



An At Glance Insight to the Immune Resilience

Ibrahim M S Shnawa

College of Biotechnology,

University of Qasim and Hilla University College, Babylon, Iraq

ABSTRACT

The immune resilience IR and the allied concepts are being expressed in this opinion paper. IR is the capacity to preserve or restore immune competence, control inflammation and stress. IR is suggested as an individual immune trait. It can be quantified through; measuring CD8+/CD4+ T cell, gene expression signature of the effector immune cells in infection, inflammation and stress; effector like T cells in cancer patients; minimal inflammatory reaction in allergy and cytokine in stress patients. Currently workers have been proposed a grading system to IR activities. It was in four grades. Grade I is the optimist activity and grade IV is the worst activity. The molecular mechanisms behind IR is cell - cell communication through signaling pathways. IR is operable in; infection, vaccination, allergy, maternal immune activation, stress and cancer. A program for an animal model and human case study of vaccine resilience was suggested.

Keywords: Allergy, asthma, cancer, competence, infection, inflammation, immune, resilience.

INTRODUCTION

The primordial contribution to Immune resilience [IR] has been traced to around a decade ago and being in the current mode of research was in the latest three years [1-24]. IR is the capacity to preserve or restore immune competence [IR]. IR impacts human health welfare and life span. High IR is strongly correlated with improve health outcomes and confere resistance to viral infections and skin cancer [1-9]. The objective of the present overview paper ensembels as an at glance insight to the concept of IR and related concepts [10,11,12].

CONCEPT

The IR concept can be defined as the capacity to preserve or restore immune competence and controls inflammation in face of infection or antigenic stimulation [6]. Or it can be the capacity to preserve and/or rapidly restore immune functions that promotes disease resistance and control inflammation in infectious and stress associated diseases [5]. It is of multifactorial etogenesis. Among which the immune factors. A third definition is the ability to deal with microbial invading pathogens [12].

ALLIED CONCEPT

Herd or population immunity [HI] means vaccination of a part of the herd individuals will confere immunity to the other part. It is also multifactorial nature, among which immune causes. HI is mainly due to; past infection, past vaccination, pre-immunity. It is genetically

encoded by major histocompatibility system [MHS], and of three major immune fractions. The low, moderate and high responders [10]. Herd immune plots are either gaussian distribution or skewed types [11]. Both IR and HI are; multifactorial and mostly based on the individual variations, Table- 1, depicted a comparative view.

Table 1: Immune resilience and herd immunity a comparative view.

Features	Immune Resilience [1-9]	Herd Immunity [10,11]
Based on and Concerned with	Individual variation, concerned with individuals	Individual variation, concerned with population
Nature of immunity	Individual concerns	Immunization of a part lend immunity to the other part
Grades/fractions	Four grades	Three fractions
Gene encodement	Immune trait genes	MHS
Induction	Natural	Inducible
Function in	Infectious diseases, vaccination, stress and cancer	Infection, vaccination
Quantification	CD8+/CD4+, gene expression signature, cytokines	Antibody, cytokine, immune cells count

Not only herd immunity can be of relation to immune resilience, also immune tolerance related to immune resilience IR. Immune tolerance IT is the ability of the immune system to subtly respond to environment. Proper immune tolerance means that the immune system under risk of exposure it does not over-react or under react to normal every day food inborn and environmental immunogens, allergens and even your body tissue antigens. In such a case one does not have food intolerance, chemical sensitivities or autoimmune condition. Immune resilience is the ability of individual immune system to deal with biological pathogens. IR defines whether or not pathogen infect and cause significant and ongoing immune responses. Loss of IT is going to impair IR. Improving IR to improve IT. To recover impaired IT is through improving gut microbiome diversity [12,13,14,15], Table- 2.

Table 2: Comparative View to Immune resilience and immune tolerance.

Features	Immune resilience IR [5,13,14]	Immune Tolerance IT [13,14,15]
Genetics	Gene encoded in T cell genome	Gene encoded in T and B cell genome
Concerns	Mainly T cells	Mainly T and B cells
Immune function	Restore immune protection	Dampen autoimmune reactions
Gut microbiome	Influenced IR	Influenced the IT
Detection	Quantitation of CD8+/CD4+ T cells, gene expression signature	Detection of tolerant T and Tolerant B cells

OBSERVATIONAL ATTITUDE

Biodiversity has been rising up due to; geographic, genome variation, gene pool variation, migration patterns and nutritional factors. Biodiversity in human being can best be represented by the individual variation in biological responses to both external and internal stimuli [10,16]. Why do individuals express differences in life span, health status, and infectious disease susceptibility across the age. One logical possibility is that variation in immune traits contribute to these differences [5].

IMMUNE TRAIT VARIATION

The molecular genetic make up, the infections, nutritional status and the other environmental insults are the most impactful factors that shape the individual immune trait variations, which in turn impacts the host immune responses to infectious agents. The mechanisms for IR may ensemble high immune competence and prevention of infection or inflammation. These infection resistance mechanisms may confer advantages for a lower co-morbidity. High immune trait functioning is more prominent in females than in males [5].

GRADES OF IR

Four immune health grades have been described as it starts with grade I and ends up with grade IV. Such grading system is based on two basic parameters as i- the balance between CD8⁺/CD4⁺ T cells and the immune cell gene expression signature. An immune health grade I expresses best immune preventive function and grade IV showed the worst immune preventive function [4,5]. The optimal immune resilience is associated with; i- lower HIV risk, ii – survival during covid-19 and sepsis and iii – longevity [5].

MOLECULAR MECHANISMS FOR IR

Every individual good immune competence reflects; i – high immune resilience, ii- high functional immune cross talk [17], iii – good neuronal cell-immune cell unit functions [18], iv - well functional organ-organ axis [19,20]. Conversely, low IR activity reflects either low or abolished these molecular mechanisms [17-20].

IR IN MATERNAL IMMUNE ACTIVATION

Maternal immune activation MIA has been implicated in the etiology of psychiatric illness. Not all progeny exposed to MIA developed psychiatric illness, but some are susceptible others are resilient to MIA. In an experimental animal settings of laboratory mice, it has been attempted to elucidate resilience in MIA. Poly(I:C) based MIA was induced in C57BL/6J mice on gestation day 12. Control dams were subjected to comprehensive test battery when reached adulthood 12 weeks of age onwards. Behavioral characterization showed that the progeny were stratified into susceptible and resilient to MIA. This means that there were variations both in the genetic and immune response homogeneity in these experimental mice [7,8].

IR IN ALLERGY

The factors operable in predicting risks for allergy and asthma are complex. There is a paradigm whereby a balance between allergy and asthma risk and protective factors encounter them. Interaction of human being with environment, microbes and biologics in addition to the epigenetic adaptations contribute in immune homeostasis. Hence, allergic diseases are good indicators to the twisted relation to environment. In various non-communicable infectious diseases, the protective IR role of the immune system indicates low grade inflammation without an apparent cause [4].

IR IN STRESS

Depression and anxiety have been linked with inflammation. Though it is not clear whether inflammation predate the onset of or it contribute to depression and anxiety. It was reported that there is a pre-existing individual differences in the peripheral immune system that predict and promote stress susceptibility. Depression and anxiety are associated with increase of release of cytokines from the peripheral immune cells. IL6 was found regulated by stress both

in man and mice. Thus it is a must for IR high functional status to be associated with stress release, normalization of cytokine levels and inhibition of inflammation[1].

IR IN TUMORS

In human tumor microenvironment, there is found to be an effector-like T cells. These cells are characterized by; i – High cytotoxic activity, ii- marked proliferative activity iii - high migrative capacity in peripheral blood, iv- able to withstand the pressure of chronic tumor antigen stimulation without being exhausted and v- express quick expansion with full cytotoxic function upon the therapy with immune check point inhibitor ICI. Thus, such T cells hold the position of resilient T cells and the case as immune resilience and the situation found logic to explain why some human tumor patients respond well to ICI and others not.[21].

IR IN MICROBIAL PATHOGEN-HOST INTERACTIONS

When the total sum of the virulence factors of a pathogenic invader balanced by highly competitive host immune system, disease will not be manifested. Conversely, when the total sum of the immune system defense mechanisms failed to evade the vigor of the pathogen virulence disease will appear [22,23].

VACCINE IR

In an experimental animal setting, animal group vaccinated using vaccine adjuvanted with TH1 promoting adjuvant mounts a memory immune response that is biased towards TH1. While this vaccine primed group encounters subsequent infection with Th2 immune response in order to escape the immune attack. If the immune memory induced during vaccination is resilient, the pathogen will be unsuccessful at redirecting the immune response and the group will be protected. If the vaccination in this vaccine primed animal group did not induce a resilient immune response, the pathogen will succeed in redirecting the recall response and survive, so that the primed animal group is not protected[24].

PROPOSAL FOR IR ANIMAL MODEL

The proposed model immune system can be the rabbit, the IR quantitation system may be inflammatory and anti-inflammatory cytokine measurements. The experimental rabbit settings will be as; A – Normal rabbit group, B – bacterial infected skin group, C – Bacterin primed group and D - bacterin primed challenged with skin infecting bacteria. Blood collected, sera separated and cytokines determined via ELISAs to determine IR status.

PROPOSAL FOR IR IN HUMAN CASE STUDY

In an experimental human case study proposal. Election of BCG vaccinated normal human individual with age range of 40-50 years and BCG vaccinated pulmonary tuberculosis patients of matching age ranges. Then, detect CD8+/CD4+ T cell through flow cytometry, one anti-inflammatory cytokine one inflammatory cytokines in their peripheral blood through ELISAs to determine the IR status.

CONCLUSIONS

Immune resilience IR gains several in practice applications like; infection, vaccination, stress and cancer. The quantification parameters are different in different IR aimings, Table – 3.

Table 3: Quantitation parameters in various IR conditions.

Condition	Immune Resilience	Quantitation	Reference
Infection, vaccination, inflammation	Operable	CD8+/CD4+ Cell balance, gene expression signature	Ahuja et al. [5]
Allergy	Operable	Low grade inflammation	Haahtella et al [4]
Stress	Operable	Cytokine detection	Hode et al. [1]
Cancer	Operable	Effector like T cells	Gicobi et al. [21]
Infection	Operable	Natural and specific antibody	Bergof et al. [9]

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