

**USDA-ARS / USWBSI  
 FY04 Final Performance Report  
 July 15, 2005**

**Cover Page**

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<b>Year:</b>	<b>FY2004 (approx. May 04 – April 05)</b>
<b>FY04 ARS Agreement ID:</b>	<b>59-0790-4-119</b>
<b>FY04 ARS Agreement Title:</b>	<b>Human Susceptibility to Trichothecene Mycotoxins.</b>
<b>FY04 ARS Award Amount:</b>	<b>\$ 95,041</b>

**USWBSI Individual Project(s)**

<b>USWBSI Research Area*</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
FSTU	Human Susceptibility to Trichothecene Mycotoxins.	\$ 95,041
	<b>Total ARS Award Amount</b>	<b>\$ 95,041</b>

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 Principal Investigator

Date

\* BIO – Biotechnology  
 CBC – Chemical & Biological Control  
 EDM – Epidemiology & Disease Management  
 FSTU – Food Safety, Toxicology, & Utilization  
 GIE – Germplasm Introduction & Enhancement  
 VDUN – Variety Development & Uniform Nurseries

**Project 1: *Human Susceptibility to Trichothecene Mycotoxins.***

**1. What major problem or issue is being resolved and how are you resolving it?**

Deoxynivalenol (DON or vomitoxin) and other trichothecenes are elaborated during head blight and thus pose a potential threat to human health. There have been several European studies that have suggested that a lower action level for DON be considered rather than the 1-2 ppm being employed by most countries. Based on the report of the Joint Expert Committee on Food Additives (JEFCA) on safety concerns for DON and other mycotoxins, the CODEX Alimentarius Commission has proposed the following maximum levels for DON are proposed for discussion: a) raw cereal grains, to be subjected to sorting or other physical treatment (e.g. starch production) before human consumption or use as an ingredient in foodstuffs (after which the DON levels should comply with the other relevant maximum level): 2000 µg/kg b) all products derived from cereals (e.g. flour, processed cereal products) including cereal grains intended for direct human consumption, except infant food: 500 µg/kg c) cereal-based infant food: 100 µg/kg. Also mixing of lots with the aim to decrease the contamination level below the maximum level would not be allowed.

Based on studies in the mouse immune system, we believe that the most critical step for toxicity induction is its action on cell signaling in leukocytes (white blood cells). We currently evaluating whether human leukocyte cytokine production and/or apoptosis induction are indeed targeted by the same levels of DON and related 8-ketotrichothecenes as are their mouse equivalents. If this is true, then the risk of low ppm levels of DON to humans will be extremely small when one considers the diversity of the human diet and the actual potential level of DON exposure in human tissues. Such evidence is critical because it would support the argument against establishing lower action levels than those currently set for DON. We believe that this work is impacting discussions of DON safety.

**2. What were the most significant accomplishments?**

- a. We are continuing studies using the direct culturing of human blood obtained from volunteers and measuring key mediators of DON –induced toxicity by highly sensitive real-time PCR. The results suggest that some people may be resistant to DON whereas others are sensitive. DON sensitivity can vary within an individual perhaps due to non-genetic factors (eg.prior/ongoing infections diet, medication,). We have determined that human peripheral blood cell cultures that the monocyte is the primary target of DON. A paper describing this work will be submitted this week.
- b. We have used microarray to determine scope and breadth of genes induced by DON in the immune system using the mouse model.
- c. We have identified novel kinases involved in induction and protection against trichothecene-induced cell death in cloned and primary leukocyte models.
- d. We are applying a rapid method for measuring DON in blood and tissues of mice and relating these to levels required to induce stress related response.
- e. We have compared the structure function effects trichothecene effects on a cloned human T lymphocyte model (Jurkat cells).
- f. We have written two major reviews on the toxicology of DON and related trichothecenes. One covers all aspects of DON toxicology and was published in the Journal of Toxicology and Environmental Health this year. The second was based on a presentation at the ILSI Conference on Trichothecenes in Dublin in 2003 and was published in 2004.

**Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

1. Zhou, H. R., Islam, Z., and Pestka, J. J. (2005). Induction of competing apoptotic and survival signaling pathways in the macrophage by the ribotoxic trichothecene deoxynivalenol. *Toxicol. Sci.* (in press)
2. Li, M., Cuff, C. F., and Pestka, J. (2005). Modulation of murine host response to enteric reovirus infection by the trichothecene deoxynivalenol. *Toxicol. Sci.* (in press)
3. Jia, Q., and Pestka, J. J. (2005). Role of cyclooxygenase-2 in deoxynivalenol-induced immunoglobulin a nephropathy. *Food Chem. Toxicol.* **43**(5), 721-728.
4. Zhou, H. R., Jia, Q., and Pestka, J. J. (2005). Ribotoxic stress response to the trichothecene deoxynivalenol in the macrophage involves the SRC family kinase Hck. *Toxicol. Sci.* **85**(2), 916-926.
5. Pestka, J. J., and Smolinski, A. T. (2005). Deoxynivalenol: toxicology and potential effects on humans. *J. Toxicol. Environ. Health B Crit Rev.* **8**(1), 39-69.
6. Kinser, S., Li, M., Jia, Q., and Pestka, J. J. (2005). Truncated deoxynivalenol-induced splenic immediate early gene response in mice consuming (n-3) polyunsaturated fatty acids. *J. Nutr. Biochem.* **16**(2), 88-95.
7. Pestka, J. J., Uzarski, R. L., and Islam, Z. (2005). Induction of apoptosis and cytokine production in the Jurkat human T cells by deoxynivalenol: role of mitogen-activated protein kinases and comparison to other 8-ketotrichothecenes. *Toxicology* **206**(2), 207-219.
8. Jia, Q., Zhou, H. R., Bennink, M., and Pestka, J. J. (2004). Docosahexaenoic acid attenuates mycotoxin-induced immunoglobulin a nephropathy, interleukin-6 transcription, and mitogen-activated protein kinase phosphorylation in mice. *J. Nutr.* **134**(12), 3343-3349.
9. Kinser, S., Jia, Q., Li, M., Laughter, A., Cornwell, P., Corton, J. C., and Pestka, J. (2004). Gene expression profiling in spleens of deoxynivalenol-exposed mice: immediate early genes as primary targets. *J. Toxicol. Environ. Health A* **67**(18), 1423-1441.
10. Pestka, J. J., Zhou, H. R., Moon, Y., and Chung, Y. J. (2004). Cellular and molecular mechanisms for immune modulation by deoxynivalenol and other trichothecenes: unraveling a paradox. *Toxicol. Lett.* **153**(1), 61-73.
11. Jia, Q., Shi, Y., Bennink, M. B., and Pestka, J. J. (2004). Docosahexaenoic acid and eicosapentaenoic acid, but not alpha-linolenic acid, suppress deoxynivalenol-induced experimental IgA nephropathy in mice. *J. Nutr.* **134**(6), 1353-1361.