2018

Challenges for successful implantation of biofuel cells.

New directions in membrane designs for biosensors.
Lopes IC, Zebda A and Vadgama P. *Current Opinion in Electrochemistry* vol. 12, 107-112.

Bifunctional aptamer-mediated catalytic hairpin assembly for the sensitive and homogenous detection of rare cancer cells.

High temporal resolution delayed analysis of clinical microdialysate streams.

2017

An electrochemical study of microporous track-etched membrane permeability and the effect of surface protein layers.

2016

Materials for improved point of care biosensor-tissue interfaces.
*Medical Biosensors For Point of Care (Poc) Applications.*

Nanoscience and Nanotechnology and the Armory for the Twenty-First Century Health Care.
*Nanoscience and Nanotechnology For Human Health.*

2015

Electrochemical determination of microRNAs based on isothermal strand-displacement polymerase reaction coupled with multi-enzyme functionalized magnetic micro-carriers.

3D Printed Microfluidic Device with Integrated Biosensors for Online Analysis of Subcutaneous Human Microdialysate.

Assessing the carcinogenic potential of low-dose exposures to chemical mixtures in the environment: the challenge ahead.
The potential for chemical mixtures from the environment to enable the cancer hallmark of sustained proliferative signalling.

2014

Surface modification of titanium plate enhanced fibronectin-mediated adhesion and proliferation of MG-63 cells.

Electropolymériser Phenolic Films as Internal Barriers for Oxidase Enzyme Biosensors.

2013

Antimicrobial, mechanical and thermal studies of silver particle-loaded polyurethane.

Barrier membrane protected in vivo biosensors.

Silver surface-enhanced Raman scattering substrates prepared by a nanofabrication process using Electron Beam Lithography and magnetron sputtering.

Integrated chemistries for analytical simplification and point of care testing.
. Rsc Detection Science 35-64.

Wearable electronic sensor for potentiometric and amperometric measurements.

Chemosensors and biosensors based on polyelectrolyte microcapsules containing fluorescent dyes and enzymes.
. Analytical and Bioanalytical Chemistry vol. 405, (5) 1559-1568.

Characterization of thin films and membranes.
. Analytical and Bioanalytical Chemistry vol. 405, (5) 1433-1434.

Packaging and coating materials for implantable devices.
.

2012

Oxygen detection using different types of membranes deposited on needle based platforms.

General platform for in Vivo sensors for oxygen, glucose and lactate monitoring.

Stabilised Biosensing Using Needle-Based Recess Electrodes.

Development of bacterially resistant polyurethane for coating medical devices.

Circadian Disruption and Remedial Interventions Effects and Interventions for Jet Lag for Athletic Peak Performance.
Chemosensors and biosensors based on polyelectrolyte microcapsules containing fluorescent dyes and enzymes. Kazakova LI, Shabarchina LI, Anastasova S, Pavlov AM, Vadgama P, Skirtach AG and Sukhorukov GB. *Analytical and Bioanalytical Chemistry* 1-10.

**Characterization of thin films and membranes.**
Vadgama P and Mandler D. *Analytical and Bioanalytical Chemistry* 1-2.

**Oxygen diffusion through collagen scaffolds at defined densities: implications for cell survival in tissue models.**

2011

**Fabrication of biomaterials via controlled protein bubble generation and manipulation.**
* . *Biomacromolecules* vol. 12, (12) 4291-4300.

**Multifunctional Biosensor Development and Manufacture.**
Vadgama P. *Comprehensive Biotechnology, Second Edition.*

**Isopropyl Myristate Modified Silicone as a Potential New Encapsulating Material for Implantable Devices.**

**Concluding remarks.**

**Clinical context and fundamental advances: the need to build linkages.**
Vadgama P. *Faraday Discuss* vol. 149, 357-364.

2010

**Both sides nanopatterned tubular collagen scaffolds as tissue-engineered vascular grafts.**

**Bio-sensing using recessed gold-filled capillary amperometric electrodes.**
* . *Analytical and Bioanalytical Chemistry* vol. 398, (4) 1687-1694.

**Focus on sensor interfaces.**

**Polyurethane membranes modified with isopropyl myristate as a potential candidate for encapsulating electronic implants: A study of biocompatibility and water permeability.**

**Study of albumin and fibrinogen membranes formed by interfacial crosslinking using microfluidic flow.**
* . *Biofabrication* vol. 2, (3).

**Modulation of cell growth on exposure to silkworm and spider silk fibers.**

2009

**Isopropyl Myristate-Modified Polyether-Urethane Coatings as Protective Barriers for Implantable Medical Devices.**

**Surface plasmon resonance imaging for biosensing.**

**Influence of nanopatterns on endothelial cell adhesion: Enhanced cell retention under shear stress.**
Synthesis and characterisation of enhanced barrier polyurethane for encapsulation of implantable medical devices.

Impedance resonance: A novel technique for signal acquisition from interdigitated electrodes (IDE) in sensor applications.
Ieee Sensors Journal vol. 9, (2) 143-145.

Synthesis and characterisation of enhanced barrier polyurethane for encapsulation of implantable medical devices.

Impedance Resonance: A Novel Technique for Signal Acquisition From Interdigitated Electrodes (IDE) in Sensor Applications.
Snyder DM and Vadgama P. Ieee Sens J vol. 9, (1-2) 143-145.

2008

Liquid crystalline phthalocyanine thin films as nanoscale substrates for protein adsorption.

Sol-gel coated bioelectrodes for the selection of cells in microfluidic systems.
8th World Biomaterials Congress 2008 vol. 2.,

A test method to monitor in vitro storage and degradation effects on a skin substitute.
Medical Engineering and Physics vol. 30, (5) 640-646.

Assessment of tissue scaffold degradation using electrochemical techniques.

Editorial - Detection for security.
Analyst vol. 133, (5).

In Vivo Applications: Glucose Monitoring, Fuel Cells.

Bipartite expressions for amperometric currents of recessed, membrane covered planar and hanging mercury drop electrodes.

Development of electrochemical biosensors based on sol-gel enzyme encapsulation and protective polymer membranes.

Detection for security.
Bell A and Vadgama P. Analyst vol. 133, (5) 557-557.

Needle enzyme electrode for lactate measurement in vivo.
Ieee Sensors Journal vol. 8, (1) 113-120.

Polypyrrole incorporating biomolecules.
International Journal of Nano and Biomaterials vol. 1, (3) 222-236.

2007

Technology developments to initiate a next generation of Cochlear Implants.
Impedimetric sensing of cells on polypyrrole-based conducting polymers.

Biocompatible materials developments for new medical implants.

Effective diffusion coefficient determination within cylindrical granules of adsorbents using a direct simulation method.
Rong ZM, Terzyk AP, Gauden PA and Vadgama P. *J Colloid Interf Sci* vol. 313, (2) 449-453.

Sensor biocompatibility: final frontier in bioanalytical measurement.
Vadgama P. *Analyst* vol. 132, (6) 495-499.

Biocomposite nanofibres and osteoblasts for bone tissue engineering.
Venugopal J, Vadgama P, Kumar TSS and Ramakrishna S. *Nanotechnology* vol. 18, (5).

Magnetic counter-gravity flow separation of electrically prepolarised lymphoid cells.

Modifying surfaces and interfaces for improved biomaterial performance.

Spider and mulberry silkworm silks as compatible biomaterials.
Hakimi O, Knight DP, Vollrath F and Vadgama P. *Compos Part B-Eng* vol. 38, (3) 324-337.

Preparation, characterization and applications of ultrathin cellulose acetate Langmuir-Blodgett films.

2006

Polypyrrole-based conducting polymers and interactions with biological tissues.

Bipartite expressions for diffusional mass transport in biomembranes.
Rong Z and Vadgama P. *Biophys J* vol. 91, (12) 4690-4696.

Microfluidic cell optimization for polymer membrane fabrication.

Editorial for special issue of medical engineering and physics.
Vadgama P. *Med Eng Phys* vol. 28, (10) 933-933.

Characterization of a laminar flow cell for the prevention of biosensor fouling.

Simple expressions for diffusion coefficient determination of adsorption within spherical and cylindrical absorbents using direct simulation method.
Rong ZM and Vadgama P. *J Colloid Interf Sci* vol. 303, (1) 75-79.

In situ fabrication of cross-linked protein membranes by using microfluidics.

Microfluidic systems for in situ formation of nylon 6,6 membranes.

Ultrastructure of insect and spider cocoon silks.
Hakimi O, Knight DP, Knight MM, Grahn MF and Vadgama P. *Biomacromolecules* vol. 7, (10) 2901-2908.
A bipartite expression for the transient amperometric current at a membrane covered planar electrode to characterize solute diffusion through the membrane.
Rong ZM, Rashid S and Vadgama P. *Electroanal vol. 18*, (17) 1703-1709.

Dynamic simulation method to characterise oxygen transport in hydrogel membranes.
Rong Z and Vadgama P. *Biomaterials vol. 27*, (23) 4266-4268.

Microfluidic assays in practice.
Vadgama P. *Nano Today vol. 1*, (3) 56-56.

Biocompatibility - shifting priorities.

Characterisation of the nanoporous structure of collagen-glycosaminoglycan hydrogels by freezing-out of bulk and bound water.

Culture of human keratinocytes on polypyrrole-based conducting polymers.

Needle enzyme electrode based glucose diffusive transport measurement in a collagen gel and validation of a simulation model.
Rong ZM, Cheema U and Vadgama P. *Analyst vol. 131*, (7) 816-821.

2005

Surface biocompatibility.

Microelectrodes and biocompatible sensors for skin pO2 measurements.
.

Interaction of myofibroblasts with silk scaffolds.
Vadgama P. *European Cells and Materials vol. 10*, (SUPPL.2).

Preface.
. *Surfaces and Interfaces For Biomaterials*.

Tissue implanted glucose needle electrodes: early sensor stabilisation and achievement of tissue-blood correlation during the run in period.

Mucin/carboxpol matrix to immobilize oxalate oxidase in a urine oxalate amperometric biosensor.

Stable use of biosensors at the sample interface.
Pearson J, Kyriakou G and Vadgama P.

Issues concerning the use of assays of cell adhesion to biomaterials.
James SL, Mikhalovsky S, Vadgama P and Tomlins PE.

Surfaces and interfaces for biomaterials.
. *Surfaces and Interfaces For Biomaterials 1-802*.

On the topographical characterisation of biomaterial surfaces.
.

2004

O-2 microsensors for minimally invasive tissue monitoring.
Detection of DNA hybridization on a liposome surface using ultrasound velocimetry and turbidimetry methods.

2003

Hybridization of DNA at the surface of phospholipid monolayers. Effect of orientation of oligonucleotide chains.

Voltammetric and impedance studies of inosine-5’-monophosphate and hypoxanthine.

Biosensors - picking up the vibes.
VADGAMA PM. Biological Sciences Review vol. 15, (4) 32-36.

2002

Advances in continuous in vivo glucose monitoring.

Entrapment of glucose oxidase in non-porous poly(vinyl chloride).

Modified microelectrode interfaces for in-line electrochemical monitoring of ethanol in fermentation processes.

A lightweight measuring device for the continuous in vivo monitoring of glucose by means of ultraslow microdialysis in combination with a miniaturised flow-through biosensor.

Strategic issues in reliable sensing.

Reagentless biosensing using electrochemical impedance spectroscopy.

2001

A versatile biosensor device for continuous biomedical monitoring.

Electrochemical impedance spectroscopy as a platform for reagentless bioaffinity sensing.

A rapid receptor-ligand assay determination of estrogens using surface plasmon resonance.

Amperometric detection of DNA hybridization on a gold surface depends on the orientation of oligonucleotide chains.

Biomedical sensors: materials.

Basic structure and functional properties of medical biosensors with special regard to biocompatibility.
VADGAMA PM and Farace G. Biocybernetics and Biomedical Engineering vol. 21, (4) 11-20.
2000

An enzyme electrode for extended linearity citrate measurements based on modified polymeric membranes.

Novel open flow microflow sensor for reduced fouling of chemical sensors in physiological sampling environments.
. *Sensors and Actuators, B: Chemical* vol. 65, (1) 305-309.

Development of a redox mediated amperometric detection system for immunoassay. Application to urinaryamphetamine screening.

Reagentless enzyme electrode for malate based on modified polymeric membranes.

Analytical aspects of biosensors.

1999

PVC as a sensor membrane material: influence of solvent casting variables.

One-dimensional modelling of foulant reduction in a microflow, amperometric-sensor system.
Higgins SW, Gregory CM, Hatfield JV, Iacovides H and Vadgama PJ. *Journal of Medical Engineering and Technology* vol. 23, (3) 102-107.

Method for reducing fouling at the sensor-sample interface.

1998


Whole blood assay of glucose-6-phosphate dehydrogenase: potential for simplified immunoassay.
Tham SY, Pearson JE, Kane JW, Treloar PH and Vadgama PM. *Sensor Actuat B-Chem* vol. 50, (3) 204-209.

Whole blood assay of glucose-6-phosphate dehydrogenase: potential for simplified immunoassay.

Development of an oxidase-based glucose sensor using thickness-shear-mode quartz crystals.

1997

Minimally invasive glucose and lactate sensors.
. *Iee Colloquium (Digest) (318).*

Stability of dodecyl sulphate-doped poly(pyrrole) glucose oxidase modified electrodes exposed in human blood serum.

A lactate dehydrogenase amperometric pyruvate electrode exploiting direct detection of NAD(+) at a poly(3-methylthiophene): poly(phenol red) modified platinum surface.
Blood compatibility and extended linearity of lactate enzyme electrode using poly(vinyl chloride) outer membranes.

Bioelectrochemical determination of citric acid in real samples using a fully automated flow injection manifold.

A study of the permeability properties of surfactant modified poly(vinyl chloride) membranes.

Surfactant-modified poly(vinyl chloride) membranes as biocompatible interfaces for amperometric enzyme electrodes.

Amperometric enzyme electrode for the determination of urine oxalate.

Infrared analysis in clinical chemistry: its use in the laboratory and in non-invasive near patient testing.

Stability of dodecyl sulphate-doped poly(pyrrrole)/glucose oxidase modified electrodes exposed in human blood serum.

A lactate dehydrogenase amperometric pyruvate electrode exploiting direct detection of NAD+ at a poly(3-methylthiophene):poly(phenol red) modified platinum surface.

Minimal-fouling enzyme electrode for continuous flow measurement of whole blood lactate.

Ion exchanger modified PVC membranes selectivity studies and response amplification of oxalate and lactate enzyme electrodes.
Reddy SM and Vadgama PM. Biosens Bioelectron vol. 12, (9-10) 1003-1012.

The effect of lipid bilayer manipulation on the response of the glucose oxidase liposome electrode.
Taylor MA, Jones MN, Vadgama PM and Higson SPJ. Biosens Bioelectron vol. 12, (6) 467-477.

1996

Flow and microflow - Applications in biomedical sensing devices.
. Iee Colloquium (Digest) (176).

Diffusion restricting outer membranes for greatly extended linearity measurements with glucose oxidase enzyme electrodes.

Materials biocompatibility.

Stabilized needle electrode system for in vivo glucose monitoring based on open flow microperfusion.

Poly(vinyl chloride), polysulfone and sulfonated polyether-ether sulfone composite membranes for glucose and hydrogen peroxide perm-selectivity in amperometric biosensors.

Use of direct and indirect methods in diaphragm cell method for estimation of liquid diffusivities of biosolutes.
Direct non-enzymic amperometric glucose sensor based on a novel glucose selective membrane.

Use of surfactant-modified cellulose acetate for a high-linearity and pH-resistant glucose electrode.

Enzyme electrodes for food analysis.
Maines A, Ashworth D and Vadgama P. Food Technol Biotech vol. 34, (1) 31-42.

1995

ESTIMATION OF LIQUID DIFFUSIVITIES OF BIOSOLUTES BY USING DIAPHRAGM CELL METHOD WITH DEFINED PORE CHARACTERISTICS.
TURHAN M, DESAI MA, VADGAMA P and MUTLU M. Biotechnol Tech vol. 9, (6) 413-416.

Open flow microperfusion: approach to in vivo glucose monitoring.

MEDIATED AMPEROMETRIC DETECTION OF GLUCOSE-6-PHOSPHATE-DEHYDROGENASE AT A POLY(VINY chloro THIOLE) COVERED ELECTRODE USING 1,4-BENZOQUINONE AND DIAPHORASE.
TRELOAR PH, CHRISTIE IM, KANE JW, CRUMP P, NKOHKWO AT and VADGAMA PM. Electroanal vol. 7, (3) 216-220.

DIAMOND-LIKE CARBON-COATED FILMS FOR ENZYME ELECTRODES - CHARACTERIZATION OF BI OCOMPATIBILITY AND SUBSTRATE DIFFUSION LIMITING PROPERTIES.
HIGSON SPJ and VADGAMA PM. Anal Chim Acta vol. 300, (1-3) 77-83.

DIAMOND-LIKE CARBON-FILMS FOR ENZYME ELECTRODES - CHARACTERIZATION OF NOVEL OVERLYING PERMSELECTIVE BARRIERS.

The modification of enzyme electrode properties with non-conducting electropolymerised films.

Engineering the right membranes for electrodes at the biological interface; solvent cast and electropolymerised.
Vadgama PM. Biosensors and Bioelectronics vol. 10, (1-2) 195-201.

. Pharmacy and Pharmacology Communications vol. 1, (12) 585-588.

Bio-/haemocompatibility: implications and outcomes for sensors?.

Engineering the right membranes for electrodes at the biological interface; solvent cast and electropolymerised.
Treloar PH, Christie IM and Vadgama PM. Biosens Bioelecrot vol. 10, (1-2) 195-201.

The characterization of liposomal glucose oxidase electrodes for the measurement of glucose.
Taylor MA, Jones MN, Vadgama PM and Higson SP. Biosens Bioelectronics vol. 10, (3-4) 251-260.

1994

Biosensors: a viable monitoring technology?.

ELECTROCHEMICAL IMMUNOASSAY - SIMPLE KINETIC DETECTION OF ALKALINE-PHOSPHATASE ENZYME LABELS IN LIMITED AND EXCESS REAGENT SYSTEMS.
TRELOAR PH, NKOHKWO AT, KANE JW, BARBER D and VADGAMA PM. Electroan vol. 6, (7) 561-566.

Selective membranes for the construction and optimization of an amperometric oxalate enzyme electrode.
A STUDY OF ELECTRICAL DOUBLE-LAYER EFFECTS IN THE PRETREATMENT OF 2-ELECTRODE CELLS FOR ENZYME ELECTRODES.
HIGSON SPJ and VADGAMA P. *Electroanal* vol. 6, (5-6) 431-436.

CHRONOCOULOMETRIC INTERROGATIONS OF OXIDASE-BASED ENZYME ELECTRODES FOR ENHANCED SELECTIVITY.
HIGSON SPJ, VADGAMA PM and WARD JP. *Electroanal* vol. 6, (2) 83-88.

1993

An in vitro study of enhanced H+ diffusion by urease action on urea. Implications for Helicobacter pylori-associated peptic ulceration.
Desai MA and Vadgama PM. *Scand J Gastroenterol* vol. 28, (10) 915-919.

AMPEROMETRIC ENZYME ELECTRODE BIOFOULING AND PASSIVATION IN BLOOD - CHARACTERIZATION OF WORKING ELECTRODE POLARIZATION AND INNER MEMBRANE EFFECTS.

**Biosensors in clinical biochemistry.**

GLUCOSE-OXIDASE ENZYME ELECTRODE - RELATION BETWEEN INNER MEMBRANE-PERMEABILITY AND SUBSTRATE RESPONSE.

**POTENTIAL POLYMERIC MEMBRANES FOR ENZYME ELECTRODES.**
PISKIN E, MUTLU S, SERBETCI AI, MUTLU M and VADGAMA PM. *Abstr Pap Am Chem S* vol. 205, 39-IEC.

MODIFICATION OF ELECTRODE SURFACES WITH OXIDIZED PHENOLS TO CONFER SELECTIVITY TO AMPEROMETRIC BIOSENSORS FOR GLUCOSE DETERMINATION.

**THE DIFFUSION LIMITED OXIDASE-BASED GLUCOSE ENZYME ELECTRODE - RELATION BETWEEN COVERING MEMBRANE-PERMEABILITY AND SUBSTRATE RESPONSE.**

**DIRECT ELECTROCHEMICAL DETERMINATION OF PARACETAMOL IN PLASMA.**

**DIAMOND-LIKE CARBON COATED MICROPOROUS POLYCARBONATE AS A COMPOSITE BARRIER FOR A GLUCOSE ENZYME ELECTRODE.**
HIGSON SPJ and VADGAMA PM. *Anal Chim Acta* vol. 271, (1) 125-133.

Internal membranes and laminates for adaptation of amperometric enzyme electrodes to direct biofluid analysis.

Enhanced H+ diffusion by NH4+/HCO3-: implications for Helicobacter-pylori-associated peptic ulceration.
Desai MA and Vadgama PM. *Digestion* vol. 54, (1) 32-39.

**FOCUS 92 ASSOCIATION-OF-CLINICAL-BIOCHEMISTS NATIONAL MEETING - JUNE 8-12, 1992, BLACKPOOL, UK.**
VADGAMA P. *Analyst* vol. 118, (1) N2-N3.

1992

**PLASTICIZED POLY(VINYL CHLORIDE) AS A PERMSELECTIVE BARRIER MEMBRANE FOR HIGH-SELECTIVITY AMPEROMETRIC SENSORS AND BIOSENSORS.**
BIOSENSORS - RECENT TRENDS - A REVIEW.

Opportunities for the cellular approach in biomedical engineering.

THE MATHEMATICAL-MODELING OF IONIC-DIFFUSION THROUGH STAGNANT LAYERS - A MODIFICATION OF THE MORF AND SIMON EQUATION.

Bicarbonate and other buffer systems can enhance the rate of H+ diffusion through mucus in vitro.
Desai MA and Vadgama PM. Biochim Biophys Acta vol. 1116, (1) 43-49.

DESIGNING BIOSENSORS.
VADGAMA P. Chem Brit vol. 28, (3) 249-252.

SIMPLIFIED MEASUREMENT OF SERUM ALKALINE-PHOSPHATASE UTILIZING ELECTROCHEMICAL DETECTION OF 4-AMINOPHENOL.

A study of macromolecular diffusion through native porcine mucus.

Biosensors: Recent trends a review.

1991

A liposomal enzyme electrode for measuring glucose.
Rosenberg MF, Jones MN and Vadgama PM. Biochim Biophys Acta vol. 1115, (2) 157-165.

Estimation of effective diffusion coefficients of model solutes through gastric mucus: assessment of a diffusion chamber technique based on spectrophotometric analysis.

IMMOBILIZATION OF PROTEINS, COFACTORs, MEDIATORS, TISSUES, CELLS IN THE CONTEXT OF BIOSENSORS FOR USE INVITRO AND INVIVO.

ELECTROCHEMICAL TRANSDUCERS FOR INVIVO MONITORING.

CHEMICAL SENSORS AND BIOSENSORS - NEARER THE PATIENT.

pH dependence of hydrochloric acid diffusion through gastric mucus: correlation with diffusion through a water layer using a membrane-mounted glass pH electrode.

MATRIX SURFACE MODIFICATION BY PLASMA POLYMERIZATION FOR ENZYME IMMOBILIZATION.

ELECTRODE RESPONSES TO PHENOLIC SPECIES THROUGH CELLULOSIC MEMBRANES.

Electrochemical determination of the permeability of porcine mucus to model solute compounds.
Desai MA, Nicholas CV and Vadgama P. J Pharm Pharmacol vol. 43, (2) 124-127.
Problems of clinical data interpretation.

MEASUREMENT OF EFFECTIVE HCI DIFFUSION-COEFFICIENTS THROUGH AQUEOUS AND GEL FILMS BY A PH JUMP TECHNIQUE.

Determination of urate in undiluted whole blood by enzyme electrode.
. Biosensors and Bioelectronics vol. 6, (6) 491-499.

Estimation of effective diffusion coefficients of model solutes through gastric mucus: Assessment of a diffusion chamber technique based on spectrophotometric analysis.

In vivo biosensors.
Vadgama P and Desai MA. Bioprocess Technol vol. 15, 303-338.

1990

MEMBRANE BASED SENSORS - A REVIEW.
VADGAMA P. J Membrane Sci vol. 50, (2) 141-152.

COMPOSITE LIQUID MEMBRANE FOR ENZYME ELECTRODE CONSTRUCTION.

Optimisation of enzyme electrodes.
. Medical &amp; Biological Engineering &amp; Computing vol. 28, (3).

Optimisation of enzyme electrodes.

DIFFUSION-COEFFICIENTS FOR HCL UNDER CONDITIONS APPROACHING NEUTRALITY.

1989

MEMBRANES - SEPARATION PRINCIPLES AND SENSING.
MCDONNELL MB and VADGAMA PM. Select Electr Rev vol. 11, (1) 17-67.