# THE EFFECT OF ACCLIMATION ON STRESS AND CYTOKINE GENE EXPRESSION AFTER RAPID DECOMPRESSION IN RATS

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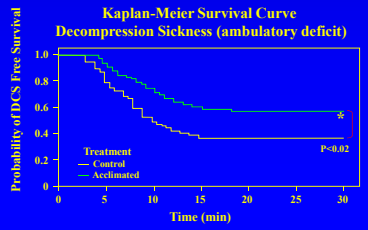
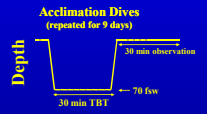
## INTRODUCTION

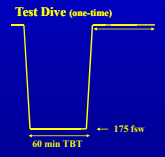
Our previous studies showed that animals were acclimated to rapid decompression after repeated exposures to mild decompressive stress. The present study characterizes changes in inflammatory- and stress-related gene expression associated with acclimation to rapid decompression.




## MATERIALS & METHODS

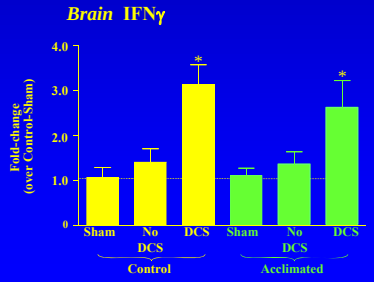
Rats were divided into four groups: 1) Control-sham = naïve rats; 2) Acclimation-sham = received daily acclimation dives (70 fsw, 30 min) for 9 days; 3) Control = received a test dive (175 fsw, 60 min); and 4) Acclimation = received acclimation dives for 9 days and a test dive. After the test dive, rats were rapidly decompressed and observed for decompression sickness (DCS) (*i.e.*, ambulatory deficit). Total RNA was isolated from liver, spleen, and brain tissue and 13 genes were examined by real-time PCR. Phosphorylation of Akt and ERK protein in lung tissue was also examined.

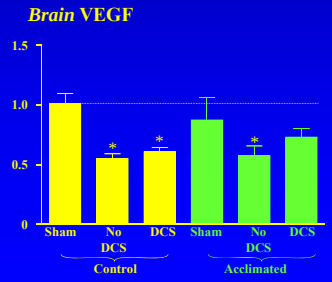



| Group | # Acclimation Dives | Test Dive |
|---|---|---|
| Control-sham | 0 | No |
| Acclimated-sham | 9 | No |
| Control | 0 | Yes |
| Acclimated | 9 | Yes |

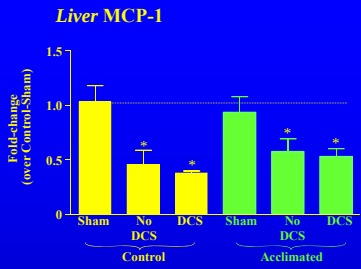
## RESULTS

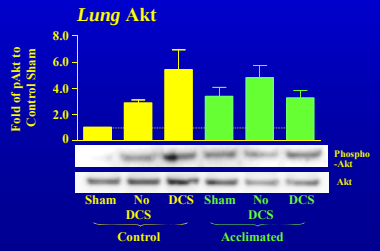


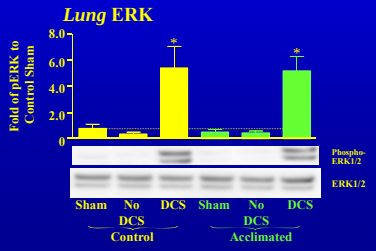




### Gene List

- CD14 antigen (CD14)
- monocyte-chemoattractant-protein-1 (MCP-1)
- macrophage inflammatory protein-1beta (MIP-1β)
- early growth response-1 (Egr-1)
- interferon gamma (IFNγ)
- interleukin 1 beta (IL-1β)
- interleukin 6 (IL-6)
- interleukin 10 (IL-10)
- selectin, endothelial cell (E-Sel)
- transforming growth factor alpha (TGFα)
- tumor necrosis factor (TNFα)
- tumor necrosis factor receptor (TNFr1)
- vascular endothelial growth factor (VEGF)




## RESULTS

There were no changes in gene expression in the spleen. In the brain, elevated levels of IFNγ occurred in all acclimated and control animals that had DCS. VEGF was downregulated in the brains of all animals subjected to a test dive, regardless of DCS incidence. Similarly, MCP-1, was downregulated in the liver in all animals that were subjected to a test dive. High levels of Akt phosphorylation were observed in lungs of acclimation-sham, acclimation, and control animals; phosphorylated ERK was only observed in animals with DCS.

## CONCLUSIONS

This study demonstrates that decompressive stress significantly increases expression of immediate early genes and cytokine genes in animals with DCS. Acclimated animals with DCS had decreased levels of immediate genes and cytokine genes expression. Our findings suggest a relationship among the significantly regulated factors. Decompressive stress rapidly increased the transcription of Egr-1. Egr-1 protein binds to the TNFα promoter to increase transcription and release a cytokine cascade including IL-1 and TNFα initially, subsequently leading to the production of IL-6, as well as IL-10, which may subsequently produce a negative feedback suppression on the cascade.

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