Gene Expression Associated With Virus Resistance in Chickens

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Recommended Citation

Available at: https://lib.dr.iastate.edu/ans_air/vol652/iss1/48

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Gene Expression Associated With Virus Resistance in Chickens

A.S. Leaflet R2130

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Summary and Implications
We used the powerful contemporary genetic technologies of microarray and Q-PCR to test global gene expression in a unique population of birds after challenge with infectious bursal disease virus (IBDV). Identification of genes that have differential expression between resistant and susceptible birds helps to determine the mechanisms of host resistance to this virus and may be used to select breeding stock for greater innate resistance to viral infection.

Introduction
Infectious Bursal Disease Virus (IBDV) causes highly contagious, immunosuppressive disease that leads to high mortality in young chickens. IBDV is a double-stranded RNA virus. The main target organ of virus destruction is the bursa of Fabricius, the primary immune organ in which the cells differentiate that will have the capacity to produce antibodies. Therefore, in addition to the morbidity and mortality caused by the acute infection with IBDV, surviving birds can be severely immunosuppressed and later be susceptible to other infections. The objective of our study was to identify genes that are involved in resistance to IBDV infection, so that this information will elucidate the host resistance mechanisms to the virus. This information can be applied to improve animal health by contributing to the rational design of vaccines and by providing gene targets for genetic selection of more resistant breeding stock.

Materials, Methods, and Results
Chicks of an F2 generation of two lines divergently selected for high (HH) or low (LL) antibody (Ab) response to Escherichia coli vaccination, were challenged with virulent IBDV. Viral load varied among individual birds, which indicates variation in resistance mechanisms of the individuals (Figure 1).

Viral load in infected bursae was used to designate resistant (R, high virus count) and susceptible (S, low virus count) birds. By using a 13K chicken cDNA microarray (Fred Hutchison Cancer Research Center), and pooled spleens of R, S and non-challenged, control (C) chicks, several genes were identified with differential expression associated with host resistance to IBDV. These genes were also subjected to RT-PCR on individual samples to verify the microarray results. The major finding was coordinated upregulation of 7 genes (Ets2, H963, RGS1, ABIN-2, CREM/ICER, DUSP1 and CXCR4) in several R, but not S or C, individuals. There were very high correlations of expression levels among genes (Figures 2 and 3).
Figure 3. Two examples of the high correlation of gene expression in the IBDV-resistant (but not control or susceptible) chicks.

**Discussion**

Based on reported functions of these genes, our findings suggest that resistance is mediated by the activation of specific cellular mechanisms, primarily involving macrophages and T-lymphocytes. Early and intense formation and activity of germinal centers in the spleen of resistant birds, followed by the migration of these cells towards the bursa is presumably important for resistance to occur. Identification of genes that have differential expression between resistant and susceptible birds helps to determine the mechanisms of host resistance to this virus and may be used to select breeding stock for greater innate resistance to viral infection.

**Acknowledgements**

Partial financial support from Research Grant No. US-3408-03C from BARD, The United States-Israel Binational Agriculture Research and Development Fund.