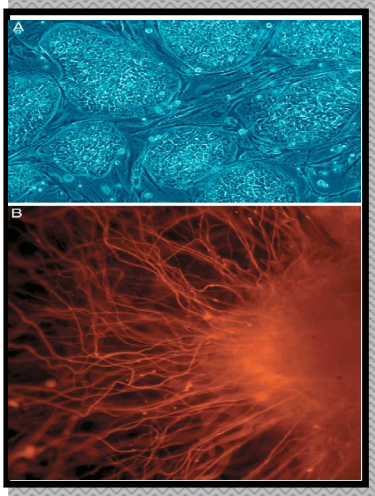

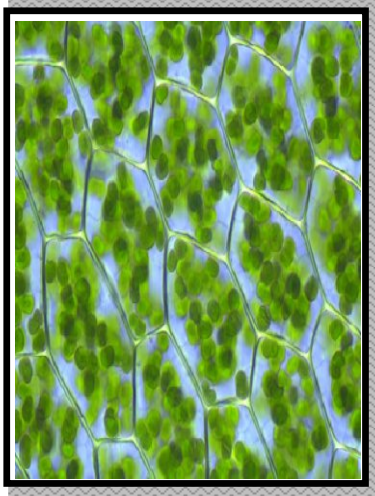

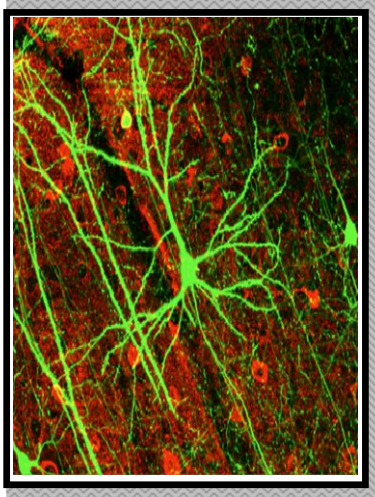

EMGEN Newsletter

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INSIDE THIS ISSUE:

Eastern Mediterranean Health Genomics and Biotechnology Network (EMHGBN) was created in 2004 with collaboration of representatives of selected centre of excellence in (health related) molecular biology, biotechnology & genomics in the Eastern Mediterranean region by recommendations and efforts of WHO/EMRO.

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Immune response to Leishmania antigen in anthroponotic cutaneous leishmaniasis

The article entitled "Immune response to Leishmania antigen in anthroponotic cutaneous leishmaniasis" reports High *levels of IFN-gamma, IL-5, and IL-13 in non-healing patients suggest a mixed Th1/Th2 response, whereas patients with acute lesion respond to infection by Th1-type response*. The study was done by *Ajdary S, Riazi-Rad F, Alimohammadian MH, Pakzad SR. Corresponding author of this paper, Dr. Ajdary is Associate Professor of Immunology Department in Pasteur Institute of Iran, and the paper was published in Journal of infection. 2009 Aug; 59(2):139-43.*

Dr. Soheila Ajdary, Ph.D.

In the present study for the first time cell – mediated immune responses in leishmaniasis patients with acute and chronic *L. tropica* infection have been evaluated by analyzing proliferation and cytokine secretion in response to *Leishmania* antigen.

The leishmaniases are parasitic diseases with manifestations that vary from cutaneous lesion to systemic disease. Clinical outcomes depend on the species of parasite and on the specific immune responses to *Leishmania (L.)* antigens. Cutaneous leishmaniasis (CL) is endemic in Iran and represents two separate diseases, each caused by different species of *leishmania.* Zoonotic cutaneous leishmaniasis (ZCL) due to *L. major* tends to form wet lesions, however anthroponotic cutaneous leishmaniasis (ACL) caused by *L. tropica* usually presents as dry lesions. Moreover, *L. tropica* infections tend to be more difficult in both diagnosis and treatment, and last longer than infections caused by *L. major* (Klaus et al., 1999; Dowlati et al., 1996). Although old world CL is usually a self-limited infection that resolves without specific therapy, chronic (non-healing) lesions lasting for more than two years and do not respond to conventional chemotherapies are also known. Chronic ACL, also known as leishmaniasis recidivans, is characterized by development of new lesions at the periphery of the scars of original lesions. In addition to cutaneous lesions, *L. tropica* results in viscerotropic leishmaniasis, a chronic debilitating systemic illness and classic visceral leishmaniasis (Magill et al., 1993).

Course of infection with *L .major* and *L. tropica* in BALB/c mice is also different. The mice fail to control *L. major* infection and develop a fatal systemic disease however; small or no lesion develops after *L. tropica*

infection (Sacks et al., 2002).

Numerous studies have shown that resistance and susceptibility to *Leishmania* in mice result from the development of Th1 and Th2 responses, respectively. Activation of Th1 cells leading to the production of gamma interferon (IFN-g) is critical for recovery from disease and the stimulation of Th2 cells resulting in interleukin (IL)-4, IL-5, IL-10, and IL-13 production likely contributes to disease progression (Reiner et al., 1995; Kane et al., 2001; Matthews et al., 2000). However, several studies revealed differences in the immune responses to various *Leishmania* species (Mattner et al., 1996; Pinheiro et al., 2007). Considering the differences in clinical features of CL caused by *L. major* and *L. tropica* the profile of immune response to each parasite species can differ. Immune responses to *L. major* infection in human have been studied extensively however, little is known about the host immune response to *L. tropica* infection. The aim of this study was to analyze the immune response of *L. tropica*-infected patients with acute and chronic form of disease.

Three different groups were included in the study: i) Twenty newly infected individuals suffering from acute ACL ii) Twenty-three patients with chronic lesions (non-healing patients) who had a clinical history of disease for more than two years. iii) The control group consisted of 16 leishmanin skin test negative healthy individuals without any history of leishmaniasis.

Peripheral blood mononuclear cells (PBMC) were isolated on a Ficoll-hypaque density gradient. PBMC were resuspended in RPMI 1640 medium supplemented with L-glutamine, penicillin, streptomycin, and heat inactivated normal human AB serum (complete medium). The cells were seeded into complete medium with or without *Leishmania* antigen. The cultures were incubated for 7 days and pulsed with [^{3}H] thymidine for the last 18 h of incubation. All tests were performed in triplicate. The stimulation index (SI) was obtained by dividing the mean counts per minute (cpm) of stimulated cultures by the mean cpm of unstimulated cultures.

The release of cytokines in culture supernatants was measured after 7 days incubation of PBMCs with antigen as described above. Cell culture supernatants from triplicate wells were pooled and stored at -70 ^{o}C for later determination of IFN-g, IL-5, and IL-13 by ELISA.

The results of proliferative response showed that *L. tropica* antigen induced strong proliferative response in PBMC from ACL patients compared to healthy controls (P=0.001). However, the stimulation index difference between non-healing donors and patients with acute lesion was not significant.

PBMCs from patients with acute lesions and non-healing cases produced significantly higher amounts of IFN- g than normal donors (P<0.005).

The difference between patients with acute lesions and non-healing patients was not significant.

Moreover, significantly higher levels of IL-5 were detected in the supernatants of *Leishmania* -stimulated PBMC cultures from non-healing patients than in supernatants of cultures from patients with acute disease (P=0.014) and normal individuals (P=0.001). The median levels of IL-5 produced by PBMC from patients with acute lesion and normal individuals were comparable.

It has been demonstrated that IL-13 was induced in PBMC from both *Leishmania*-infected groups. Non-healing patients had higher median levels of IL-13 than controls (P=0.004). Likewise, the difference between patients with acute lesions and controls was significant (P=0.03). Although, the level of IL-13 in non-healing patients was higher than that of patients with acute lesion the difference was not statistically significant.

The cytokine ratios were calculated from the ratios of the medians. The results show that the IFN-g/IL-5 and IFN-g/IL-13 ratios were greater in patients with acute lesion than in patients with chronic lesion.

Our findings showed that PBMC from ACL patients with acute and chronic infection displayed comparable strong proliferative responses and IFN-g production in response *to Leishmania* antigen, however the cells from healthy controls did not respond to this antigen. Vigorous proliferative response and high IFN-g production in acute ACL is in agreement with finding in acute ZCL and new world CL (Ajdary et al., 2000; Convit 1993, Follador et al., 2002). However, in contrast to chronic ACL patients PBMC from non-healing ZCL patients neither proliferate nor produce IFN-g in response to *Leishmania* antigen (Ajdary et al., 2000).

Our data showed that patients with chronic lesion produce significantly higher IL-5 than those with acute lesion upon antigenic stimulation. This pattern of cytokine production is in line with our previous observation of little or no IL-4 production in patients with acute ZCL and high IL-4 production in non-healing donors (Ajdary et al., 2000).

It has been shown that IL-13 is involved in susceptibility to *Leishmania* infection (Matthews et al., 2000; Bourreau et al., 2001). In our study IL-13 was detected in both patients with acute and chronic lesions. Mohrs et al. have shown that IL-13 displays an exacerbative role in the early phase of *L. major* infection in BALB/c mice and a protective activity in chronic phase of the disease. They suggested that IL-13 may involve in controlling dissemination of the parasite and progressive inflammation in chronic leishmaniasis

(Mohrs et al., 1999). IL-13 production by PBMC from both acute and non-healing cases could be explained by a disease promoting role for IL-13 in acute infection and an anti-inflammatory role in chronic infection. Moreover, in spite of high levels of IFN-g production lower ratios of IFN-g to IL-5 and IL-13 in patients with chronic lesion compared to those in patients with acute lesion suggest that IFN-g amount may be sufficient to control parasite infection but high IL-13 and IL-5 levels underlie the immunopathogenesis of long duration of disease in chronic forms.

In conclusion, high levels of IFN-g, IL-5, and IL-13 in non-healing ACL patients suggest a mixed Th1/Th2 response which is distinct from Th2 response in non-healing ZCL patients. High IFN-g and low IL-5 and IL13 production in response to *Leishmania* antigens in patients with acute lesion is indicative of predominant Th1 response.

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Restriction enzyme mapping

Not long before, the existence of restriction enzymes were unknown. Nowadays you cant find a molecular lab without its freezer stocked with different kinds of restriction enzymes.

The question is how these enzymes became the work horse of molecular studies.

The use of restriction enzymes for mapping is in the work of three scientists- Danial Nathans, Werner Arber, and Hamilton Smith – that led them to the noble prize for physiology and medicine in 1978.

The discovery of restriction enzymes goes back to 1968 , Matthew Meselson and Robert Yuan identified an enzyme in the bacterium *Escherichia coli*, strain K-12 and reported that it is able to recognize and digest foreign DNAs. The system described by Meselson and Arber (who demonstrated it biochemically) is known as type I.

At 1970s, Hamilton Smith was able to purify the first site specific Type II restriction enzyme, known as Hind II.

Danial Nathans used type II restriction enzyme purified by Smith to produce fragments of simian virus 40 (SV40).

The work of these three scientists became a trigger to further molecular studies and helped the dream of human genome mapping come true.

But what are type I and type II restriction enzymes?

Type I enzymes cut the DNA from a distance to their recognition site. The recognition site has two parts which are separated by a 6-8 nt spacer. The sites are 3-4 nt and 4-5 nt long and asymmetrical. Type I needs cofactors S-Adenosyl methionine and Mg^{++} for its activity.

Type II enzymes recognizes and cleaves DNA at the same site which can be 4-8 nt long. It dose not need cofactors for its activity and this makes it more common to use in molecular studies.

There is also a Type III enzyme that cuts the DNA 20-30 nts after the recognition site. They do need cofactors S-Adenosyl methionine and Mg^{++} for DNA methylation and restriction respectively.

How do they work ?

The origin of restriction enzymes are bacteria and their function is to protect the host DNA from foreign DNA. They can distinguish the foreign DNA from their own by using methylation method. Methylation on certain bases protects the bacterial DNA from restriction enzyme activity.

Restriction enzymes scan through the genome, and where ever they find their recognition site they cleave the

DNA.

Restriction enzymes have three patterns for cleaving DNA, 5´overhangs, 3´overhangs and blunt ends.

5´overhangs: the enzyme cuts the DNA asymmetrically so that the sticky end protrudes from the 5´end;

3´overhangs: again, the cut is asymmetrical but it protrudes from the 3´end;

Blunt ends: the enzyme cutting is symmetrical in this case and it occurs at the exact opposite sites in the DNA.

Restriction mapping:

In the case of mapping a genome, the double helix DNA has to be cut into smaller fragments via different restriction enzymes and separated by gel electrophoresis. The pattern produced by the digestion reveals the distance between the restriction sites that are used.

By using different restriction enzymes that cut the DNA at different sites with different lengths the map of an unknown piece of DNA can be predicted.

This technique can be used for different applications such as gene insertion to plasmids. The plasmid is cut at certain sites with a specific enzyme and by using the sequence of the sticky end produced, the desired gene can be inserted.

It can be used as a tool to distinguish gene mutation by detecting a single nucleotide change in the sequence of a fragment of DNA. The fragment assigned has to have a recognition site for a restriction enzyme and in that case any change, even in one nucleotide, can completely delete the recognition site.

As the recognition site deleted, a different pattern would be visible in gel electrophoresis. This method can be used to detect mutations without the need of gene sequencing. It can also identify how many mutation has occurred in a population, a method named RFLP (restriction fragment length polymorphism).

In somewhat similar way, restriction mapping can be used to digest DNA for the use of southern blot. This technique is used to predict how many copies of a gene exists in a genome.

Some examples of different restriction enzymes are as follow :

Enzyme	Source	Recognition Sequence	Cut
EcoRI	*Escherichia coli*	5'GAATTC 3'CTTAAG	5'---G AATTC---3' 3'---CTTAA G---5'
EcoRII	*Escherichia coli*	5'CCWGG 3'GGWCC	5'--- CCWGG---3' 3'---GGWCC ---5'
BamHI	*Bacillus amyloliqueciens*	5'GGATCC 3'CCTAGG	5'---G GATCC---3' 3'---CCTAG G---5'
HindIII	*Haemophilus influenzae*	5'AAGCTT 3'TTCGAA	5'---A AGCTT---3' 3'---TTCGA A---5'
TaqI	*Thermus aquaticus*	5'TCGA 3'AGCT	5'---T CGA---3' 3'---AGC T---5'
NotI	*Nocardia otitidis*	5'GCGGCCGC 3'CGCCGGCG	5'---GC GGCCGC---3' 3'---CGCCGG CG---5'
HinfI	*Haemophilus influenzae*	5'GANTC 3'CTNAG	5'---G ANTC---3' 3'---CTNA G---5'
Sau3A	*Staphylococcus aureus*	5'GATC 3'CTAG	5'--- GATC---3' 3'---CTAG ---5'
PovII*	*Proteus vulgaris*	5'CAGCTG 3'GTCGAC	5'---CAG CTG---3' 3'---GTC GAC---5'
SmaI*	*Serratia marcescens*	5'CCCGGG 3'GGGCCC	5'---CCC GGG---3' 3'---GGG CCC---5'
HaeIII*	*Haemophilus aegyptius*	5'GGCC 3'CCGG	5'---GG CC---3' 3'---CC GG---5'
HgaI	*Haemophilus gallinarum*	5'GACGC 3'CTGCG	5'---NN NN---3' 3'---NN NN---5'

AluI*	*Arthrobacter luteus*	5'AGCT 3'TCGA	5'---AG CT---3' 3'---TC GA---5'
EcoRV*	*Escherichia coli*	5'GATATC 3'CTATAG	5'---GAT ATC---3' 3'---CTA TAG---5'
EcoP15I	*Escherichia coli*	5'CAGCAGN_{25}NN 3'GTCGTCN_{25}NN	5'---CAGCAGN_{25}NN ---3' 3'---GTCGTCN_{25} NN---5'
KpnI	*Klebsiella pneumoniae*	5'GGTACC 3'CCATGG	5'---GGTAC C---3' 3'---C CATGG---5'
PstI	*Providencia stuartii*	5'CTGCAG 3'GACGTC	5'---CTGCA G---3' 3'---G ACGTC---5'
SacI	*Streptomyces achromogenes*	5'GAGCTC 3'CTCGAG	5'---GAGCT C---3' 3'---C TCGAG---5'
SalI	*Streptomyces albus*	5'GTCGAC 3'CAGCTG	5'---G TCGAC---3' 3'---CAGCT G---5'
ScaI	*Streptomyces caespitosus*	5'AGTACT 3'TCATGA	5'---AGT ACT---3' 3'---TCA TGA---5'
SpeI	*Sphaerotilus natans*	5'ACTAGT 3'TGATCA	5'---A CTAGT---3' 3'---TGATC A---5'
SphI	*Streptomyces phaeochromogenes*	5'GCATGC 3'CGTACG	5'---G CATGC---3' 3'---CGTAC G---5'
StuI	*Streptomyces tubercidicus*	5'AGGCCT 3'TCCGGA	5'---AGG CCT---3' 3'---TCC GGA---5'
XbaI	*Xanthomonas badrii*	5'TCTAGA 3'AGATCT	5'---T CTAGA---3' 3'---AGATC T---5'

Key:

* = blunt ends

N= C or G or T or A

W= A or T

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The 6th annual MedChem Europe conference and exhibition will be held in Munich, Germany in 8-9 April 2010. The conference will be co-located with Advances in Synthetic Chemistry, ADMET Europe and Pharma Outsourcing Congress. Registered delegates will also have access to these meetings ensuring a very cost-effective trip.

Make the most of your trip by also attending a pre-conference training course.

You can also present your research on a poster while attending the meeting. Submit an abstract for consideration now!

Agenda Topics

- Compound Management
- Chemogenomics
- Fragment Based Lead Detection
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Nanomedicine

Nanomedicine is the medical use of nanotechnology which tend to bring us a valuable set of research tools and helpful clinical devices in the future. In fact, nanomedicine is a field of science which plans to improve human health. The creation and swift expansion of nanomedicine as a novel field of study in the last decade is based on the convergence of nanotechnology with other science, such as biology, genetics, biochemistry, chemistry, physics, pharmacology and medicine. Nanomedicine branched out into two major categories: diagnostics (imaging) and therapeutics (drug delivery). Each of these branches has several subgroups that are actively under research and development. Currently, nanomedicine trends are to improve the health through discovery and application of new initiative methods of drug delivery and nanotechnology by enhancing safety and efficiency of new existing therapeutic and diagnostic agents.

Nanomedicine is creating medical miracles. For example, scientists at Rice University applied lasers and nanoparticles, have discovered a new technique for singling out individual infected cells to destroy them with miniature explosions. From the point of view of practical business consideration, however it is important to separate out area where nanomedicine seem likely to produce revenue in the next few years and area where nanomedicine has great potential for spectacular result as in enabling super-enhanced longevity.

Nanotechnology seems set to provide some major benefits to the pharmaceutical industry in the near future, both in the terms of drug discovery and drug delivery. These will enable big pharmaceutical firms to find new blockbuster drugs and add to the life of those already on the market or in the pipeline.

There are many ways that nanotechnology can lead to great leap forward for regenerative medicine, that to gain any improvements it is essential to understand molecular interactions that lead to regenerative pathways. For example nano-based technologies will let the scientists to develop bioactive materials that release signaling molecules at controlled rates by diffusion which turn the cells to its activate position in contact with the stimuli. After that the cells can produce additional growth factors that will stimulate multiple generations of growing cells to self-assemble into the required tissues *in-situ*.

An idea that recently developed in nanotechnology, robotics and biotechnology is trans-humanism, which led us to become more than human, there is somewhat an infantile tone to many of pronouncement, but a closer look at the some of their claims make this direction of nanomedicine seem not only fascinating but also potentially profitable.

Nanomedicine and medical diagnostic:

With fast increase in the cost of medical care in many countries and given "how early diagnosis can affect the ability of patients to survive diseases", no further justification for lab-on-chip need to be given. Nanotechnologys' impact on lab-on-chip will not be revolutionary but will rather make this devices more sensitive. For example, it has been demonstrated that a nanosensor using nanowires can detect single virus; Or superparamagnetic nanoparticles are used to characterize hepatic tumors since they are rapidly taken up by the liver following intravenous administration,

This kind of capability certainly has important R&D applications and probably practical medical one too.

Demographic and the potential technological power of nanomedicine seem to point to the emergence of a huge market for the nanomedical products and drugs in the future. After all the populations of developed nations are aging and nanomedicine operate at the cellular size level, which seems to suggest to be more effective than other forms of medicine, for example the small size of naoparticle give them some properties that can be very useful in oncology. Another example of these particles are Quantum dots. These are nanoparticles with quantum limitation properties, such as size-tunable light emission. When these particles are used in conjunction with magnetic resonance imaging (MRI), it can produce high quality images of tumor sites. This kind of nanoparticles are more sensitive and excite immediately with one light sources. Also high surface area to volume ratio create opportunity to immobilize certain functional groups on the surface of such particles to target special tumors cells that Fig 1 schematically illustrate this processes.

James Baker, at the university of Michigan has developed a highly efficient and successful mean of cancer treatment drug delivery which is harmless to the surrounding body. It can locate and then eliminate cancerous cells. This strategy is based on using vitamin- laden dendrimers loaded whit anticancer drugs that enter the cancer cells. That is because of more vitamin receptors on cancer cells than normal cells.

But nano market survey show that the pharmaceutical industry faces demanding market condition that are leading to an intensified search for better drug delivery and discovery technologies.

As the drug industry compete to reach the increasingly critical task of manufacturing novel drugs, and especially new blockbuster drugs, nano based drug discovery technologies, which can improve research and development success time and rates to market will led to influential new business revenues over the next few years. Nanotechnology also led to some major opportunities in advanced nano-based drug delivery systems.

From the business point of view, these are important not only in providing better, more effective, better targeted, more profitable and less toxic drug delivery, but as way of increasing the values of patents, since new products can be created from older drugs with new delivery systems.

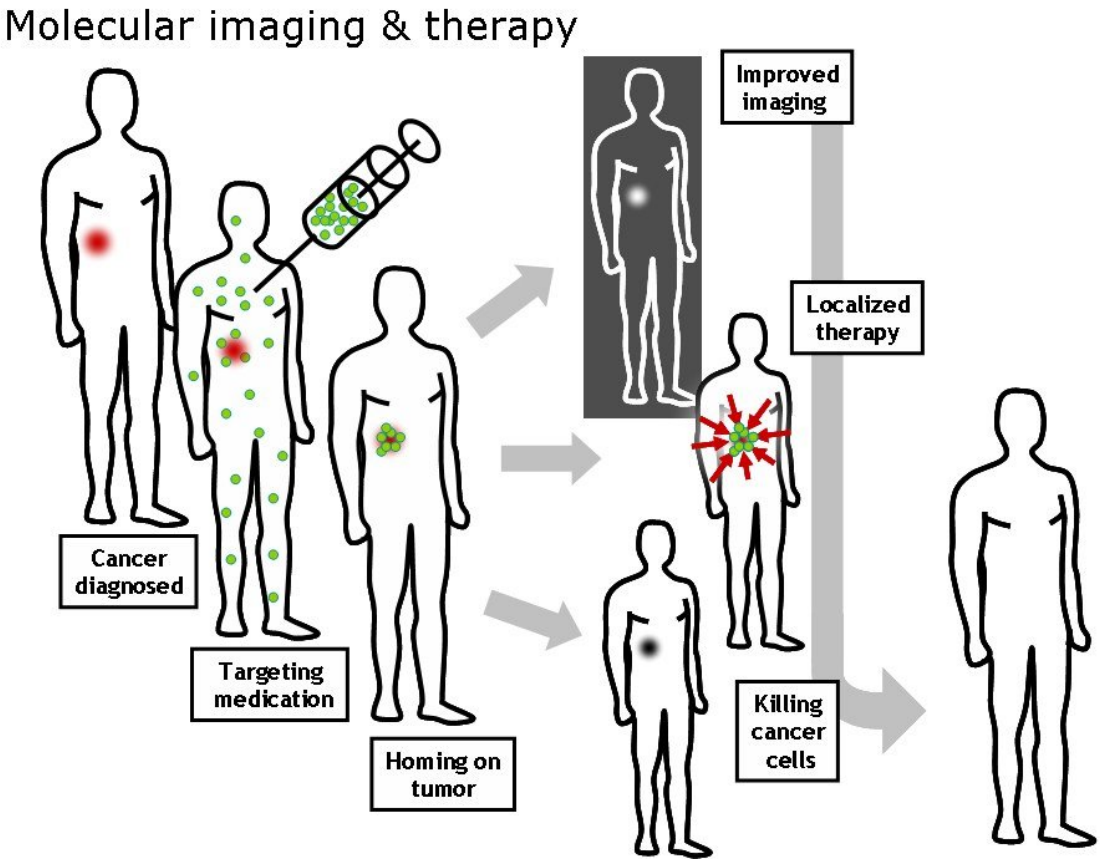

Fig 1. A schematic illustration showing how nanoparticles or other cancer drugs might be used to treat cancer.

Most drugs perform better as nanoparticls, because they can be targeted better and there they have fewer side effects.

In addition, by using smaller amount of drugs, treatment cost maybe reduced. For example according to Minimarket's research patients show a strong preference for nanoparticle as an alternative the widely used injectable methods, which may permit far lower doses of expensive protein-based drugs like insulin.

There are various types of drug delivery systems with different functions in which nanotechnology is likely to have an impact:

Injectable delivery systems;

Implantable delivery systems;

And oral delivery systems.

Topical delivery systems: nanomaterails are able to penetrate human tissue and cells due to their small size.

Toxin removal: colloidal objectivity have been demonstrated to omit potentially lethal compounds from the blood stream, including high concentration of lipophilic therapeutics, illegal drugs, and chemical and biological agents.

Transdermal systems: There are many polymers which are approved by FDA to be used on skin or medical tools which are increasing rapidly. This in mind, the industry will be presented with occasions to create new transdermal platform designs which improve the on-skin diffusion and properties of active molecules from patches.

Scientist expects that in the coming years significant research will be undertaken in the following areas of nanomedicine:

Syntheses and use of novel nanostructures and nonmaterials;

Using nanotechnology for tissue engineering and regenerative medicine;

Identification of new biologic targets/receptors/ligands for imaging, diagnosis, and therapy.

Using nano-based devices and nanosensores for early point of care detection of disease and photogenes.

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Dear Colleague,

Please kindly visit our recently organized site with improved features; please find it in below address:

<<WWW.EMHGBN.net>>

It is necessary to say that our previous site (www. EMGEN.net) exists and functioning as usual.

We will be grateful if you send us your comments in this regard related to further improvement of the mentioned sites.

Sincerely Yours,

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Announcement

Dear EMGEN User,

We would like to introduce you the Bioinformatics section that has been presented in EMGEN web site (WWW.EMHGBN. net). Moreover, please note that this section has been available in the other EMGEN web site (WWW.EMGEN.net) as it was before. This section is designed to be a general purpose Bioinformatics section.

We certainly appreciate your useful comments in this regard.

Please do not hesitate to contact us if you have any further questions about the mentioned section.

Sincerely Yours,

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Announcement

The 3rd Iranian Proteomics Congress (IPC)

As the Co-Chairs of the 3rd Iranian Proteomics Congress (IPC), we are pleased to invite you to join us on 26-27 May, 2010 at Pasteur Institute of Iran. The 3rd IPC will be held at Modares Conference Hall of Pasteur Institute of Iran, located in Tehran.

The format for the 3rd IPC will be based on a multi-disciplinary theme featuring lectures from national and international leaders in the field. The scope of this year's congress includes human proteome project, human Y chromosome proteome project, clinical proteomics, stem cells proteomics, plant and animal proteomics and protein bioinformatics.

We are pleased to present the following keynote speakers:

Young-Ki Paik President, Human Proteome Organization (HUPO), Director, Yonsei Proteome Research Center & Biomedical Proteome Research Center (Korea)

Pierre Legrain Secretary General, Human Proteome Organization (HUPO) (France)

Juan J. Calvete Head of the Structural Proteinomics Laboratory at the Instituto de Biomedicina de Valencia (Spain), Editor-in-Chief, Journal of Proteomics

Reiner Westermeier Scientific marketing director, Gelcompany (Germany)

Virginie Brun Laboratoire d'Etude de la Dynamique des Protéomes (France)

Christoph Borchers Director, University of Victoria Genome Proteomics Centre (Canada)

Kazuyuki Nakamura AOHUPO vice president, Yamaguchi University Graduate School of Medicine (Japan)

Christine Finnie Technical University of Denmark (Denmark)

The deadline for submission of abstracts will be 30 April 2010. For further information please check the website: www.proteomics.ir/congress

We are looking forward to seeing you at the 3rd IPC in Pasteur Institute of Iran.

Behrouz Vaziri, Conference Co-Chair
Ghasem Hosseini Salekdeh, Conference Co-Chair

Cover Picture

Title: Embryonic Stem Cells (Human embryonic stem cells.png (A) shows hESCs. (B) shows neurons derived from hESCs)
Description: Embryonic stem cell lines (ES cell lines) are cultures of cells derived from the epiblast tissue of the inner cell mass (ICM) of a blastocyst or earlier morula stage embryos. A blastocyst is an early stage embryo—approximately four to five days old in humans and consisting of 50–150 cells. ES cells are pluripotent and give rise during development to all derivatives of the three primary germ layers: ectoderm, endoderm and mesoderm. In other words, they can develop into each of the more than 200 cell types of the adult body when given sufficient and necessary stimulation for a specific cell type. They do not contribute to the extra-embryonic membranes or the placenta.
Source: commons.wikimedia.org/wiki/Human_embryonic_stem_cells.png

Title: Plagiomnium affine laminazellen
Description: Chloroplasts are one of the many different types of organelles in the cell. In general, they are considered to have originated as endosymbiotic cyanobacteria (previously known as blue-green algae). This was first suggested by Mereschkowsky in 1905 after an observation by Schimper in 1883 that chloroplasts closely resemble cyanobacteria. All chloroplasts are thought to derive directly or indirectly from a single endosymbiotic event (in the Archaeplastida), except for *Paulinella chromatophora*, which has recently acquired a photosynthetic cyanobacterial endosymbiont which is not closely related to chloroplasts of other eukaryotes. In that they derive from an endosymbiotic event, chloroplasts are similar to mitochondria, but chloroplasts are found only in plants and protista. The chloroplast is surrounded by a double-layered composite membrane with an intermembrane space; further, it has reticulations, or many infoldings, filling the inner spaces. The chloroplast has its own DNA, which codes for redox proteins involved in electron transport in photosynthesis; this is termed the plastome.
Source: en.wikipedia.org/wiki/File:Plagiomnium_affine_laminazellen.jpeg

Title: GFPneuron
Description: Neurons exist in a number of different shapes and sizes and can be classified by their morphology and function. The anatomist Camillo Golgi grouped neurons into two types; type I with long axons used to move signals over long distances and type II with short axons, which can often be confused with dendrites. Type I cells can be further divided by where the cell body or soma is located. The basic morphology of type I neurons, represented by spinal motor neurons, consists of a cell body called the soma and a long thin axon which is covered by the myelin sheath. Around the cell body is a branching dendritic tree that receives signals from other neurons. The end of the axon has branching terminals (axon terminal) that release neurotransmitters into a gap called the synaptic cleft between the terminals and the dendrites of the next neuron.
Source: http://en.wikipedia.org/wiki/GFPneuron.png