The Chemical Evolution of Mankind: The Challenges of Drug Development

Werda Alam

Abstract- Species' have been evolving for the past 2.7 billion years. In order to do this they have had to adapt to their environment and find a means of survival. Even now this is the case for us, except we humans are at a time where we "evolve" chemically though the usage of drugs.

Keywords: Species, environment, survival, humans, evolve chemically, drugs.

I. INTRODUCTION

The interface between biochemistry and medicine is found the drug development. New drugs are developed through the understanding of key biochemical pathways within the human body. Drugs are chemicals that can act in the body by binding to specific receptors and affecting activities in the cell. The effects of the drugs can either be excitatory or inhibitory, by either amplifying or negatively regulating a reaction or process. Due to this, a thorough understanding of molecules and their behavior is necessary for drug development. Within the human body, the mechanisms that are naturally present have been developed over millions of years through evolution. When synthetic drugs are put into the human body, they must account for all the complex processes that have developed within us over time. As such, drugs cannot modulate the activities of biomolecules other than their target. The complexities of the human body make this a very difficult task. This directly alludes to the fact that a thorough understanding of all mechanisms is necessary.

II. DETOXIFICATION

When a drug is put into the body it must account for all the complex mechanisms within us that have evolved these billions of years. The obstacles range from making sure these chemicals reach their targets, to being careful about what other reactions they take place in. Just as when any foreign substance enters the body, when a drug enters the body, the body attempts to compromise its effect in order to maintain homeostasis. The main detoxification center of the body is the liver. When a drug is absorbed at the small intestine it travels through the hepatic portal vein to the liver. At the liver it undergoes phase 1 and 2 transformations which include hydroxylation and conjugation. These decrease the toxicity of the particles and allow them to be excreted from the body. Here scientists are faced with the challenge of making sure the modifications do not compromise the functionality of the drug. Hand in hand with this, the drug's structure must be very specific in not just the compounds that make it up but even the stereospecificity of each molecule and its reactions. Before excretion occurs, compounds enter the main bloodstream where they come into contact with cells.

III. RESPONSE

The cells that possess the correctly shaped receptors will then produce a reaction that is a series of chemical steps to form a response. This is how we respond to changing environmental conditions which can range from infections by other organisms to malfunctions within our own body. After getting the compound into the body, researchers face the next challenge: their compounds must mainly affect only targets cells; otherwise there will be adverse side effects. Along the same lines, their compounds must be able reach places where there are biological barriers, such as the brain whose fluids are strictly regulated by the highly selective blood brain barrier. Due to this, advanced ways are being used to expand the horizons of drug experimentation and application. These include applied genomics in animal testing, reverse drug synthesis in labs, as well as extensive human trials.

IV. APPLICATIONS

Scientists are now working in labs to produce hundreds or thousands of different mouse strains with different genes that are altered. This approach allows drug developers to evaluate potential targets without any pre-conceived notions regarding physiological functions. These models are then applied to humans. Similarly, scientists have been able to sequence the genomes of hundreds of pathogens, which include bacteria and viruses. Due to this, new antibiotic and antiviral drugs have been developed because there are proteins that are essential to a wide range of bacteria and viruses. By inhibiting the production of these common proteins in antibiotic versus antiviral drugs, scientists are able to combat these diseases. Drugs that inactivate such proteins are expected to be broad range spectrum antibiotics and antivirals and are useful for treating infections from any of a range of bacteria and viruses.

V. CONCLUSION

Indubitably, all aspects considered the integration of applied chemistry and biology has resulted in the evolution of mankind not by changing ourselves but rather by accommodating for everything around us.

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Werda Alam, New York Institute of Technology, Old Westbury NY.