The Time-dependent Transport of Chromium in Adult Rats from the Bloodstream to the Urine

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While Cr was proposed to be an essential trace element over 40 years ago and if essential should possess a specific transport and distribution mechanism, the details of its transport from the bloodstream to the urine have not been elucidated. However, Cr is known to be maintained in the bloodstream bound to transferrin and to be excreted in the urine bound to the oligopeptide chromodulin or a similar species. Injection of ^{51}Cr-labeled transferrin into the bloodstream results in a rapid and insulin-sensitive movement of ^{51}Cr into the tissues as ^{51}Cr-transferrin; >50% of the ^{51}Cr is transported to the tissues within 30 minutes. Tissue levels of ^{51}Cr are maximal 30 minutes after injection; decreases in tissue ^{51}Cr with time are mirrored by increases in urine ^{51}Cr. Approximately 50% of the ^{51}Cr appears in the urine with 360 minutes of injection in the absence of added insulin; insulin treatment concurrent with injection of ^{51}Cr-labeled transferrin results in ~80% of the label appearing in the urine within 180 minutes. The removal of ^{51}Cr from the blood is faster than the appearance of ^{51}Cr in the urine; the lag in time indicates that the Cr-transferrin in the blood and Cr in the urine are not in direct equilibrium and that intermediates in the transport of Cr must be involved. This establishes a clear pathway of transport of Cr starting from transport by transferrin from the bloodstream into the tissues, followed by release and processing in the tissues to form chromodulin, excretion into the bloodstream, rapid clearance of chromodulin or a similar species into the urine, and ultimately excretion as this species. Insulin stimulates the processing of Cr in the tissues.