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DNA-Protein Cross-Links in Erythrocytes of Freshwater Fish Exposed to Hexavalent Chromium or Divalent Nickel

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DNA-protein cross-links (DPXs) in fish erythrocytes represent a potential biomarker for exposure to metal cations, such as hexavalent chromium (Cr[VI]) and divalent nickel (Ni[II]). Species-specific sensitivities to DPX formation were studied by coexposure of juvenile specimens of rainbow trout, hybrid bluegill, and channel catfish to waterborne metals, such as Cr(VI) and Ni(II). In a species comparison, 4 days of exposure to 2 ppm Cr(VI) induced highest DPXs in bluegill erythrocytes, followed by trout and catfish, at 186%, 97%, and 48% above controls, respectively. A similar pattern of species sensitivity was observed following co-exposure of the fish to 15 ppm Ni(II) for 4 days, with 237%, 124%, and 82% increased DPXs above control bluegill, trout, and catfish, respectively. Biological stability of Cr(VI)-induced DPXs was demonstrated in Cr(VI)-exposed bluegill, as DPX levels remained elevated for up to 20 days after discontinuation of exposure. Similar results were found following exposure of catfish to Ni(II), with detectable DPXs found 10 days after acute exposure. In both bluegill and catfish, a continued increase in DPX formation in erythrocytes was seen for 5–10 days after Cr(VI) was removed from tank water, suggesting that residual Cr(VI) may be involved in DPX formation following acute exposure of fish.