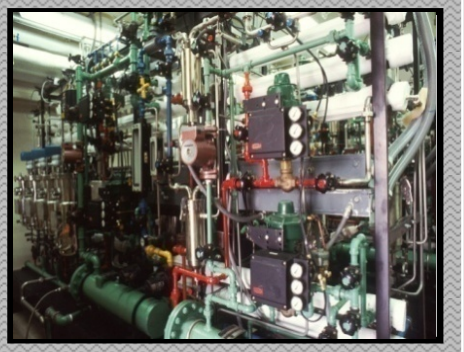

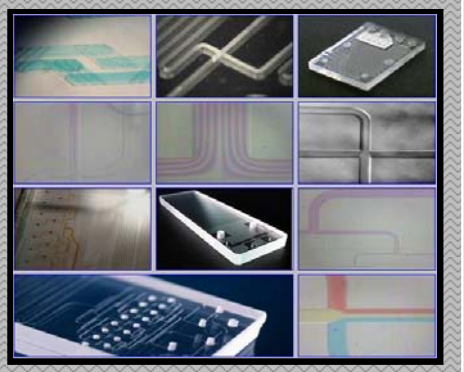

# EMHGBN Newsletter

Vol. 2, Issue 1, December 1st, 2007

## 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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## Genotyping of Hepatitis C Virus in Northwest of Iran

*An article entitled "Genotyping of Hepatitis C Virus in Northwest of Iran" published in Biotechnology 6 (3): 302-308, 2007, Asian network for scientific information, deals with the study of patients with Hepatitis C virus (HCV) infection, to identify HCV genotypes in Northwest Iran. The study was done by Mohammad Saeid Hejazi, Reza Ghotaslou, Majid Farshdoosty Hagh and Yashar Mohammadzadeh Sadigh. Corresponding author of this Paper, Dr. Reza Ghotaslou, is working in Department of Microbiology, Faculty of Medicine and Drug applied research centre, Tabriz University of medical science, Tabriz, Iran.*

Hepatitis C virus (HCV) is one of the main causes of chronic hepatitis in the world. In Iran, its prevalence in general population seems to be less than 1 %. HCV is unique among viruses infecting human beings in that, one, the detection of the viral genome remains the most sensitive and reliable means of establishing infection and, two, variations in nucleotide sequences are used for classifying them. On the basis of phylogenic analysis, HCV has been grouped into six major genotypes, each of which contains one or more subtypes. The types have been numbered 1 to 6 and the subtypes are identified a, b and c, in both cases in ordered of discovery Sera from 50 HCV patients from Northwest of Iran were studied. We used an improved and simplified method of genotyping developed for classifying HCV isolates into the five common genotypes (modified Okamoto et al method), i.e., I/1a, II/1b, III/2a, IV/2b and V/3a, by PCR with genotype-specific primers deduced from the core gene. HCV RNA was detected in 30 cases by RT-PCR (fig 1). Of 30 HCV isolates, 20 (66.6%) were shown to belong to genotype 1a, 4 isolates (13.3%) 1b, 4 cases (13.3 %) 2a,1 case (3.3%) 3a, and 1 HCV sera was not genotyped by this assay (fig 2). The analysis of current data and other findings indicate that subtype 1a incidence is the highest within Iran, but further studies are recommended. In addition, we need to develop more effective therapies for persons with infection, particularly for those with genotype 1; the most difficult to treat.There was no difference in genotype distribution when compared with results from others Iranian locations. The subtypes found in Iran, were neither similar to those in neighbouring countries like Turkey or Pakistan, where the dominating subtypes are 1b and 3 nor to those in Middle East countries such as Iraq, Saudi Arabia, Yemen, Kuwait where 4 is the most prevalent HCV genotype. The similarities in the distribution of the HCV subtypes in Iran with European countries and the USA might support a common origin through large-scale medical contacts between Iran and these countries.

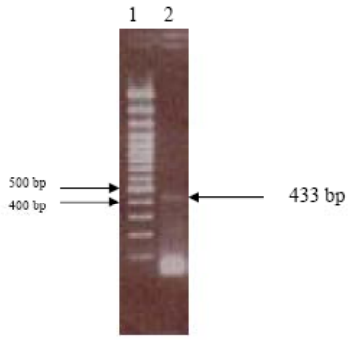



Figure 1: Agarose gel electrophoresis of first round PCR product. Lane1) 100bp DNA ladder. Lane 2) PCR product of first round with 433 bp size.

In conclusion, the result of this study indicate that, since the number of HCV genotypes in Iran, is generally restricted, it is possible, using analysis of new core sequences and optimization of PCR amplifications, useful for typing HCV on a population basis.

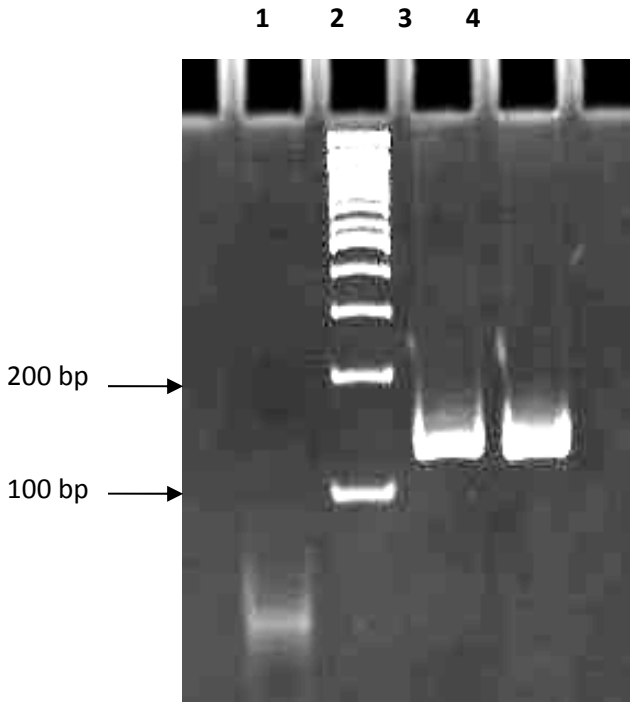



Figure2: Acryl amide gel electrophoresis of second round PCR products of *Okamoto* et al method. Lane 1) PCR product of genotype 2a with 69 bp size, lane 2) 100 bp DNA ladder, lane 3) genotype 1a with 128 bp size and lane 4) genotype 1b with 125 bp size.

**Left to right**: Dr. Mohammad Saeid Hejazi and Dr. Reza Ghotaslou

# Antibiotic like -Substances Production by Dermatophytes Fungi

*An article entitled "Antibiotic like-substances produced by sometrichophytic dermatophytes" published in African Journal of Biotechnology Vol. 6 (15), pp. 1788-1790, 6 August 2007, is about antibiotic production by Dermatophytes fungi. This work was done by Hammadi, D. K., Selselet, G. A., and S. A. Bensoultane.*

*Dr. Hammadi, D. K., corresponding author of this paper, is working as an assistant professor, teaching as a lecturer "Applied microbiology" and supervising many research project of Ministry of Higher Education and Scientific Research at:The department of biological sciences; faculty of sciences; university of Mostaganem; BP 227 (W-27000) Algeria; she did her PhD at department of microbiology and infectious diseases supervised by Prof W.C.Noble in 1988 at "U.M.D.S."(United Medical and Dental Schools) London University GB.*

**Summary**

The antibiotic production by dermatophytes fungi has been demonstrated in the shaker culture of the F.U.M. (Fermentation Unit Medium). Among 10 anthropophilic dermatophytes strains tested for their ability to produce antibiotics, only 4 strains have been found producers. The outcome for a qualitative identification of the produced antibiotics has been shown by the thin-layer chromatography and Betina classification methods. Four types of antibiotics have been revealed: a penicillin-like substance produced by the strain of *Trichophyton gourvillii*, and two different types of unknown substances obtained from *Trichophyton mentagrophytes var. interdigitales* and the Kojic acid -like antibiotics substance which has been given by *Trichophyton verruccosum* strain.

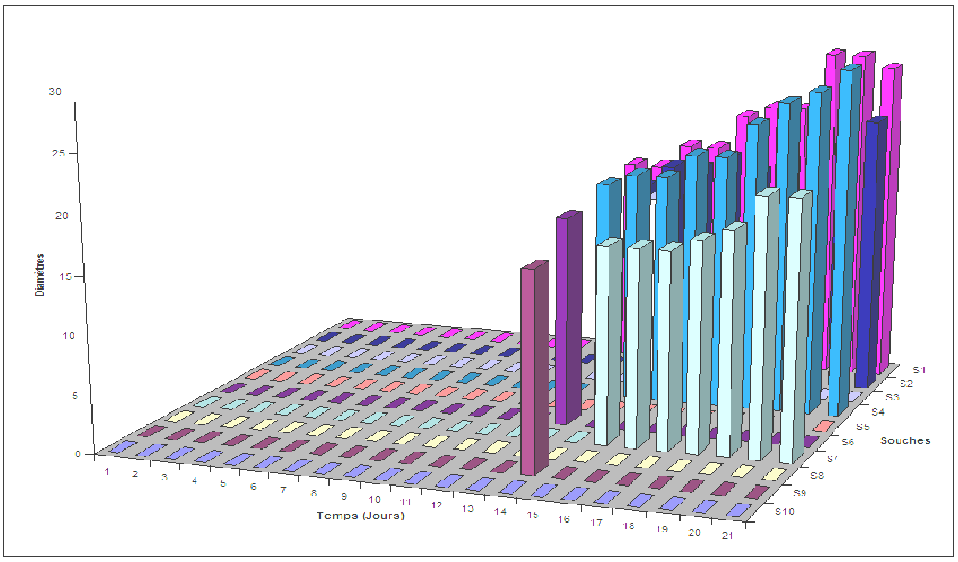
dermatophytes are group of closely related fungi that have the capacity to invade keratinized tissue (skin, hair and nail) of humans and animals to produce an infection (Zagnoli 2005); dermatophytes and congeners, like most filamentous fungi of ascomycetous affinity have a secondary metabolism characterized by the production of substantial quantities of distinctive metabolites (Weizman and Summerbell 1995).

dermatophytes fungi have long been known to produce antibacterial substances; the ability of dermatophytes to produce penicillin-like substances *in vitro* has been reported by Hammadi *et al.;* 1988. The purpose of our study is the continuation of the identification of the antibiotic products of some trichophytic species, hunting new antibiotic products; from some other trichophytic species not studied before using Betina analysis methods.

Among 10 anthropophilic and trichophytic dermatophytes strains tested for their ability to produce antibiotics, only 4 strains have been found producers. Ten strains isolated and brought from Pasteur institute of Algeria; characterized as-five strains of *Trichophyton mentagrophytes var.interdigitale* coded as S2, S3, S4, S9, and S10.

One strain of *Trichophyton gourvillii* coded is S1; *Trichophyton violacium* coded is S5; Trichophyton *rubrum* coded is S6; *Trichophyton verrucosum* coded is S7; *Trichophyton shoenleini* coded is S8. For the antibiotic production; spores were inoculated in 100m, amounts of fermentation Unit medium (F.U.M) and Incubated at 30c° in an orbital incubator at 140revs/minute.

The diameter zones of inhibition the 10 strains of Dermatophytes during fermentation was recorded:

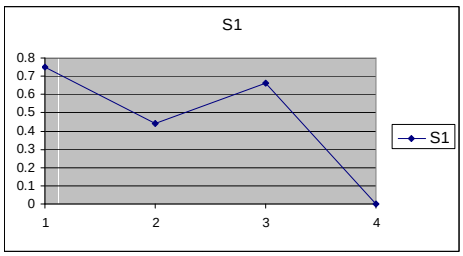



The outcome for a qualitative identification of the produced antibiotics has been shown by the Thin-layer chromatography and Betina classification methods.

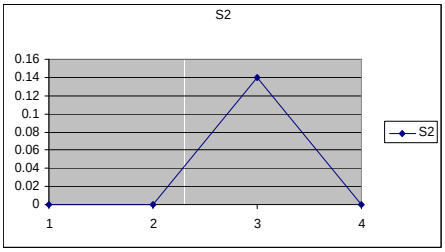
Four trichophytic species coded S1, S2, S4 and S7 gave an active substance patterns profiles.

However six species were not producers, S3, S5, S6, S8, S9, and S10.

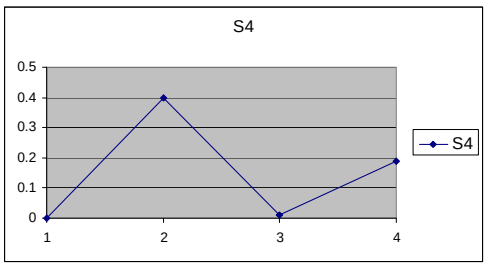
**Rf profiles given by bioautography results**

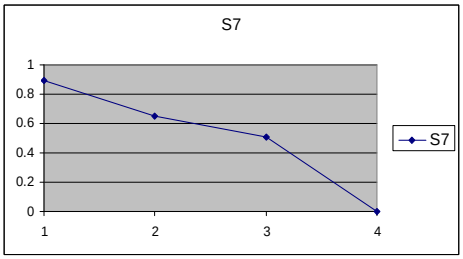



*Profile of penicillin-like antibiotic (S1)*




*Profile of unknown compound (S2)*




*Profile of unknown compound (S4)* *Profile of kojik acid-like (S7)*

Four types of antibiotics have been revealed: a penicillin -like substance produced by the strain of *Trichophyton gourvillii*, and two different types of unknown substances obtained from *Trichophyton mentagrophytes var. interdigitales* and the Kojic acid -like antibiotics substance which has been given by *Trichophyton verruccosum* strain.

The two unknown compounds produced by two species of *T.mentagrophytes* have the same Rf values of the water solvent. This would help suggest that the use of the different solvent system would help to classify the unknown compounds and may be if we continue the research by testing the secondary metabolite products from Dermatophytes fungi is also necessary to find antibiotics active against viral infections and cancers. The project we are working on for the moment and the first results were published in summary of the 16th congress of ISHAM 2006.


Dr. Hammadi, D. K.

# Protein Microarray Technology

**Abstract**

Protein chips have emerged as a hopeful approach for a wide range of applications including the recognition of protein–protein interactions, protein–phospholipid interactions, small molecule targets, and substrates of proteins kinases. In addition, they can be used for clinical diagnostics and monitoring disease status.

## Introduction

Understanding multifaceted cellular systems will necessitate the recognition and analysis of each of its components and determining how they function together and are regulated. A crucial stage in this process is to characterize the biochemical activities of the proteins and how these activities themselves are controlled and adjusted by other proteins. Conventionally, the biochemical activities of proteins have been clarified by studying single molecules, one test at a time. This procedure is not optimal, as it is time-consuming and labour intensive.

In contrast with this conventional approach, high-output scientific methods have been developed in the last decade to optimize the study of huge numbers of molecules, comprising DNA, proteins and metabolites. Specifically DNA microarrays have proved beneficial in genomic research (Schena et al., 1995).

More recently high-output methods have been evolved for the study of proteins, comprising profiling of proteins using mass spectrometry (Gavin et al., 2006, 2002; Ho et al., 2002; Krogan et al., 2006; Washburn et al., 2001), tagging and subcellular localization (Ghaemmaghami et al., 2003; Huh et al., 2003) and protein microarrays (MacBeath and Schreiber, 2000; Zhu et al., 2001, 2000).

## 1. Types of protein microarrays

Three kinds of protein microarrays are at present used to analyze the biochemical activities of proteins: analytical microarrays, functional microarrays, and reverse phase microarrays.

Analytical microarrays are usually utilized to profile a complex mixture of proteins with the aim of determining binding affinities, specificities, and protein expression levels of the proteins in the mixture. In this method, a library of antibodies, aptamers, or affibodies is arrayed on a glass microscope slide. The array is then probed with a protein solution. Antibody microarrays are the most frequent analytical microarray (Bertone and Snyder, 2005).

These types of microarrays can be used to observe differential expression profiles and for clinical diagnostics. Instances include profiling responses to environmental stress and healthy *vs.* disease tissues (Sreekumar et al., 2001).



Functional protein microarrays are different from analytical arrays in that functional protein arrays are comprised of arrays having full-length functional proteins or protein domains.
These protein chips are used to analyze the biochemical activities of whole proteome in a single test. They are utilized to study various protein interactions, such as protein–protein, protein–DNA, protein–RNA, protein–phospholipid, and protein–small molecule interactions (Hall et al., 2004; Zhu et al., 2001). A third kind of protein microarray, associated with analytical microarrays, is recognized as a reverse phase protein microarray (RPA). In RPA, cells are separated from a variety of tissues of interest and are lysed. The lysate is arrayed onto a nitrocellulose slide using a contact pin microarrayer. After that the slides are probed with antibodies against the target protein of interest, and the antibodies are usually discovered with chemiluminescent, fluorescent, or colorimetric assays. Reference peptides are printed on the slides to permit for protein quantification of the sample lysates.
RPAs allow for the detection of the presence of changed proteins that may be the consequences of disease. Particularly, posttranslational modifications, which are usually altered as a result of disease, could be found using RPAs (Speer et al., 2005). Once it is identified which protein pathway may be dysfunctional in the cell, a specific treatment can be established to target the dysfunctional protein pathway and treat the disease of interest.

**2. Protein chips**

Usually, protein chips are prepared by immobilizing proteins onto a treated microscope slide via a contact spotter (MacBeath and Schreiber, 2000; Zhu et al., 2001) or a noncontact microarrayer (Delehanty, 2004; Delehanty and Ligler, 2003; Jones et al., 2006). It is crucial that the proteins remain in a wet environment. Thus, sample buffers contain a high percent of glycerol, and the printing process is done in a humidity-controlled situation (MacBeath and Schreiber, 2000; Zhu et al., 2001). Because equipment and procedures developed for DNA microarrays are simply flexible to the development of protein microarrays, the option of utilizing treated microscope slides follows from the ready accessibility of robotic arrayers and laser scanners that have become usual in the world of DNA microarrays (Bertone and Snyder, 2005).
You can download a video here which shows A DNA microarray being printed by a robot at the University of Delaware. To download the video click here.

**3. Detection methods**

To find reactive proteins on a proteome chip, small molecule probes are labelled with either fluorescent, affinity, photochemical, or radioisotope tags. Fluorescent labels are usually chosen, as they are safe and efficient and are well-matched with readily accessible microarray laser scanners. Despite the kind of label used, there are troubles related to labelling the molecules utilized to probe a proteome chip.

Chief among these problems is the probability that the label itself may interfere with the probe's capability to interact with the target protein.
To conquer this problem, a number of label-free detection methods have newly been developed. Label-free detection methods not only overcome the problem of steric hindrance of a label, but also permit the collection of kinetic binding data (reviewed in Ramachandran et al., 2005).
The present leading technology for label-free recognition of protein interactions is surface plasmon resonance (SPR), which probes the local index of refraction. Other options comprise carbon nanotubes, carbon nanowires, and microelectromechanical systems cantilevers. Although these technologies are still in their infancy and are not appropriate for high-output protein interaction detections, there is great promise with their application in future. (Ramachandran et al., 2005).

**4. An example of protein chips application**

The biochemistries of thousands of proteins can be described and quantified in a parallel format through the application of protein microarrays. Not only have protein chips been utilized to distinguish the functions of formerly uncharacterized proteins, in addition they have been used to detect new functionalities for previously characterized proteins. Proteome chips have been used to analyze protein–protein interactions (Zhu et al., 2001), protein–DNA interactions (Hall et al., 2004), protein–lipid interactions (Zhu et al., 2001), protein–drug interactions (Huang et al., 2004), protein–receptor interactions (Jones et al., 2006), and antigen–antibody interactions (Michaud et al., 2003). Furthermore, proteome chips have been utilized to study kinase activities (Ptacek et al., 2005; Zhu et al., 2000) and have been used for serum profiling (Zhu et al., 2006). Hall et al. (2004) used yeast proteome chips to identify previously unrecognized DNA binding activities.

Both single and double stranded Cy3 labelled yeast genomic DNA was employed, to probe a yeast proteome array. Over 200 DNA binding proteins were detected, but just near half of those were anticipated to bind DNA based on their recognized function. One of the unforeseen targets we found was Arg5,6, a mitochondrial enzyme required in arginine biosynthesis. Chromatin immunoprecipitation tests showed that Arg5,6 associates with particular nuclear and mitochondrial loci in vivo. Gel shift assays demonstrated that Arg5,6 binds to specific DNA fragments in vitro, and a common binding motif was established. Real time PCR tests with Arg5,6 showed that it may have a function in regulating gene expression.
Therefore, a yeast proteome chip was applied to identify a novel DNA binding protein, and a metabolic enzyme was established that appears to have a role in straightly regulating eukaryotic gene expression. Additional applications of protein chips could be found in the original paper.

[**Ref**: David A. Hall, Jason Ptacek, Michael Snyder, Protein microarray technology, Mechanisms of Aging and Development 128 (2007) 161–167]

vacsera
Holding company

## A Tradition of Confidence and Future of Security

The holding company for biological products and vaccines (VACSERA) is the only manufacturer of vaccines and biological products in Egypt. VACSERA is come from the words (vaccines) and (sera) representing our dedication to serve the preventive medicine branch in the healthcare division by production of top quality vaccines and antiserum. In addition of being the sole producer of vaccines in Egypt, VACSERA holds one of the major Egyptian blood banks.

VACSERA perform two WHO reference laboratory standards (influenza separation lab and enteric virus separation lab) VACSERA core policy is to generate value by quickly developing and successfully marketing vaccines and medicines that satisfy the requirements in large population, we focus on bringing efficient and cost effective healthcare solution.

VACSERA is the most important company in the field of biological products &vaccines manufacturing in Egypt and the Middle East. We are centered on following strategic investment opportunities in a number of divisions in the pharmaceutical and biopharmaceutical industries.

These consist of research and development, manufacturing, distribution, and intellectual property achievements. Our expert and committed employees are the driving power that assists in moving forward with our business vision. We look forward to sustained growth and to dividing our success with our clients and stakeholders.

**A brief history of company:**

With a small laboratory established in 1881 by the Health Department, the long journey of disease prevention and vaccine production initiated with the small pox vaccine created for the first time in Egypt in 1893, accompanied by the rabies vaccine in Kasr El Ainy – Pasteur Institute in 1907.

In 1973 the "Egyptian Organization for Biological Products and Vaccines" VACSERA was founded under the presidential decree # 94. During the years many products were included in VACSERA product portfolio and different laboratories and production units were built. In 1985 a Research Center was established for the diagnosis of Homophiles Influenza type b, rheumatic fever and bilharzias, and also the production of vaccines by genetic engineering technology.

From 1997 until 2002 VACSERA scientists in the Scientific Research Academy of Egypt successfully invented about 18 patents. Newly, two new patents were registered overseas in the United States and Jordan.

**VACSERA** was one of the oldest laboratories for vaccine manufacturing in Egypt and the Arab world. VACSERA comprised of five companies. The companies are as follows:

1) **EGYVAC** the Egyptian Company for Production of Vaccines, Sera and Drugs.

2) **Egytec**: Egyptian company for Biotech industries.

3) **EgyBlood**: Egyptian company for Blood transfusion services.

4) **EgyVet**: Egyptian company for Drugs & Veterinary products.

5) **Diagsera**: Egyptian company for Diagnostics.

**Some EGYVAC products:**

| Bacterial vaccines | Viral vaccines | Combined bacterial and viral vaccines | Antisera | Immunoglobulin |
|---|---|---|---|---|
| Cholera Vaccine | Hepatitis A&B Vaccine | Tritanirix-HB | Botulinum Anti-Toxin serum | Hepatitis B Immunoglobulin |
| Meningococcal Polysaccharide Vaccine Groups A,C,W&Y | Influenza Vaccine | | Snake Venom Antiserum | Rabies Immunoglobulin |
| Mixed Typhoid&Tetanus vaccine | Yellow Fever Vaccine | | Diphtheria Anti-Toxin serum | |

**[Ref:** http://www.vacsera.com**]**

## Innovation by the Numbers

**1** = Number of new drugs that result from every 5,000-10,000 compounds screened

**10-15** = Number of years needed to produce a medicine

**82,000** = Number of scientists investigating novel medicines in America's pharmaceutical companies

**$51,300,000,000** = costs associated with research and development of new medicines by pharmaceutical companies in 2003.

**$802,000,000** = typical cost to develop one medicine. This amount is up from $138 million in 1975 and $318 million in 1987 (2000 dollars)

**3 out of 10** = Number of new medicines that generate profits that match or go beyond average research and development costs

**Over 2,300** = Number of medicines in development

**over 360** = Number of new medicines approved between 1993 and 2005

**nearly 250** = Number of medicines to treat rare conditions (influencing less than 200,000 in the U.S.) approved by the FDA in the last two decades

**$4.44** = Amount saved in hospital expenses for every $1 spent on medicines

**50-60%** = Portion of cancer survival raises attributable to new medicines

**70%** = Reduction in AIDS death rate since arrival of new medicines in 1995

**10¢** = Portion of every dollar spent on health care that goes to prescription medicines

**11-12** = Years of efficient patent life for medicines - about 6-7 years shorter than other products

[**Ref**: http://www.innovation.org/index.cfm/ToolsandResources/FactSheets/Innovation_by_the_Numbers]

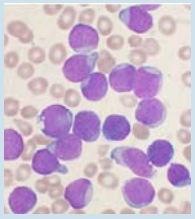
# Diseases Conditions: Then and Now

It is simple to forget, but not very long ago the treatments we might nowadays take for granted had not yet been developed. Probably there were no medicines at all for the disease, or those that did exist were not very efficient or had severe side effects. A comparison between treatments of recent past and today emphasizes how far we have come, as well as the significance of constant innovation.

Read below to recognize what's changed in treating: Leukaemia, HIV/AIDS, juvenile rheumatoid arthritis and organ transplants.

## then LEUKEMIA now

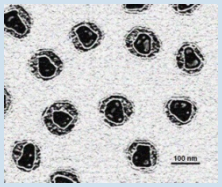
If you had been diagnosed with chronic myeloid leukemia (CML) in 1999, chances were that you would not live today. Only three out of ten patients survived for even five years. In addition in this period, you had two frightening treatment alternatives: a high-risk bone marrow transplant or every day injections of interferon, the side effects of which have been compared to "having a bad case of the flu every day of your life."



You can take a daily tablet that has a good chance of driving your cancer into remission - normalize your blood count with few, if any, side effects. The new drug targets CML on a molecular level, so it influences merely the enzyme responsible for the disease. The great efficiency and accuracy of the approach is indicated as the "wave of the future."

## then HIV/AIDS now

If you were diagnosed with AIDS in 1990, you might anticipate living for just about 26 months. Throughout that time, you would be likely to deal with a number of opportunistic infections that would make your remaining days disagreeable and painful. The sole treatment accessible had to be taken every four hours - around the clock - and had severe side effects.



Thanks to the approval of protease inhibitor in 1995 - and additional advancements in new drugs and combination therapies in the decade since - the AIDS death rate has reduced by 70 percent. If diagnosed today, a variety of treatment alternatives (including different combinations of drugs) might be capable to keep you symptom-free for years to come.

## then JUVENILE RHEUMATOID ARTHRITIS

In previous generations, a child growing up with this incapacitating autoimmune disease, which causes serious joint inflammation, had no options but to take large doses of steroids to manage the swelling or dozens of aspirins everyday to decrease the pain. Most of the time, neither did very much, resulting in a childhood lost to hospitals, wheelchairs, body casts, and pain.

## now JUVENILE RHEUMATOID ARTHRITIS

Nowadays a child growing up with rheumatoid arthritis - as well as many adults living with the disease - can now advantage from novel biotech proteins and antibodies that assist control the body's inflammatory response. Along with other more efficient treatments, including new kinds of pain relievers, these new medicines can quickly and noticeably decrease symptoms, assisting today's generation of patients enjoy a completely active, healthy, and normal childhood.

## then ORGAN TRANSPLANTS

In the 1950s and early 1960s, patients requiring an organ transplant were in a disastrous bind. Transplants were surgically feasible, but the body's immune response quickly rejected organs donated by unrelated persons. People either died or led really diminished lives.

## now ORGAN TRANSPLANTS

Thanks to anti-rejection drugs that were developed in the 1960s and 1980s, tens of thousands of peoples have received transplants of a wide range of organs and are capable of prolonging their lives, regain their health, and maintain their independence.

[**Ref**: http://www.innovation.org/index.cfm/InnovationToday/Then_&_Now]

# Anouncements

## 1st International Conference on Drug Design and Discovery

### February 4 - 7, 2008, Dubai, UAE

The ICDDD 2008 is going to be the first major international conference and exhibition of this series, which aims to present cutting edge advances in various disciplines of drug design and discovery that have been recently achieved. Over 400 leading industrial and academic experts will present their findings in the form of lectures and poster presentations at this four-day conference. The ICDDD 2008 will offer an in-depth assessment of the challenges involved in the dynamic and fast moving field of drug discovery and development. It will bring together leading chemists, pharmacologists, biotechnologists, and other allied professionals to discuss and present the latest important developments in drug design and discovery.


The major topics of discussion related to drug design and discovery will include: Cancer; Cardiovascular Diseases; CNS; Pharmacogenomics; Protein & Peptides; Inflammation & Allergy; Drug Delivery & Safety; Drug Discovery Informatics; Drug Metabolism; Medicinal and Combinatorial Chemistry; Nanotechnology; Emerging Biomarkers & Drug Targets; Case Studies of Successful Drug Discovery and Development.

Dubai, the host city, is the region's business and tourism centre which is connected to all international markets. The city is also famous as the regional trading hub and gateway to the rest of the Middle East. The visitors coming to Dubai can enjoy a whole range of different experiences which includes elements of adventure, contrast, discovery and surprise. Dubai World Trade Centre, the venue of the conference, offers a comprehensive range of facilities catering to all types of meetings and major international conventions.

**[Ref**: http://www.icddd.com]

# Cover pictures

## Cover Pictures Description (up to down):

**Title:**
Technology: Drugs: Biologics
**Description:**
Pictured is a fermentation laboratory at the Frederick Cancer Research Facility (FCRF). Only the vast rooms of equipment are seen. This equipment is used to produce biologics, *e.g.*, interferon or antibiotics such as Adriamycin. This equipment is used when large quantities must be produced for clinical trials.
**Source:** National Cancer Institute
**Author:** Linda Bartlett (photographer)

**Title:**
Technology: Monoclonal Antibodies
**Description:**
Pictured is a laboratory setting. A technician wearing a white lab coat and head covering, rubber gloves, is holding a large glass roller bottle and looking into it. A red liquid is visible in the tilted roller bottle. This process is the growing of monoclonal antibodies. They can be grown in unlimited quantities in bottles in the lab. Several shots available.
**Source:** National Cancer Institute
**Author:** Linda Bartlett (photographer)

**Title:**
Glass microfluidic devices from Syrris and Dolomite
**Description**:
Microfluidics deals with the behavior, precise control and manipulation of microliter and nanoliter volumes of fluids. It is a multidisciplinary field intersecting engineering, physics, chemistry, microtechnology and biotechnology, with practical applications to the design of systems in which such small volumes of fluids will be used. Advances in microfluidics technology are revolutionizing molecular biology procedures for enzymatic analysis (e.g., glucose and lactate assays), DNA analysis (e.g., polymerase chain reaction and high-throughput sequencing), and proteomics. The basic idea of microfluidic biochips is to integrate assay operations such as detection, as well as sample pre-treatment and sample preparation on one chip. An emerging application area for biochips is clinical pathology, especially the immediate point-of-care diagnosis of diseases. In addition, microfluidics-based devices, capable of continuous sampling and real-time testing of air/water samples for biochemical toxins and other dangerous pathogens, can serve as an always-on "bio-smoke alarm" for early warning.
**Source**: Wikipedia encyclopaedia. http://en.wikipedia.org/wiki/Main_Page

**Title:**
Technology: Computer
**Description:**
Pictured here is a computer laboratory with rows of machinery. This technology aids in cancer research. Without it, it would be impossible to store and retrieve the vast amounts of information needed for detailed research projects.
**Source**: National Cancer Institute
**Author:** Linda Bartlett (photographer)