Pathogen Traffickers: Disease causing pathogens do not have legs

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Corresponding Author:
Dr. Julie O Osayande,
NA, NA, Federik Van Eedenplein, 2050 - Belgium

Submitting Author:
Dr. Julie O Osayande,
NA, NA, Federik Van Eedenplein, 2050 - Belgium

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Introduction

The Ebola virus first appeared in 1976 in two simultaneous outbreaks - in Nzara, Sudan; and in Yambuku, in the Democratic Republic of Congo. Since its outbreak, about 700 deaths have been recorded and a spread to more than four African countries.

What about QUARANTINE?

When Ebola was first discovered, what happened to quarantine?

I ask about quarantine, maybe I simply should ask about education, proper education of people especially in outbreak of diseases.

It is possible there was quarantine; there was proper education, but what about a 'good heart'? A lot of people have contagious diseases, even when they know how dangerous these diseases are and the simple need for them to get isolated, they rather choose to become very heartless to travel with these diseases so that others can be contaminated. Imagine if only Ebola remained in the place where it first surfaced!

The current idea is written because of the outbreak of the Ebola virus and also because of the fact that, over the years, no remedy is coming forth as regards the issues of antibiotic resistance and viral infections (in particular the Human immunodeficiency virus).

Phage therapy is being praised, even to the extent of being regarded as a last resort, but we as scientists should remember that what we are talking about here are "Viruses", being introduced to kill bacteria.

When disease-causing organisms successfully find themselves into the body of a host, they need a lot of things (including essential nutrients) to enable them feel comfortable and get established within the host environment. A number of these disease-causing organisms need essential nutrients to be able to survive and a knowledge of such nutrients can be an area we as scientists can target. In addition, using other strains better equipped in fight for these nutrients can be an avenue to ameliorate the pain and suffering of sick people.

I am proposing the "Engineering of avirulent bacteria strains against pathogenic organisms". These engineered avirulent strains should be constructed to be better equipped in fighting for essential nutrients needed by pathogenic organisms (which may be virus or even deadly bacteria) to survive or thrive within a host, it will simply be a case of the survival of the fittest.

It has been scientifically documented that iron for instance is required for particular steps of the HIV replication life cycle in cells, and this same iron is important for Pseudomonas aeruginosa. Can avirulent strains of Pseudomonas aeruginosa be designed to compete with the virus (for example the HIV) for iron such that those "particular steps" of the HIV replication life cycles requiring iron is blocked? If the virus is unable to replicate, then it cannot survive. Could this be a remedy?

My proposition to us scientists is to see how we can perform experiments to show the essential nutrients disease causing pathogens need to survive, and how avirulent bacteria strains can be engineered to compete with these deadly pathogens for essential nutrients within a host, the best competitor survives, while the other dies, " The era of the survival of the fittest".

The Ebola Virus issue.

The Ebola virus is introduced into the human population through close contact with the sweat, blood, secretions, organs or other bodily fluids of infected animals such as chimpanzees, gorillas, fruit bats, monkeys, forest antelope and porcupines.

Early symptoms are similar to those of flu but are followed by severe vomiting and diarrhoea, and eventually internal and external bleeding.

It started in Guinea in February and spread to neighbouring Liberia and Sierra Leone. The virus then spreads in the community through human-to-human transmission.

Symptoms begin with fever, muscle pain and a sore throat, then rapidly escalate to vomiting, diarrhoea and internal and external bleeding. The incubation period can be up to 21 days.

Since March, there have been 1,201 cases of Ebola and 672 deaths in Guinea, Liberia and Sierra Leone, according to the World Health Organisation (WHO).

Patrick Sawyer, an American, travelled from his home
of Minnesota to attend the funeral of his sister who died from Ebola. He was able to board multiple flights despite vomiting and suffering from diarrhoea, arriving in Nigeria where he died.  
The scientist who helped discover the Ebola virus said the outbreak in West Africa was unlikely to trigger a major epidemic outside the region, adding he would happily sit next to an infected person on a train.  
But Professor Peter Piot said that a "really bad" sense of panic and lack of trust in the authorities in West Africa had contributed to the world's largest-ever outbreak.  
The Belgian scientist, now based in Britain, urged officials to test experimental vaccines on people with the virus so that when it inevitably returns, the world is prepared. ......News culled from the Telegraph  
During holiday and often times, a lot of people travel with children and family, with the spread of some deadly diseases like the Ebola virus, one would wonder if there is a safe place. Human traffickers lure their victims who end up being forced into some kind of slavery they never intended in their lives, pathogen traffickers may do so without knowing it. We talk about disease spread, but do these pathogens causing diseases have legs?  
Pathogens are transported by human beings who travel from one place to the other, people go on holidays, they go with their personal effects, they use sponge, soap and towels, and they make use of toilets and bathrooms, not actually knowing the person or persons who have previously used these bathrooms and toilets. After holidays, these same personal effects are never disinfected, they are brought back to their homes to continue their usage, some persons simply leave their toiletries behind or throw them away, while others do not. One would be left to imagine what would happen if a sick or an infected person previously lodged in a hotel room before a healthy person's arrival. Majority of these hotel rooms are not properly cleaned up nor disinfected.  
Proper attention is not paid to the cleaning of rooms in hotels or hospitals. In some countries, no diploma is required to do a cleaning job, yet it is one of the most sensitive jobs ever. Majority of the cleaning staff are either illiterates or not highly educated, some clean with protective or disposable gloves on, while it is on the contrary for others. In addition, the hotel or hospital management worldwide leave the issues of cleaning to these classes of people. One would wonder how diseases are transmitted from one place to the other.  
I was listening to news sometime ago of a patient who went to hospital with a simple wound, she ended up with *P. aeruginosa* infection, these group of bacteria cause a number of hospital related infections, how did it happen?  
Next to her ward where she was hospitalized was a soldier earlier diagnosed with this bacterial infection, however, the cleaning team succeeded in transporting it to her. Using the same cleaning materials, the whole hospital is regularly cleaned, no one pays attention to this, the illiterate or not so highly informed cleaner goes from one hospital room to another using the same mop, the same hand gloves, etc.  
A healthy person visits the hospital one day and the next day comes back sick with new infection, most probably acquired from the hospital. It is assumed that these infections are hospital related, but nothing is done to address the reason the healthy person got infected.  
Who is to blame in the area of pathogen transmission? The pathogen or the person who traffics the pathogen without knowing it? Can something be done to enlighten ‘Cleaners' all over the world?  
We hear of Scientific and Medical Conferences, Scientists and Medical Doctors coming together to brainstorm on how to develop the latest vaccine in Science and Medicine. These conferences sometimes focus on disease spread but the actual causes of the problems are not addressed, the actual persons responsible for disease spread are not invited to the conference, I would one day be happy to see a scientific conference having as its attendees: Cleaners (hotels and hospitals) and environmental sanitation workers all over the world, where, ‘the harm caused by not disposing off gloves used in cleaning for instance one hospital room before proceeding to clean another’ can be demonstrated or shown. Can there be a way to help cleaners, cleaning industry and human beings all over the world on how to minimize disease spread? Disease causing pathogens do not have legs, yet they are everywhere.  

The Era of the Survival of the Fittest: Virus Kill Bacteria  

Bacteriophages are viruses that infect and replicates within a bacterium and phage therapy is the therapeutic use of bacteriophages to treat pathogenic bacterial infections. This technique actually involves injecting viruses into humans in order to get them cured or treated of bacterial infections; a treatment some consider as “Last Resort” and because of fear, its use have not been widespread. Please read the
Phage therapy gets revitalized

By Sara Reardon

* Nature 510, 15–16 (05 June 2014) doi:10.1038/510015a

The rise of antibiotic resistance rekindles interest in a century-old virus treatment.

For decades, patients behind the Iron Curtain were denied access to some of the best antibiotics developed in the West. To make do, the Soviet Union invested heavily in the use of bacteriophages - viruses that kill bacteria - to treat infections. Phage therapy is still widely used in Russia, Georgia and Poland, but never took off elsewhere. "This is a virus, and people are afraid of viruses," says Mzia Kutateladze, who is the head of the scientific council at the Eliava Institute in Tbilisi, which has been studying phages and using them to treat patients for nearly a century.

Now, faced with the looming spectre of antibiotic resistance, Western researchers and governments are giving phages a serious look. In March, the US National Institute of Allergy and Infectious Diseases listed phage therapy as one of seven prongs in its plan to combat antibiotic resistance. And at the American Society for Microbiology (ASM) meeting in Boston last month, Grégory Resch of the University of Lausanne in Switzerland presented plans for Phagoburn: the first large, multi-centre clinical trial of phage therapy for human infections, funded by the European Commission.

Ryland Young, a virologist at Texas A&M University in College Station, attributes the previous lack of Western interest to clinicians’ preference for treating unknown infections with broad-spectrum antibiotics that kill many types of bacterium. Phages, by contrast, kill just one species or strain. But researchers now realize that they need more precise ways to target pathogenic bacteria, says microbiologist Michael Schmidt of the Medical University of South Carolina in Charleston. Along with the rising tide of strains resistant to last-resort antibiotics, there is growing appreciation that wiping out the human body’s beneficial microbes along with disease-causing ones can create a niche in which antibiotic-resistant bacteria can thrive. "Antibiotics are a big hammer," Schmidt says. "You want a guided missile."

Finding a phage for a bacterial target is relatively easy, Young says. Nature provides an almost inexhaustible supply: no two identical phages have ever been found. As a bacterium becomes resistant to one phage - by shedding the receptor on the cell surface that the virus uses to enter - the Eliava Institute researchers simply add more phages to the viral cocktails that patients receive. Kutateladze says that they update their products every eight months or so, and do not always know the exact combination of phages that make up the cocktail.

Resch, who is one of the leaders of the Phagoburn study, says that regulatory agencies would need to figure out how to oversee such a rapidly evolving product before the therapy could progress beyond clinical trials. He hopes that phage therapy will be treated in a similar way to the seasonal influenza vaccine, for instance, which is updated every year as new flu strains emerge.

The fact that the European Union (EU) is contributing €3.8 million (US$5.2 million) to the Phagoburn study shows that it is willing to consider the approach, Resch says. Beginning in September, researchers in France, Belgium and the Netherlands plan to recruit 220 burn victims whose wounds have become infected with the common bacteria *Escherichia coli* or *Pseudomonas aeruginosa*. The patients will be given phage preparations from a company in Romainville, France, called Pherecydes Pharma, which has isolated more than 1,000 viruses from sources such as sewage or river water and screened them for the ability to kill pathogenic bacteria. To lower the chance that resistance will develop, the patients will receive a cocktail of more than a dozen phages that enter bacterial cells in different ways. If the phage treatment fails, patients will then receive standard antibiotics.

Although governments are starting to pay attention to phage therapy, pharmaceutical companies remain reluctant to get on board, Young says. Because phage therapy is nearly a century old, it would be difficult for a company to claim a treatment as intellectual property, and therefore recoup its costs. Young says it is likely that a 2013 ruling by the US Supreme Court against the patenting of natural genes would also apply to phages isolated from nature. Jérôme Gabard, chief executive of Pherencydes, says that the company is banking on hopes that developing and characterizing precise combinations of natural phages to target particular bacteria will be patentable.

An engineered phage could, in theory, be patented. At the ASM meeting last month, researchers led by synthetic biologist Timothy Lu at the Massachusetts Institute of Technology in Cambridge presented work on a phage engineered to use a DNA-editing system called CRISPR to kill only antibiotic-resistant bacteria. The phage injects the bacterium with DNA, which the microbe transcribes into RNA. If part of the
bacterium's antibiotic-resistance gene matches that RNA sequence, an enzyme called Cas9 cuts up the cell's DNA, killing it.

In initial trials, the researchers found that their phage could kill more than 99% of the E. coli cells that contained specific antibiotic-resistance gene sequences, whereas it left susceptible cells alone. Giving the phage to waxworm larvae infected with resistant E. coli increased the worms' chance of survival. The researchers are now starting to test the system in mice (human trials are a long way off).

Gabard does not expect that phage therapy will ever replace antibiotics. But he says that he can envisage regulatory agencies approving it for patients in whom drug treatments have failed. And some people with antibiotic-resistant infections are taking matters into their own hands. Kutateladze says that an increasing number of EU patients are travelling to Georgia for phage treatment. She adds that doctors in some EU countries send patients' samples to the Eliava Institute, which then sends back a phage cocktail specific to the bacterium causing the infection. "When there's no hope, you'll do anything," Schmidt says.

Meanwhile, researchers are watching the Phagoburn study with interest, hoping that it will lay the groundwork for moving the technology into the clinic. "We just need one really great success for the field to really open up," says Lu.  "........." Culled from Nature News

After reading this very promising article, I cast my mind back to when I was working (during my PhD thesis) at the Queen Astrid Military Hospital (Burn Unit, Nederoverhembeek), located in Belgium.

My former Supervisor, Dr Jean-Paul Pirnay actually was working very hard on this topic, my question then was, "could this be the era of the survival of the fittest"?

Can bacteria also be engineered to kill viruses?
Bacteria strains will not be introduced into a sick host just like that, the strains will first of all be made "avirulent" and avirulent bacteria strains are non-pathogenic.

My proposition today to scientists all over the world is to see how things can also go the other way round, meaning, we should try to "Engineer avirulent bacteria strains against viruses to reduce or treat viral infections".

I propose that we re-strategize the way the virus has been dealt with. Please read my little write up below.

**Pseudomonas aeruginosa, the human immunodeficiency virus and iron: What Role Does Iron Play in the HIV Infection process?**

**Pseudomonas aeruginosa**

Pseudomonas aeruginosa, a gram negative bacterium and a member of the rRNA homology group I Pseudomonas family, have several characteristics which includes

- Ability to carry out strict respiratory type of metabolism using oxygen as terminal electron acceptor (they can also grow anaerobically using nitrate as final electron acceptor, a process called denitrification)
- Growth at an optimum temperature of 37°C, and some may even grow at temperatures as high as 42°C and as low as 4°C (Iglewski, 1991)
- Having very simple nutritional needs, the simplest medium for growth of these species of gram negative bacteria consists of acetate as sole carbon source and ammonium sulphate as nitrogen source
- Ability to withstand a variety of physical conditions like temperature, high salt concentrations, weak antiseptics and resist many antibiotics attributed to their being in possession of multidrug efflux (Mex) systems, outer membrane permeability barrier, and chromosomal β-lactamase activities such that in cases of infection with these bacteria, majority of administered antibiotics face extrusion out of the cell of an infected host (Masuda et al. 1999; Schweizer, 2003).

Infection by Pseudomonas aeruginosa causes serious problem in patients hospitalized with cystic fibrosis, burns and cancer; mortality rates arising from these diseases are as a result of infection with this pathogen. P. aeruginosa is associated with many hospital acquired infections and has become popular because of the frequency with which it is involved in human diseases such as urinary tract infections, colonization of the lungs of cystic fibrosis patients, severe corneal infection, and diarrhoea (Van Balen et al. 2003, Todar's online book of Bacteriology).

The production of water-soluble, fluorescent pigments (pyoverdine) makes them characteristically referred to as "true" Pseudomonas (sensu stricto) and members of this group of bacteria are found within the gamma-subclass of the proteobacteria (De Vos et al. 1989).

P. aeruginosa is able to thrive in various ecological niches such as soil, river water, and plants. It has also been isolated from burn wound and found to inhabit the lungs of cystic fibrosis patients and once within these environments, in the cystic fibrosis lungs for instance, this organism displays long-term persistence.
due to decreased efficacy of antibiotics and formation of biofilms which makes the penetration of antibiotic difficult.

Siderophore

Iron, which is an essential but insoluble element, is required in soluble quantities by bacteria, however, the predominant form of iron is its ferric form which is insoluble, the relative amount of bioavailable iron is therefore low resulting in its scarcity (Poole and Mckay, 2003; Braun and Braun, 2002).

To narrow down iron limitation in microbial environment, bacteria secrete compounds called siderophores which serve as iron chelators in iron limiting environment. In addition, bacteria uses alternative means such as surface reduction of ferric iron to the more bioavailable ferrous forms, lowering the pH of their environment and stripping off iron bound to protein complexes as avenues to increase the amount of usable iron in their environment (Bagg and Neiland, 1987; Neilands, 1995; Abdul-Tehrani et al. 1999; Ratledge and Dover, 2000; Ankenbauer et al. 1985; Crosa, 1989).

Siderophores are low molecular weight compounds which bind iron with high affinity, and not only do they bind iron, they also solubilise them, mediating their transport into the bacterial cell.

Once synthesised and secreted, siderophores mediate iron exchange between the bacterial cell and the external environment (Guerinot, 1994; Matzanke, 1991; Winkelmann, 2002).

See Fig 1

SIDEROPHORES OF P. aeruginosa

P. aeruginosa produces two siderophores; Pyoverdine and pyochelin.

SIDEROPHORE RECEPTORS

In Pseudomonas aeruginosa, iron bound to siderophore (ferri-siderophore) is successfully internalized following the recognition at the outer membrane level, by a specific iron repressed outer membrane receptor (IROMP).

Several siderophores produced by other bacteria or fungi like cepabactin, coprogen, desferriferrichrysin, desferrifericrocin, desferriferioxamine B and desferriferioxamine E has been observed to promote iron uptake under iron limiting conditions into P. aeruginosa in addition to being growth stimulated by its own siderophores (Meyer, 1992; Llamas and Bitter, 2006).

More than thirty TonB- dependent receptors are present in the genome of P. aeruginosa, with two endogenous and multiple heterologous siderophores to choose from, P. aeruginosa is highly equipped in its need to sequester iron making it a strong competitor for iron in relation to other florescent species.

The progression of HIV infection towards its more advance stages is accompanied by increasing body iron stores, there is urgent need for careful clinical studies to clarify the role of iron status on the course of HIV infection.

Increased bone marrow iron is associated with shortened survival and increased opportunistic infections, iron could be playing an important role in the interaction between host and virus. Knowledge of these interactions is necessary to predict morbility response to disturbance in host iron homeostasis (Pradeep et al. 2010).

Iron is important to Pseudomonas aeruginosa, (Meyer et al. 1996) where it serves as a signal for biofilm development in this organism (Banin et al. 2005). Various studies in the past have elucidated how iron dependence by microorganisms can be utilized as an avenue of drug discovery, looking at the P. aeruginosastrains I worked with, following PCR amplification (please see reference 17), variants of P. aeruginosa were presented based on their ability to utilize iron (Strains Br678 and Mi162, both are clinical P. aeruginosa isolates from burn wound, Br678, a pyoverdine positive P. aeruginosa strain able to produce pyoverdine under iron limiting conditions (CAA medium), Mi162 a pyoverdine negative P. aeruginosa strain unable to produce pyoverdine but yet was growth stimulated by iron under iron limiting conditions (CAA medium).

The outbreak of the Ebola Virus in Africa is of great worry, and the above news (culled from Nature) speaks about viral cocktails, can “Avirulent bacteria (Pseudomonas aeruginosa) cocktails be engineered into HIV or other deadly viral situations to see which organism survives best in a sick host? The fight will then be between the engineered avirulent bacteria strains and the virus competing for survival within the host.

Does Iron play a role in the infection process of the Human immunodeficiency virus?

Pradeep et al. in 2010 documented that iron is central to physiology and required for particular steps of the
HIV replication life cycle in cells. If iron is important, then can bacteria be engineered to compete with virus for iron so that the virus is unable to replicate?

If bacteria is able to compete for iron with virus, then these particular 'steps' of the HIV replication life cycle may be affected in cells. Can this be a remedy?

In addition, even in areas of antibiotic resistance, tougher avirulent bacteria strains (which I may like to call "beneficial bacteria") better equipped for survival can be engineered against disease causing bacteria, the only thing we as scientist should concentrate on now is to see

• First and foremost, what compounds or nutrients are essential for the survival of a pathogenic organism in a host such that in the absence of these essential nutrients (for example) the pathogenic organism is unable to thrive. For instance, iron serves as a signal for biofilm development in P.aeruginosa (Banin et al. 2005), and the biofilm serves as a protective covering (some kind of protective shield) against administered antibiotics, so if avirulent strains of the same P. aeruginosa or other bacteria species which are better equipped to compete for iron could be engineered and subsequently introduced as a form of treatment into a sick host, the biofilm would not be developed and administered antibiotics will find their way directly to the targeted pathogenic bacteria. I think a great difference will be made, also in the situations of viral infections. It will only boil down to the survival of the fittest organism within a host and the pathogen which is unable to survive, dies.

It may sound strange or may be considered as nonsense, perhaps, it may be worth trying out!

Reinvention of the Vitek Machine

The Vitek System (bioMerieux.Inc. Hazelwood, MO), is an automated antibiotic susceptibility testing and microbiology identification system that evaluates an optical signal generated by individual biochemical reactions contained within a variety of microbe identification cards. The VITEK 2 technology with the Advanced Expert System™ offers:

• Knowledge base developed from >100,000 references
• >2,000 described phenotypes
• >20,000 MIC distributions
• >100 resistance mechanisms detected
• >99 organisms
• On average, provides a resulting range of five to seven MIC doubling dilutions per antibiotic
• Extended MIC range to enable low-level resistance detection
• Resistance-oriented results that highlight unusual phenotypes
• Deduced antibiotic results to meet formulary requirements
• Checks every result every time

But there is no where it is stated that it can be used for mutant identification. Following my work at the laboratory (Osayande J.O., 2013; Ferripyoverdine receptors and General metabolism in Pseudomonas aeruginosa, Preliminary results, WebmedCentral Microbiology, 4(6):WMC004302, I observed that this machine could identify constructed mutants and in addition could also detect changes (please see reference 19) introduced into the culture's media, I am proposing a reinvention of the vitek machine to help reduce scientific work load based on my observations. The vitek machine is a highly automated machine that cannot only identify organisms, in addition, can detect a change in the culture’s media and subsequently presents the effect on the result automatically produced.

In my work at the laboratory, introduction of Iron (Fe) and Gentamicin into the culture media could lead to differential substrate utilization for the wildtype and ferripyoverdine mutants of Pseudomonas aeruginosa used, this kept me thinking

So many things can be done

• There are worldwide scientific publications explaining how scientists are trying to develop vaccines, these publications carry information about constructed
mutants where the authors try to show the importance of one or more genes in several pathogenic organisms (Alvarez-Ortega et al. 2010)

- The vitek machine can serve as a Small Laboratory Workstation (SLW) by helping to minimize time spent on carrying out experimental procedures, this kind of SLW will be used for the identification of mutants, and in addition used to see how these different mutants will thrive in the presence or absence of various antibiotics, enabling scientists to score genes in relation to antibiotics, that is, in the presence or absence of some genes, some organisms can either resist or become more susceptible to some antibiotics impregnated in the vitek identification cards

- In addition, there are compounds that acts as antidotes against pathogenic organisms, some are already known, while others are yet to be tried. NEW cards impregnated with special Compounds or Synthetic eCaps (synthesized compounds known to minimize or reduce symptoms of disease conditions; see reference 18) can be reinvented and utilized in the vitek machine.

It is going to be a whole lot of work but I promise a fruitful outcome whereby following a few hours of running the vitek experiment, the adverse effect a compound or compounds can have on an unknown pathogenic organism or a mutant (as the case may be) will be automatically shown by the machine, such that no time is wasted.

**MY PROPOSITION**

- I propose a construction of a database of such mutants (Alvarez-Ortega et al., 2010) showing the relevant genes that have been mutated in the past from several pathogenic organisms and such database incorporated into the vitek machine
- Development of new vitek cards (as stated earlier above) to be biochemically tested against these mutants or other pathogenic organisms
- Control experiments should be run in parallel, the vitek machine has this potential, it contains a lot of wells where different experimental conditions can be tried in the different tubes
- Presently, there is Vitek 2 technology, the reinvented machine might be called something else and will be used for what I am proposing, it will also have the ideal vitek machine cards (substrate and antibiotic identification cards), in addition to the new cards impregnated with synthetic compound or ecaps known to be effective against disease-causing organisms, so that a single experimental run can show the effect these synthetic compounds or ecaps impregnated into these new cards have on pathogenic organisms or mutants and such results are then ultimately automatically generated by the machine
- There are compounds which are not be allowed in laboratories because of damaging effects on the humans but these compounds are also potential poison to disease-causing bacteria, such compounds can be impregnated into these cards to generate preliminary results so that information is provided on what best can be used as antidotes for pathogenic organisms, the only little work left for scientists then is to see how to detoxify these compounds and incorporate them into vaccines, this version I am proposing will further reduce laboratory work load.

The reinvention of the Vitek Machine is proposed in this issue, if this is done, it would be in agreement with the discoverer of the Ebola virus who urged officials to test experimental vaccines on people with the virus so that when it inevitably returns, the world is prepared. A machine that can test virus, vaccines... and so on is needed at this point in time and also in the future in severe cases of disease outbreak.

**Conclusion**

With the little knowledge I have, I tried to address issues related to health and propose some few ideas on how best we can help each other as scientists, (no offence to cleaners), I do not know where these ideas may be put to use, but wherever laboratory experiments are run and trials are carried out based on these ideas, please credit should never be taken for using these ideas.

(Julie Osaretin Osayande, osayandejulie@yahoo.com, osayandejulie@gmail.com, Belgium)

**References**

2. Ankenbauer, R.G., Suriyosachati, S., and Cox, C.D.


Illustrations

Illustration 1

Cathecolate-Fe complex
Reviews

Review 1

Review Title: Pathogen Traffickers

Posted by Prof. Joel Wesley Thompson on 30 Mar 2015 09:23:14 AM GMT

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Rating: 7

Comment: N/A

Invited by the author to make a review on this article? : Yes

Experience and credentials in the specific area of science:
I am board certified in Internal Medicine and HIV Medicine

Publications in the same or a related area of science: No

How to cite: Thompson J.Pathogen Traffickers[Review of the article 'Pathogen Traffickers: Disease causing pathogens do not have legs ' by Osayande J].WebmedCentral Aids 1970;6(3):WMCRW003201
Review 2

Review Title: Pathogen Traffickers: Disease causing pathogens do not have legs

Posted by Dr. Palash Samanta on 23 Mar 2015 03:48:57 AM GMT

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7. Can you suggest any reductions in the paper, or deletions of parts?
8. Is the quality of the diction satisfactory?
9. Are the illustrations and tables necessary and acceptable?
10. Are the references adequate and are they all necessary?
11. Are the keywords and abstract or summary informative?

Rating: 6

Comment: NA

Invited by the author to make a review on this article? : Yes

Experience and credentials in the specific area of science: NA

Publications in the same or a related area of science: No

How to cite: Samanta P. Pathogen Traffickers: Disease causing pathogens do not have legs [Review of the article 'Pathogen Traffickers: Disease causing pathogens do not have legs ' by Osayande J]. WebmedCentral Aids 1970;6(3):WMCRW003197
Review 3

Review Title: *Pathogen Traffickers: Disease causing pathogens do not have legs*

Posted by Dr. Weidong Zhang on 13 Oct 2014 02:24:45 AM GMT

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<td>Can you suggest brief additions or amendments or an introductory statement that will increase the value of this paper for an international audience?</td>
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<td>Can you suggest any reductions in the paper, or deletions of parts?</td>
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<td>Is the quality of the diction satisfactory?</td>
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<td>Are the keywords and abstract or summary informative?</td>
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Rating: 6

Comment: No

Invited by the author to make a review on this article?: Yes

Experience and credentials in the specific area of science:
Reviewer for EID, JID.

Publications in the same or a related area of science: No

How to cite: Zhang W. *Pathogen Traffickers: Disease causing pathogens do not have legs* [Review of the article 'Pathogen Traffickers: Disease causing pathogens do not have legs ' by Osayande J]. WebmedCentral Aids 1970;5(10):WMCRW003120

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Review 4

Review Title: Pathogen Traffickers: Disease causing pathogens do not have legs

Posted by Dr. Tarveen Jandoo on 22 Aug 2014 06:14:36 AM GMT

1. Is the subject of the article within the scope of the subject category?
2. Are the interpretations / conclusions sound and justified by the data?
3. Is this a new and original contribution?
4. Does this paper exemplify an awareness of other research on the topic?
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7. Can you suggest any reductions in the paper, or deletions of parts?
8. Is the quality of the diction satisfactory?
9. Are the illustrations and tables necessary and acceptable?
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Rating: 5

Comment:
Please revise the draft to introduce 1 or 2 key questions and conclude by answering these questions.

Please also revise the language to make it scientifically sound.

Check for grammar

Please introduce specific definitions for scientific terms like quarantine.

Competing interests: None

Invited by the author to make a review on this article?: Yes

Experience and credentials in the specific area of science:
NA

Publications in the same or a related area of science: No

References:
None

How to cite: Jandoo T. Pathogen Traffickers: Disease causing pathogens do not have legs[Review of the article 'Pathogen Traffickers: Disease causing pathogens do not have legs ' by Osayande J].WebmedCentral Aids 1970;5(8):WMCRW000397