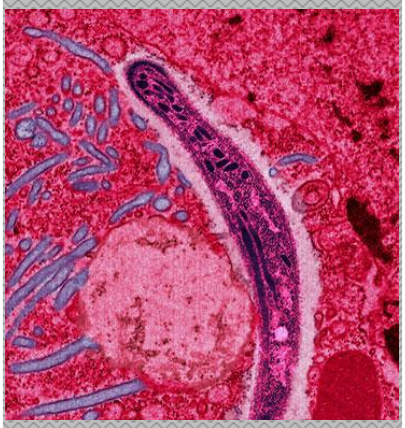

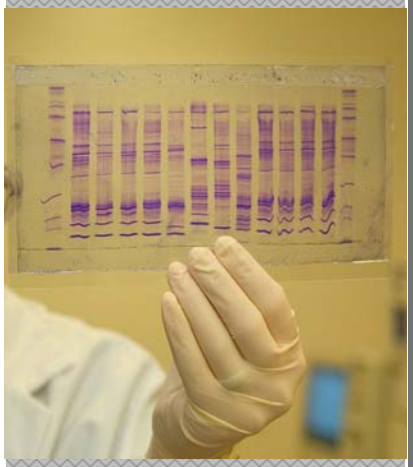

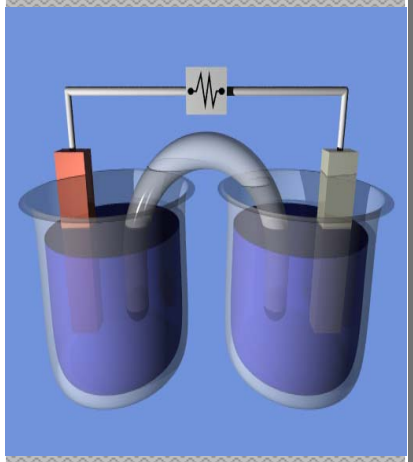

EMGEN Newsletter

Vol. 5, Issue 7

IN THIS ISSUE:

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

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Interview

In this issue of the newsletter, we have an interview with, Prof. Navid Dinparast Djadid from Biotechnology Research Center at Pasteur Institute of Iran about his group's activities (Any views or opinions expressed are solely those of the interviewed person and do not necessarily represent those of EMGEN Newsletter).

Dr. Navid Dinparast Djadid

Dear Dr. Dinparast, could you please briefly introduce yourself and explain your educational status?

Navid Dinparast Djadid, B.Sc., M.Sc., Ph.D.

Medical and Molecular Entomologist

Professor, Malaria and Vector Research Group (MVRG)

Biotechnology Research Center, Pasteur Institute of Iran

Areas of Interest & Research Activities:

- Molecular systematics and population genetics of malaria vectors
- Molecular mechanism/s of insecticide resistance in diseases vectors
- Functional genome analysis in insect vectors of human diseases
- Detection of Wolbachia in Culicidae mosquitoes: detection and possible use as gene driving system
- Para-transgenics for mosquito control: detection and application of bacterial and viral fauna in Culicidae mosquito and their genetic manipulation
- Preparation on developing transgenic mosquitoes
- Vector-Parasite interaction in malaria model
- Sexual stage transmission blocking vaccines (TBV)
- Developing molecular kit for detection of insecticide resistance in vector species
- Developing molecular key to mosquito species (i.e. Iranian Anopheles species)
- Characterization of insect natural products
- Larvae therapy

Degree:

1982-86: B.Sc.: Pest and Disease Control (Shiraz University)

1987-89: M.Sc.: Medical Entomology & Vector Control (Tehran University of Medial Sciences)

1993-1997: Ph.D.: Molecular Entomology

(Liverpool School of Tropical Medicine, University of Liverpool)

Please elaborate on the Malaria and Vector Research Group.

As you know, Malaria and Vector Research Group (MVRG) has seriously tried to follow and achieve national and international standards in order to fulfills international standards, including ISO15189, ISO18001 and ISO13485 and to develop Malaria and Vector research activities at the Pasteur Institute of Iran as a national reference laboratory and WHO candidate collaborating center. We have achieved the pertinent certificates from international organizations for detection, laboratory safety and medical equipment matters.

The focus of the group is on the malaria and vectors. The use of biological products of insects and arthropods is considered as a key research area in the group. Thus, our main policy is to conduct a production plan that will lead to the manufacturing biological (drug /vaccine/kits as well as different extracts from insects and arthropod) for their therapeutic and diagnostic use.

Could you please tell us about your group's big success?

It is called "maggot therapy" and uses the sterile larvae of *Lucilia sericata* in order to heal acute wounds, bedsore, gangrene, and severe burns with especial emphasis on those with diabetes whose feet are in the verge of amputation. These can be treated by the sterile larvae of *Lucilia sericata.*

Do you know if this method has been historically in use?

This method has been used by Maya civilization and Avicenna in Iran. It was also very prevalent in Europe and US prior to antibiotic discovery in the treatment of acute wounds.

What about international tendency towards it?

There are already two giant companies in this regard, entitled Monarch Company and Biomonde Company that are active in the field of maggot therapy. They mainly supply the health centers all over the world.

I think it is the time that our readers get familiar with the larvae and their features.

The function of larvae is very fascinating. When the sterile larvae are put on the wound they act like an antibiotics factory and a micro surgeon. The larvae perform 4 vital missions on the wound including debridement, disinfection, tissue regeneration and biofilm inhibition and eradication which tighten the tissue generation. For instance, in debridement function, the larvae makes digestive enzymes to secret which makes it possible to digest dead tissue before the larvae eats it. These enzymes are carboxypeptidase A and B, leucine aminopeptidase, collagenase, serine protease and metalloproteinase. They are all secretions of the larvae digestive system. On the other hand, it also destroys the wound-causing bacteria, which is particularly effective against gram-positive bacteria and *Staphylococcus aureus* considering their drug-resistant characteristic. The secretion of bicarbonate ammonium promotes larval tissue regeneration feature which leads to granulation tissue.

When did you start all this? What did you think of it at first?

Since we have studied vector-borne diseases such as malaria for a long time we felt that we should enter into production phase. We preferred to mix the research with R&D. We developed some kits for molecular detection of plasmodium. We designed a method for the detection of asymptomatic malaria and worked internationally in detection of drug resistance. The use of biological products was deemed as a long-term strategy of Malaria and Vector Research Group (MVRG) and Pasteur Institute of Iran. We wanted to develop the technology.

Initially, we caught local *Lucilia sericata* and reared them in National Insectarium, which is located at Research and Production Facility of Pasteur Institute of Iran. *In vitro* mass breeding was accomplished in standard condition for the first time. We dedicated a full story at the insect breeding in National Insectarium to the maggot therapy-related activities. It is noteworthy that we have been able to rear more than 300 generations of these flies over last five years. However, there is an overlap among many of these generations.

We primarily standardized the breeding condition by patenting the process. Then, we had to disinfect the larvae. To do this, eggs should be disinfected in order to release sterile larvae, so that we registered a patent on that. The entire processes were done by us, although we found some materials performing the task insufficiently the subject and was not valid. We worked hard and reviewed many protocols for 8 months to finalize it. The above-mentioned companies put the larvae in Biobag. Fortunately, we could produce it locally.

The process officially begun in 2012.We attempted to obtain loans from the Ministry of Health and Presidential Deputy for Science and Technology. It led to the production of larvae pack which was approved by Iranian National Standards Organization in terms of safety for the human. The relevant reference laboratory con-

firmed that larvae pack is not toxic to the human tissue and cell. Therefore, we registered it as our third patent. Finally, we could obtain ISO13485 as an international certificate and Iranian Food and Drug Administration granted us the license of larvae pack manufacturing.

What are the achievements?

We have been able to carry out a lot of research activities including training M.Sc. and PhD. students in this field. Students know what enzymes are involved in different stages at present. For instance, we have got a Ph.D. student who is studying the recombinant production of one of these enzymes. Other students are also surveying its bacterial flora. Since the project is done in the form of natural treatment we have lowered its cost down to one-third of global level for a better competitiveness in the area of commercialization. We can avoid amputation of patient to avoid further social and psychological injuries, so that the patient and his family suffer less financial and emotional damage.

Costs for treating these patients will be reduced at the national level. Larval therapy can be an employment opportunity for academics as well. Since most of the project is done in natural process, it won't have adverse effects for the environment.

Did you have any problems?

The budget was far less than the costs, but we were not disappointed, because this project was to reduce the suffering of society. We got another loan from Presidential Innovation and Development Fund to avoid suspension of the project due to financial problems.

I should mention that we started to establish the MVRG in Biotechnology Research Center by having just two benches. We know that despite of the subject (vaccine, drug, biological, kits ...), R&D has its own problems. In our experience, team work will solve most of the problems, while each stakeholder enters to the team based on specialty and motivation. Accordingly, for the sake of our nation and those patients that suffer from diseases, we are ready to cooperate with local, national and international partners (researchers, producers, etc) on maggot therapy and other interested issues.

Thank you for your kind cooperation.

DNA FINGERPRINTING

DNA fingerprinting is a laboratory method exercised to create a relationship between biological proof and a suspect in a criminal research. A DNA sample obtained from a crime scene is measured up to a DNA sample from a suspect. If the two DNA profiles are a alike, then the proof originated from that suspect. On the contrary, if the two DNA profiles do not conform, then the proof cannot originate from the suspect. DNA fingerprinting is also employed to create paternity.

DNA and crime solving did not match together in the very distant past. However, the technology to perform "DNA fingerprinting" was not present until the early 1980's. Then, researchers noticed they could distinguish variations in people's DNA.

The police spent a few years to begin using DNA for resolving crimes. In 1987 the first criminal was trapped using DNA proof.

Figure1: Punuk.Alaska.skulls that could be detected by fingerprinting.

Conversely, in 1989 DNA fingerprinting was brought into play for the first time to prove that somebody was truly blameless of a crime. If you refer to the media during the week you can you can understand its importance. DNA evidence exist from crime dramas to routine crimes on the news.

DNA testing can be used for many more cases. The technology which is used to arrest criminals can also be employed to resolve other riddles. After we talk about how DNA fingerprinting works, we will look at the real -life mysteries that people are solving using DNA.

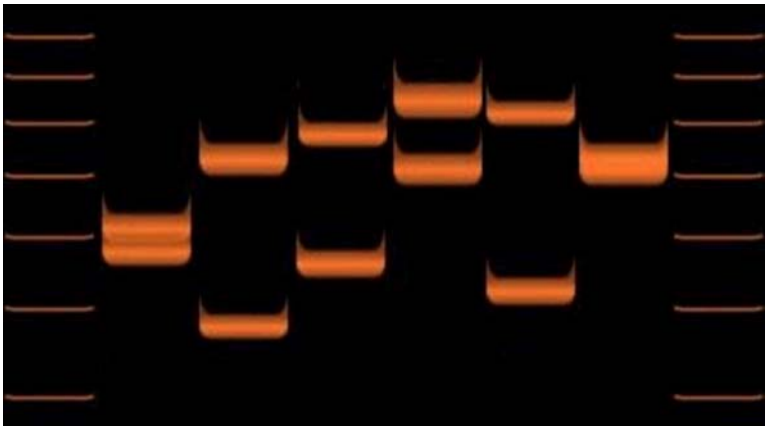

Figure 2: VNTR allelic length variation among 6 individuals.

So how does it work?

A "DNA fingerprint" is kind of like a regular fingerprint. You are born with it, it is unique to you (unless you have an identical twin!), and you can leave it behind wherever you go.

But unlike a fingerprint from your hand, your DNA fingerprint cannot be found by just "dusting for prints" like they do on detective shows. To find a DNA fingerprint, a scientist has to first take the DNA out of the nucleus of a cell.

The cell that is used to get a DNA fingerprint can be a skin cell, a hair root cell, or even a cheek cell that gets washed out of your mouth in your spit. This is because your unique DNA is the same in all of your cells.

So what do they do once they take the DNA out of the cell?

Well, the goal is to analyze the DNA in a way that shows scientists the tiny differences in the DNA of different people.

In the past, scientists used a technique called RFLP (Restriction Fragment Length Polymorphism). RFLP analysis needs lots of DNA, but sometimes only a little is left behind at a crime scene.

So scientists established a way to use less DNA. They excogitated a technique entitled microsatellite analysis.

However, researchers try to discover techniques to use yet less DNA. They also would like to discover a procedure to accelerate the route. On TV the researchers obtain the DNA answers at the end of the show, although in real life there are too many samples put for examination which labs are not able to test them all.

The sign of the future is somewhat named "lab-on-a-chip." It will be a credit card sized machine that you could load a small sample into on the spot you wouldn't have to pass the time until you return to the lab.

Lab-on-a-chip would employ small tubes and pumps to carry out all the phases usually by researchers. It would bring the DNA out of a sample, create lots of copies of the DNA, and evaluate the fingerprint. It would do all this very cheaply and fast considering the existing techniques.

DNA fingerprinting is implemented in order to:

- Identify who a person's parents or siblings are. This examination also can be used to recognize the parents of babies who were changed at birth.
- Resolve offenses (forensic knowledge). Blood, semen, skin, or other tissue remained at the scene of a crime can be investigated to help confirm whether the suspect was or was not there at the crime scene.
- Recognize a dead body. This is helpful if the body is defectively decomposed or if only body members are obtainable, such as following a natural disaster or a battle.

The primary DNA fingerprinting process used Variable Number Tandem Repeats (VNTR), which are recurring DNA sequences that are broadened throughout the genome in non-coding areas. These goals are big, with repeat numbers that are changeable from person to person and have a repeat size made of many nucleotides which can be repeated many times.

DNA fingerprinting is founded on DNA investigated from areas in the genome that take apart genes called introns. Introns are areas inside a gene that are not piece of the protein the gene encodes. They are merged out throughout processing of the messenger RNA, which is an intermediary molecule that permits DNA to encode protein. This is on the contrary to DNA examination searching for disease causing mutations, where the greater part of mutations involve areas in the genes that code for protein called exons. DNA fingerprinting usually involves introns because exons are way more preserved and thus, have less inconsistency in their sequence.

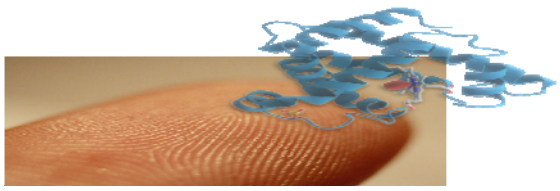

Figure 3: DNA Fingerprinting.

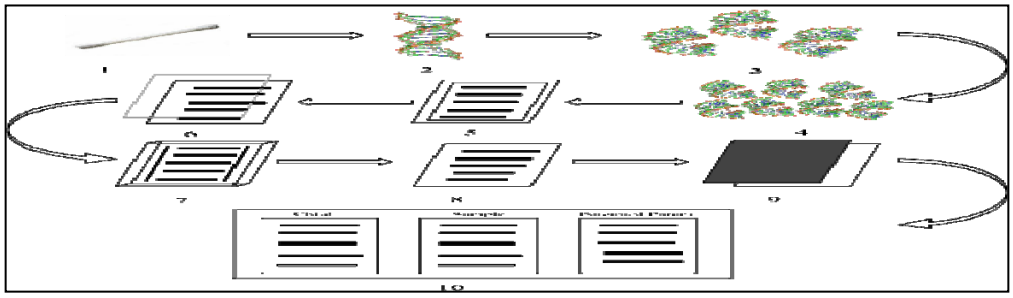

Figure 4: Stages of Gene Fingerprinting.

Stages of Gene Fingerprinting

1.A cell sample is taken- usually a cheek swab or blood test.

2.DNA is extracted from sample.

3.Cleavage of DNA by restriction enzyme- the DNA is broken into small fragments.

4.Small fragments are amplified by the Polymerase Chain Reaction- results in many more fragments.

5.DNA fragments are separated by electrophoresis.

6.The fragments are transferred to an agar plate.

7.On the Agar Plate specific DNA fragments are bound to a radioactive DNA probe.

8.The Agar Plate is washed free of excess probe.

9.An X-ray film is used to detect a radioactive pattern.

10.The DNA is compared to other DNA samples.

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3. https://en.wikipedia.org/wiki/File:Punuk.Alaska.skulls.jpg
4. https://en.wikipedia.org/wiki/File:D1S80Demo.png
5. https://en.wikipedia.org/wiki/File:Stages_of_Gene_Fingerprinting.svg
6. https://en.wikipedia.org/wiki/File:Fingerprint_detail_on_male_finger.jpg

ELECTRO-FERMENTATION

Fermentation processes are the literally biotechnology that are employed for centuries to produce ethanol and biogas. The promising bio-economy is rested a lot upon microbiology's workhorses to force biorefineries as a substitute to fossil fuel resources. The 'Carboxylate platform' idea has been established in previous decade to produce important chemicals, particularly carboxylic acids, in single stage bioconversion procedures by means of vague mixed cultures. Some restrictions of this know-how are nonetheless low yields and construction of mixed compounds with low added value, making it complicated to out-compete traditional petrochemical technologies.

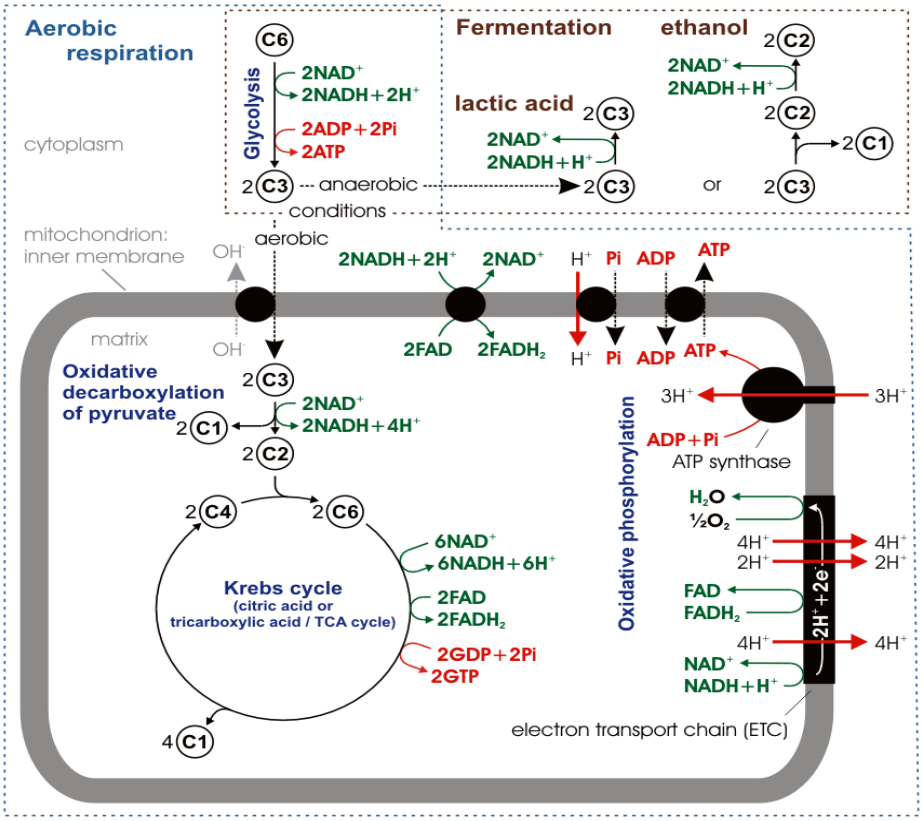

Figure 1: Stoichiometry of aerobic respiration and most known fermentation types in eukaryotic cell.

The application of (bio) electrochemical systems within fermentation processes is a new concept used for process enhancement and/or product recovery. Electro-fermentation (EF) is the application of electrochemical techniques to steer fermentation with the direct integration of an electrochemical cell. Some benefits include: i) reductive conditions to drive carbon chain elongation of carboxylates, ii) pH control without salt addition, ii) transport of ionic products from the broth and, iii) extraction and/or conversion of the target products by a selective flux through a membrane, thereby producing concentrated streams of valued products.

The electro-fermentation group bases its research in the optimization of complex culture fermentations to obtain valuable bio-products from sustainable biomass origins. Several processes are studied for the production of short-chain fatty acids, uneven carboxylates and lactate, among others. The use of (bio) electrochemical systems is investigated as a remediation know-how for fermentation and anaerobic digestion, and the enhancement of compound production and extraction.

EF is a new technology that can be employed to cross some of the restraints of traditional fermentation. This technology is anticipated to increase and better regulate microbial fermentations by proliferation of the specificity of the metabolic paths and overcoming thermodynamic boundaries.

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BACTERIAL INDIVIDUALISM: SURVIVAL STRATEGY FOR HARD TIMES

Reserachers at Eawag, ETH Zurich, EPFL Lausanne, and the Max Planck Institute for Marine Microbiology in Bremen lately realized that the number of individualists in a bacterial colony increases when its food source is limited. Their discovery is contrary to the belief that that bacterial populations only react, in retrospection, to the environmental conditions they exist. According to the study, the individualists can organize themselves for these alterations well beforehand.

References: https://www.sciencedaily.com/releases/2016/05/160509132925.htm

BIOCHEMISTS WATCH GENE EXPRESSION IN REAL TIME

Many high school students can narrate the essential view of molecular biology: DNA makes RNA makes protein. We all are familiar with it. However, have we ever observed it?

DNA transcription, the first pace in gene expression, has been enumerated in real time. However, the second pace -- the transformation of genetic code into a protein -- is much tougher to notice in living systems, and until now has misleaded us.

In an extraordinary achievement, Colorado State University biochemists have prepared a live-cell movie of RNA transformation -- the substantial cellular procedure by which a ribosome decodes a protein.

Sixty years after Francis Crick first elucidated it, CSU researchers have clarified, in a single living cell, this last pace of gene expression. Their means were some witty protein engineering, and a custom-made microscope that can demonstrate single-RNA transformation with nano-scale precision.

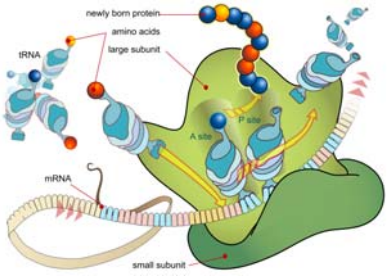


Figure 1: Ribosome mRNA translation

References:

1. https://www.sciencedaily.com/releases/2016/05/160505144850.htm
2. https://en.wikipedia.org/wiki/File:Ribosome_mRNA_translation_en.svg

FINGERPRINTS COULD PAY FOR EVERYTHING IN JAPAN

The Japanese government is struggling to have systems set up by 2020 — for the Tokyo Olympics — that would permit visitors to pay for commodities and services by a fingerprint.

Examination will initiate this summer. Visitors will insert their fingerprints alongside with passport and credit card data upon going through the country.

People can subsequently pay for things in at least 300 stores and hotels that are presently contributing. More will be put in as the system enlarges.

Alongside the route, an institute will change the data gathered to unidentified data that will be investigated to perceive how and where visitors pay out their money; this data will be utilized to cope with the tourism industry. Requesting a tourist to insert a fingerprint is a relatively old process. Japan previously executes that and we do the same in the US. Nevertheless, including it in payment system is completely innovative.

References: http://www.telegraph.co.uk/news/2016/04/11/tourists-in-japan-to-use-fingerprints-as-currency/

THE NEW LANDSCAPE OF PHARMACOGENETICS

For decades, genotyping has guaranteed to give out as a convenient tool of linking genetic make-up and pharmacological effectiveness—primarily at the level of patient groups and lately at the level of individuals. Genotyping, however, yet has a comparatively restricted function in choosing which drug therapies, and which doses, should be employed in specific conditions.

If genotyping is to discover extensive implementation, it will have to conquer a number of obstacles, most particularly difference in assays and stoppage in reporting, complexity in transforming genotype into particular actions, and an apparent shortage of economic and/or clinical value. Technological developments together with changes in the accessibility of genetic data will considerably revolutionize the sphere of pharmacogenetics.

The efficiency of any particular drug therapy is subject to several issues, most usually illustrated throughout the pharmacokinetic parameters of absorption, distribution, metabolism, and elimination (ADME). These factors collectively verify whether a patient will require improved or reduced dosages, or whether a known therapy will work at all in that patient.

References:http://www.genengnews.com/gen-articles/the-new-landscape-of-pharmacogenetics/5751/?kwrd=GE#gsaccess

Book Alert

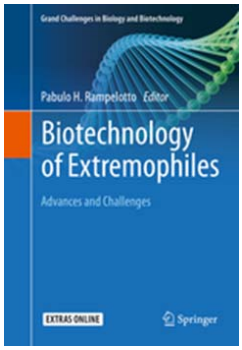
BIOTECHNOLOGY OF EXTREMOPHILES: ADVANCES AND CHALLENGES

Publisher: Springer international publishing

Author: Pabulo Henrique Rampelotto

Publication date: 2016

ISBN: 978-3-319-13521-2



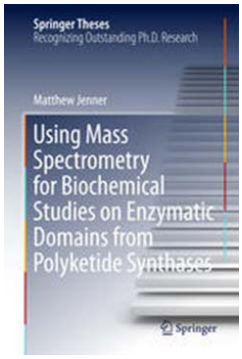
USING MASS SPECTROMETRY FOR BIOCHEMICAL STUDIES ON ENZYMATIC DOMAINS FROM POLYKETIDE SYNTHASES

Publisher: Springer international publishing

Author: Matthew Jenner

Publication date: 2016

ISBN: 978-3-319-32723-5



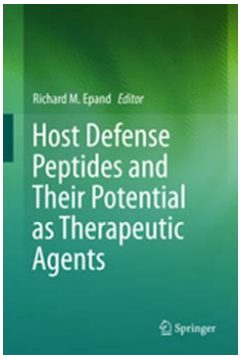
HOST DEFENSE PEPTIDES AND THEIR POTENTIAL AS THERAPEUTIC AGENTS

Publisher: Springer international publishing

Author: RICHARD M. EPAND

Publication date: 2016

ISBN: 978-3-319-32949-9



Announcements

http://globalbiotechcongress.com/index.php

http://drugdiscoverysummit.com/

http://premc.org/iconan2016/

MALARIA

Malaria is an infectious disease of humans and other creatures triggered by parasitic protozoans (a group of single-celled microorganisms) of the *Plasmodium* kind. Malaria entails signs that usually comprise fever, fatigue, vomiting, and headaches. In serious cases it may bring yellow skin, seizures, coma, or death. Symptoms typically create ten to fifteen days after sting. If not correctly cured, people may have relapses of the disease months later. In those who have lately endured an infection, re-infection generally causes slighter symptoms. This fractional resistance vanishes over months to years if the individual has no ongoing exposure to malaria.

References: https://en.wikipedia.org/wiki/File:Malaria.jpg

READING A DNA PROFILE TO DETERMINE THE ORIGIN

The unbelievable influence of DNA technology as a detection tool had brought a wonderful modification in criminal justice. DNA data base is a data source for the forensic DNA typing researchers with features on normally used short tandem repeat (STR) DNA markers. This picture illustrates the vital stages in assembling of Combined DNA Index System (CODIS) on validated polymerase chain amplified STRs and their usage in crime identification.

References: https://en.wikipedia.org/wiki/File:CBP_chemist_reads_a_DNA_profile.jpg

ELECTROCHEMICAL CELL

An electrochemical cell is a tool skillful at either generating electrical energy from chemical reactions or enabling chemical reactions through the presentation of electrical energy. A normal instance of an electrochemical cell is a standard 1.5-volt cell meant for customer usage. This kind of tool is recognized as a single Galvanic cell. A *battery* consists of two or more cells, connected in either parallel or series pattern.

References: https://en.wikipedia.org/wiki/File:ElectrochemCell.png