The EPR research center allows a number of groups from Chemistry, Physics and Biology from BIU in which several research projects are being performed:

Group Research in EPR

Dr. Laurent Benisvy

- Characterization of transition metal (Cu, Mn, Co, Fe, Pd) complexes, metal-radical complexes and free phenoxyl radical compound. (EPR measurements are carried in liquid and solid state at variable temperatures).
- Measuring antioxidant activity of compounds by using Spin trap EPR of hydroxyl radical in solution and in micelleous. (EPR measurements are carried in liquid at room temperature).
- Measuring radicals generation by via photochemistry reaction also by using Spin trap EPR (EPR measurements are carried in liquid at room temperature).

Dr. Sharon Rotshtein

- Measuring distances at the nanometer range (2.0-8.0 nm) between paramagnetic probes, nitoxide spin labels, as well as between paramagnetic metal ions such as: Cu(II), Mn(II), Fe(III).
- Characterization of paramagnetic metal ion coordination to proteins and biomolecules using various pulsed EPR experiments.

Prof. Bilha Fischer

- Measuring antioxidant activities of oligonucleotides, nucleotides, and phosphorous derivatives in solution in the presence of spin trap by EPR.
- Characterization of oligonucleotide, nucleotide or phosphorous derivatives complexes with metal ions (Cu^{2+}, Fe^{2+}). EPR measurements are performed in solid state at various temperatures.

Prof. Doron Aurbach

- Following the transition metal cations distribution and magnetic properties upon aging and cycling of Li-ion batteries cathode materials in relevant electrolyte solutions. Typical cathode materials are:

Li2MnO3-Li[M1M2M3]O2 and Li[M1M2M3]O2, where, M, M1, M2 and M3 are transition metals such as Mn, Co, Ni, V, Ti and more. (EPR measurements are carried out with powders at variable temperatures).

Dr. David Zitoun

- Characterization of Diluted Magnetic Semiconductors: Study the different local structure of transition metal (Mn(II), Co(II)…) doped in oxide (ZnO, ZrO2, HfO2) and ionic semi-conductors nanoparticles. (EPR measurements are carried out on colloidal dispersion and solid state at variable temperatures)
- Growth mechanism of magnetic nanostructures: Detect little amount of organometallic precursors, follow the formation of magnetic clusters and characterize the electronic and structural state of the resulting magnetic nanoparticles.

Prof. Aharon Gedanken

- Measuring reactive oxygen species (such as hydroxyl radical) production in metal oxide (such as ZnO) nanoparticles by using Spin trap EPR of hydroxyl radical in solution and in cells.
- Measuring Mn^{2+} doped in ZnO, ZnSe and ZnTe . (EPR measurements are carried in emulation at room temperature)
- Comparing VO_2 spectra as function of particle nanometric size at various temperatures .

Dr. Rachel Lubart

- Evaluating low energy visible light induced reactive oxygen species (ROS) formation in biological cells, for biostimulative purposes, using spin trap EPR technology.

- Evaluating the generation of oxygen species in microorganisms as a function of the illuminating wavelength and energy dose, for bacteria killing, using spin trap EPR.

- Evaluating the generation of oxygen species by nanoparticles like semiconductors of ZnO and TiO_2 in cellular environment, with and without visible light irradiation, using spin trap EPR.

Prof. Aryeh Frimer

- Measuring the spin adduct depth of synthesized lipophilic spin traps derivaties within the bilayer with extra-liposomal oxygen radical due to different adduct nobilities in the membrane.

Dr. Shai Rahimipour

- Measuring antioxidant activities of cyclic peptide nanotubes by using Spin trap EPR of hydroxyl radical in solution and in cells.

- Evaluating the ability of cyclic peptides to scavenge reactive oxygen species in different synthetic membranes and in stimulated microglia cells, by using spin trap EPR.

The EPR has been also serving groups from other departments :

- Physics, Biology and Engineering.

Cooperation with other universities and research centers

- We have some cooperation with the Department of Chemistry in the Hebrew University, with Faculty of Agriculture and with fertility research center in Tel-Hashomer Hospital.

In addition, the EPR center serves as services facilities. Samples from other universities from Israel or abroad can be studied by us, as a service or collaboration.

Contacts

For any enquiries about service at BIU EPR center please contact:

Dr. Laurent Benisvy (CW EPR)

benisvl@mail.biu.ac.il

Dr. Ronit Lavi (CW EPR)

Ronit.Lavi@mail.biu.ac.il

Dr. Sharon Ruthstein (Pulse EPR)

Sharon.Ruthstein@biu.ac.il

Prof. Bilha Fisher- Head of the Chemistry Department

Bilha.Fischer@biu.ac.il

Selected Publications

Chemistry Department

1) Zats G. M., Arora H., Lavi R., Yufit D. and **Benisvy L**. H-bonding and steric effects on the properties of phenolate and phenoxyl radical complexes of Cu(II). Dalton Trans. 7, 41 (1), 47-49 (2012).
2) Zats G, Arora H, Lavi R, Yufit D. and **Benisvy L**. Phenolate and Phenoxyl Radical complexes of Cu(II) and Co(III), Bearing a New Redox Active N,O-Phenol Pyrazole Ligand. Dalton Trans. 40 (41), 10889-10896 (2011).
3) **Ruthstein S**., Stone K. .M., Cunningham T. F., Ming J., Cascio M. and Saxena S., Pulsed Electron spin Resonance resolves the coordination site of Cu(II) ions in glycine receptor. Biophysical Journal**,** 99(8), 2497-2506**.**(2010).
4) **Ruthstein S.,** Raitsimring A.M., Bitton R., Frydman V., Godt A. and Goldfarb D. Distribution of guest molecules in Pluronic micelles studied by double electron electron spin resonance and small angle X-ray scattering. PCCP, 11, 148-160 (2009).
5) Aviran A., Shmuel E, Zagalsky R, Sayer A.H, Nadel Y. and **Fischer B**. Nucleoside-5′-phosphorothioate analogues are biocompatible antioxidants dissolving efficiently amyloid beta–metal ion aggregates. Dalton Trans. 14, 8539 (2012)
6) Baruch-Suchodolsky R. and **Fischer B**. Abeta40, either soluble or aggregated, is a remarkably potent antioxidant in cell-free oxidative systems. Biochemistry. 26, 48 (20), 4354-70 (2009)
7) Sclar H., kovacheva D, Zhecheva E., Stoyanova R., Lavi R., Kimmel G., Grinblat J., Girshevitz O., Amalraj F., Haik O., Zinigrad E., Markovsky B. and **Aurbach D.** On the Performance of $LiNi_{1/3}Mn_{1/3}Co_{1/3}O_2$ Nanoparticles as a Cathode Material for Lithium-Ion Batteries. J. Electrochem. Soc., Volume 156, Issue 11, pp. A938-A948 (2009)

8) Talyosef Y, Markovsky B, Lavi R, Salitra G, Kovacheva D, Gorova M, Zhecheva E, Stoyanova R. and **Aurbach D**. Comparing the behavior of nano-

and microsized particles of $LiNi_{0.5}Mn_{1.5}O_4$ spinel as cathode materials for Li ion batteries. *J. Electrochem. Soc*. 154, A682, (2007)

9) Bhattacharyya S., **Zitoun D**. and Gedanken A. Electron Paramagnetic Resonance Spectroscopic Investigation of Manganese Doping in ZnL (L = O, S, Se, Te) Nanocrystals. Nanoscience and Nanotechnology Letters. 3(4), 541-549 (2011).
10) Bhattacharyya S., **Zitoun D**. and Gedanken A. Magnetic properties of Cd1−xMnxTe/C nanocrystals. Nanotechnology 22, 7, 075703 (2011)
11) Lipovsky A., Levitski L, Tzitrinovich Z, **Gedanken A**. and Lubart R. The Different Behavior of Rutile and Anatase Nanoparticles in Forming Oxy Radicals Upon Illumination with Visible Light: An EPR Study Photochemistry and Photobiology, 1, 88, 14-20, (2012)
12) Lipovsky A., Nitzan Y, **Gedanken A**. and Lubart R. Antifungal activity of ZnO nanoparticles-the role of ROS mediated cell injury Nanotechnology, 10, 22, (2011)
13) Lavi R., Ankri R., Sinyakov M., Eichler Maor., Friedmann H., Shainberg A., Breitbart H. and **Lubart R**. The Plasma Membrane is involved in the Visible Light –Tissue Interaction. Photomed Laser Surg. Volume 30 (1), pages 14-19 (2012).
14) Lavi R., Shainberg A., Shneyvays V., Hochauser E., Isaac A., Zinman T., Fridmann H. and **Lubart R**. Detailed analysis of reactive oxygen species induced by visible light in various cell types. Lasers in Surgery and Medicine Volume 42, Issue 6, pages 473–480, (2010)
15) Strul G., **Frimer A.A**. and Weiner L. Spin-trapping study of free radical penetration into liposomal membranes. J. Chem. Soc., Perkin Trans. 2, 2057-2059 (1993).
16) Bodner E., Afri M. and **Frimer A. A.** Determining radical penetration into membranes using ESR splitting constants. Free Radical Biology and Medicine, 3, **49,** 427-436, (2010).
17) **Rahimipour S.,** Weiner L., Fridkin M., Shrestha Dawadi P. B. and Bittner S. Novel naphthoquinonyl derivatives: Potential structural components for the synthesis of cytotoxic peptides. Lett. Pept. Sci. *3*, 263-274 (1996).

18) **<u>Rahimipour,S.,</u>** Weiner L., Shrestha-Dawadi P. B., Bittner S., Koch Y. and Fridkin M. Cytotoxic peptides: Naphthoquinonyl derivatives of luteinizing hormone-releasing hormone. Lett. Pept. Sci.. *5*, 421-427, (1998).

<u>Cooperation with other Departments</u>

19) Ben Dror S., Bronshtein I., Garini Y., O'Neal W. G., Jacobi P. A. and **<u>Ehrenberg B</u>**. The localization and photosensitization of modified chlorin photosensitizers in artificial membranes. Photochem. Photobiol. Sci. 8, 354-361, (2009).
20) <u>Solomon A</u>., <u>Golubowicz S</u>., <u>Yablowicz Z</u>., **<u>Bergman M., Grossman S</u>**., <u>Altman A</u>., <u>Kerem Z</u>. and <u>Flaishman M. A</u>. EPR studies of O(2)(*-), OH, and (1)O(2) scavenging and prevention of glutathione depletion in fibroblast cells by cyanidin-3-rhamnoglucoside isolated from fig (Ficus carica L.) fruits. <u>J Agric Food Chem.</u> 23, 58(12), 7158-65, (2010).

<u>Cooperation with other Universities</u>

21) Eisenberg D., Quimby J.M., Ho D., Lavi R., **<u>Benisvy L., Scott L.T. and Shenhar R.</u>** Special Electronic Structure and Extended Supramolecular Oligomerization of 1,4-Dicorannulenylbenzene Eur. J. Org. Chem. in press. (2012).
22) **<u>Topaz M</u>**., Motiei M., **<u>Gedankem A., Meyerstein D. and Meyerstein N</u>**. EPR analysis of radicals generated in ultrasound-assisted lipoplasty simulated environment. Ultrasound in Medicine & Biology. <u>27, 6</u>, 851–859, (2001).