver-stimulator stimulates different locations in the spine region to provide therapeutic benefit.



**SYSTEMS AND METHODS FOR IMPLANTABLE LEADLESS SPINE STIMULATION**

# Deep Brain Stimulation and an Aptamer Chip-coating Technique

US 20090254146A1

(19) **United States**  
 (12) **Patent Application Publication** (10) Pub. No.: **US 2009/0254146 A1**  
 Bonmassar et al. (43) Pub. Date: **Oct. 8, 2009**

(54) **DEEP BRAIN STIMULATION IMPLANT WITH MICROCOIL ARRAY**

(76) Inventors: **Giorgio Bonmassar**, Lexington, MA (US); **Matti S. Hamalainen**, Boston, MA (US); **Bruce Rosen**, Lexington, MA (US)

Correspondence Address:  
**QUARLES & BRADY LLP**  
 411 E. WISCONSIN AVENUE, SUITE 2040  
 MILWAUKEE, WI 53202-4497 (US)

(21) Appl. No.: **12/418,324**  
 (22) Filed: **Apr. 3, 2009**

Related U.S. Application Data  
 (60) Provisional application No. 61/042,070, filed on Apr. 3, 2008.

Publication Classification  
 (51) Int. Cl. **A61N 1/36** (2006.01)  
 (52) U.S. Cl. **607/45**  
 (57) **ABSTRACT**  
 An implant for deep brain stimulation (DBS) has an array of electromagnetic microcoils dispersed over the length of the implant. The microcoils produce magnetic fields that are directed into, and induce current in, the adjacent brain tissue. The microcoils may be selectively operated to direct and focus electrical stimulation to targeted areas of the brain. The implant is useful in studying or treating neurophysiological conditions associated with the deep regions of the brain such as Parkinson's disease, drug addiction, and depression.

**DEEP BRAIN STIMULATION IMPLANT WITH MICROCOIL ARRAY**

DE 10 2008 040 573 A1 2010.01.28

(19) **Bundesrepublik Deutschland**  
 Deutsches Patent- und Markenamt

(12) **Offenlegungsschrift**

(21) Aktenzeichen: **10 2008 040 573.6**  
 (22) Anmeldetag: **21.07.2008**  
 (43) Offenlegungstag: **28.01.2010**

(51) Int. Cl.: **A61L 27/34** (2006.01)  
**A61L 27/54** (2006.01)  
**A61L 31/10** (2006.01)

(71) Anmelder:  
**BIOTRONIK VI PATENT AG, Baar, CH**

(74) Vertreter:  
**Lindner-Vogt, K., Dipl.-Phys., Pat.-Anw., 70499 Stuttgart**

(72) Erfinder:  
**Borck, Alexander, 91086 Aurachtal, DE; Gratz, Matthias, Dr., 91054 Erlangen, DE**

(56) Für die Beurteilung der Patentfähigkeit in Betracht zu ziehende Druckschriften:  
 DE 10 2007 016151 A1  
 DE 10 2007 003708 A1  
 DE 602 04 158 T2  
 WO 04/0 55 153 A2  
 WO 02/40 075 A1  
 WO 02/20 873 A2

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen  
 Recherchantrag gemäß § 43 Abs. 1 Satz 1 PatG ist gestellt.

(54) Bezeichnung: **Aptamer beschichtetes Implantat, Herstellverfahren und Verwendungen**

(57) Zusammenfassung: Die vorliegende Erfindung betrifft ein Implantat, umfassend oder bestehend aus einem Implantatgrundkörper, einer oder mehreren, gleichen oder verschiedenen Ankergruppen auf der Oberfläche des Implantatgrundkörpers, einem oder mehreren, gleichen oder verschiedenen Aptameren, die an das oder die Ankergruppen gebunden sind, dadurch gekennzeichnet, dass die Ankergruppen gleich oder verschieden ausgewählt werden aus ...

**Aptamer beschichtetes Implantat, Herstellverfahren und Verwendungen**

L für eine Einfach-Bindung oder -O- steht,  
 M für eine Einfach-Bindung oder -(CH<sub>2</sub>-CH<sub>2</sub>-O)<sub>x</sub> steht,  
 x für eine Zahl, ausgewählt aus der Gruppe, bestehend aus 1 bis 25, steht und  
 y für eine Zahl, ausgewählt aus der Gruppe, bestehend aus 1 bis 25, steht,  
 sowie deren Salze und Hydrate und die Aptamere so ausgerichtet sind, dass sie i) ein oder mehrere physiologische Verbindungen eines menschlichen oder tierischen Organismus und/oder ii) ein oder mehrere systemisch verabreichte Wirkstoffe unter physiologischen Bedingungen in einem menschlichen oder tierischen Organismus binden sowie ein Verfahren zur Herstellung eines erfindungsgemäßen Implantats sowie die Verwendung von Verbindungen der allgemeinen Formel (I)  
 (R<sup>1</sup>O)<sub>i</sub>(C<sub>2</sub>H<sub>5</sub>)<sub>j</sub>-L(CH<sub>2</sub>)<sub>k</sub>-M-R<sup>1</sup> (I) als Ankergruppen für Biomoleküle aus ...

# Red-light emitting Implant and airway Implant for Parkinson's Disease treatment

US 20070239235A1

(19) **United States**  
 (12) **Patent Application Publication** (10) Pub. No.: **US 2007/0239235 A1**  
 DiMauro et al. (43) Pub. Date: **Oct. 11, 2007**

(54) **RED LIGHT IMPLANT FOR TREATING PARKINSON'S DISEASE** (22) Filed: **Jun. 12, 2007**

(76) Inventors: **Thomas M. DiMauro**, Southborough, MA (US); **Mohamed Attawia**, Easton, NJ (US); **Chantal Holy**, Somerville, MA (US); **Sean L. Lilienfeld**, Sharon, MA (US); **Jeffrey K. Sutton**, Medway, MA (US); **Michael Ward**, Providence, RI (US)

Correspondence Address:  
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**JOHNSON & JOHNSON**  
**ONE JOHNSON & JOHNSON PLAZA**  
**NEW BRUNSWICK, NJ 08933-7003 (US)**

(21) Appl. No.: **11/761,708**

(62) Division of application No. 11/079,784, filed on Mar. 14, 2005.

(31) Int. Cl. **A61N 5/06** (2006.01)  
 (52) U.S. Cl. **607/88**

(57) **ABSTRACT**  
 This invention relates to an implantable device that delivers an effective amount of red light to the substantia nigra as a treatment for Parkinson's Disease (PD).

**RED LIGHT IMPLANT FOR TREATING PARKINSON'S DISEASE**

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau

(43) International Publication Date **3 November 2005 (03.11.2005)**

(10) International Publication Number **WO 2005/102458 A2**

(51) International Patent Classification: **A62B 18/08** (74) Agent: **KASER, Matthew, R.**, Bell & Associates, Suite 100, 416 Funston Avenue, San Francisco, CA 94118 (US).

(21) International Application Number: **PCT/US2005/013232** (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MY, NA, NL, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SE, SG, SK, SL, SM, SY, TI, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(22) International Filing Date: **19 April 2005 (19.04.2005)**

(25) Filing Language: **English**

(26) Publication Language: **English**

(30) Priority Data:  
 60/563,604 19 April 2004 (19.04.2004) US  
 60/620,076 20 October 2004 (20.10.2004) US

(71) Applicant (for all designated States except US): **THE BOARD OF TRUSTEES, THE LELAND STANFORD JUNIOR UNIVERSITY** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US).

(72) Inventors; and (75) Inventors/Applicants (for US only): **WALKE, Amrsh, Jayprakash** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US). **JOHNSON, Jeremy** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US). **WOO, Russell** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US). **ANDERSON, Evan** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US). **RICHARDSON, Kelly** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US). **MARTIN, Kenneth** [US/US]; 1705 El Camino Real, Palo Alto, CA 94306 (US).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**  
 — without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

**AIRWAY IMPLANT DEVICES AND METHODS OF USE**

(54) Title: **AIRWAY IMPLANT DEVICES AND METHODS OF USE**

(57) Abstract: The invention is drawn to airway implant devices that can alleviate and remediate the effects of dysphagia and aspiration that occur under a wide range of clinical conditions, such as Parkinson's disorders, Alzheimer's disease, or stroke. The devices can further be used to reduce the risk of onset of aspiration pneumonia in these and many other clinical conditions.

**WO 2005/102458 A2**



# Retinal implant and flexible Array supporting Artificial Vision

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau

(43) International Publication Date  
6 October 2011 (06.10.2011)

(10) International Publication Number  
WO 2011/120540 A1

(51) International Patent Classification:  
A61N 1/56 (2006.01) A61F 9/08 (2006.01)

(21) International Application Number:  
PCT/EP2010/002112

(22) International Filing Date:  
1 April 2010 (01.04.2010)

(25) Filing Language:  
English

(26) Publication Language:  
English

(71) Applicant (for all designated States except US): IMI INTELLIGENT MEDICAL IMPLANTS AG [CH/CH];  
Gothardstrasse 3, CH-6304 Zug (CH).

(72) Inventors; and  
(75) Inventors/Applicants (for US only): KLAVER, Tom [NL/NL]; Suckeloptstrasse 7, 51065 Köln (DE); DAP, PER, Marcus [DE/DE]; Drachenfelsweg 47, 53227 Bonn (DE); TIEDTKE, Hans-Jürgen [DE/DE]; Hartwig-Hilser-Str. 4, 53227 Bonn (DE).

(74) Agents: GEHRIG, Philip et al.; GRAF VON STOSCH, Prinzregentenstrasse 22, 80538 München (DE).

(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, 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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (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, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published with international search report (Art. 21(3))

## RETINAL IMPLANT AND VISUAL PROSTHESIS INCORPORATING SUCH AN IMPLANT

(54) Title: RETINAL IMPLANT AND VISUAL PROSTHESIS INCORPORATING SUCH AN IMPLANT

Fig. 2

(57) Abstract: A system for generating artificial vision in a subject, comprising: an image capture means for capturing an image from a surrounding environment; an image processing means for processing the image and converting the image into an image signal; and a retinal implant or stimulation device (10) configured to be implanted within an eye of a patient and positioned on or adjacent the retina. The implant or stimulation device (10) comprises a substrate (11) and a plurality of light sources (12) arranged in an array on the substrate (11) for stimulating nerve cells of the retina, wherein each of the plurality of light sources (12) is configured to emit infrared radiation to stimulate one or more nerve cells in response to a respective stimulation signal derived from the image signal.

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2010/0229384 A1

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(54) FLEXIBLE ELECTRODE ARRAY FOR ARTIFICIAL VISION

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(57) ABSTRACT

An image is captured or otherwise converted into a signal in an artificial vision system. The signal is transmitted to the retina utilizing an implant. The implant consists of a polymer substrate made of a compliant material such as poly(dimethylsiloxane) or PDMS. The polymer substrate is conformable to the shape of the retina. Electrodes and conductive leads are embedded in the polymer substrate. The conductive leads and the electrodes transmit the signal representing the image to the cells in the retina. The signal representing the image stimulates cells in the retina.

FLEXIBLE ELECTRODE ARRAY FOR ARTIFICIAL VISION

# Monitoring and manipulating brain functions

- ❑ Techniques for **monitoring** and **manipulating** brain functions are developing rapidly.
- ❑ However, we still do not know precisely the **interactions** of the different systems of the brain.
- ❑ There are still **“grey zones”** concerning for instance:
  - ❑ The connection of a particular **brain abnormality** and a **potential future psychopathology**.
  - ❑ The influence of **medication**, of **electronic** and of **biological implants** on the **beliefs, desires, intentions and emotions** that constitute the human mind.
- ❑ Therefore, the Industrial Property document search has been focussed to include fields of **cardinal social importance**.

# Social and Ethical Implications

- ❑ However, our **dream** could easily become a **nightmare**, if the social, economical and cultural **impact** of these future technologies is being **neglected**.
- ❑ Brain implant technology is loaded with **risky** and **almost terrifying** implications, related to thoroughly altering the **kernel** of human nature.
- ❑ **Restoring** and **Monitoring** Neural Functions for **Therapeutic Purposes** is necessary and morally quite acceptable.
- ❑ However, **Controlling, Modifying & Enhancing** these functions, *although presently not possible*, constitute a cardinal emerging threat for the **Mankind**, concerning, both, the **Biological** and the **Social** aspects of the **Human Personality**.

# Ethical Issues related to Neuroimaging and Neurotechnology methods

- Not only **“Brain-Chips”**, but also **Neuroimaging** and other **Neurotechnology** methods, possessing also the potential of:
  - Revealing **unconscious** attitudes;
  - Detection of **deception**;
  - Other relevant ethical problems concerning the **conception** of human nature and features;have attracted our attention
- The associated potential ethical and legal issues taken into account are concerning:
  - Privacy **intrusion** aspects.
  - **Reliability** and **validity** aspects of predictive Neuroimaging.

# Brain Enhancement related Ethical Issues

- ❑ Brain enhancement methods and emerging options are concerning:
  - ❑ *Attention.*
  - ❑ *Alertness.*
  - ❑ *Memory.*
  - ❑ *Mood.*
  - ❑ *Happiness.*
- ❑ The associated potential ethical and legal issues are concerning:
  - ❑ *Safety.*
  - ❑ *Competition.*
  - ❑ *Alteration of the human-specific conditions.*
- ❑ Neurotechnology methods and options might induce **ethical problems** concerning **features** and the **overall conception** of human nature.

# Mental vs. Brain states

- Neuroscience seems to show that **mental states** may be reduced to **brain states**, possibly even to appropriate quantum-mechanical **electron population** states.
- Such approaches and concepts of:
  - first, the **nature** and the **identity** of the human personality;
  - second, its relation to the **bodily functions** under investigation;gives birth to serious **moral-religious** and/or **ethical-legal** questions, outlined in the following slide.

# Crucial questions appraised

- First, the direct correlation of personal responsibility and liability with specific (still to be investigated) neurobiological brain processes.
- Second, the eligibility of psychiatric (?) treatment of mental disorders as “plain” brain diseases.
- Finally, CNS-enhancement techniques undermine the traditional belief (religious or natural) of the existence of the unity and autonomy of the human personality.



# Benefits of the retrieval and evaluation of Patent Documents

- We are searching Patent Documents in the hope to reveal implicitly stated Neuroscience related ethical and legal emerging issues.
- The retrieval and evaluation of:
  - technical-economical-legal Patent and other related Documents,
  - rather than or complementary to traditional applied philosophy essays,offers twofold benefits:

# Granted vs. “surviving” Patents

- The first benefit is that the Industrial Property rights related necessary **expenditure**, reduces dramatically the **number of granted** and especially of **“surviving” patents**, compared to academic scientific papers.
- Thus, the collective **technological** and **capital-investment** trends are much more **reliably “mapped”** on the **patent-trail** to be created.

# Time necessary between first Publication and Industrial Employment

- The second advantage is that there is usually enough time between the first publication of an important patent application and the incorporation of the described innovation into the industrial main-stream.
- This time period allows for at least:
  - The spotting of critical ethical and legal issues, demanding cautiousness.
  - The restraint in their application, and eventually appropriate legislative action for the protection of the general public.

# Conclusions

- It does not really matter, whether our prediction about the **future course** of Research and Development is accurate or not.
- However, **appraising** and **assessing** in advance all **relevant ethical issues**, related to each emerging technical aspect, is a **mandatory prerequisite**, in order to keep this extremely sensible field of Science and Technology **servicing** and not **dominating** the public.