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ACTIVATION ANALYSIS IN RESEARCH AND FORENSIC MEDICINE

Final Progress Report

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The date of the last yearly report was extended to 30 June 1971 from the usual date of 30 April since the contract was terminating 30 September 1971. The bulk of the remaining three months was devoted to vacations for the personnel, preparation for the move of the laboratory and the actual move of the laboratory from Cambridge to the premises of the Cancer Research Institute.

The research time was devoted to the first phases of the application of some of the findings from the previous years to two specific problems.

In the first case, we wished to explore further the finding of a high gold concentration in uterine fibroids as opposed to the corresponding low concentration of the adjacent normal uterine tissue. To make this analysis specific for the gold instead of for many elements as is possible with the new method we developed (heterogeneous isotopic exchange on an inorganic column with an organic elutant), it was decided to adapt a simple method for plating out the gold on copper foil. The initial attempts appeared favorable, and, on further investigation of the variables using a Au standard, the recoveries of the activated Au were observed to be low ($< 50\%$) and highly variable. At the same time, the chemical response of the Au from the tissues appeared to be satisfactory.

A lengthy search into the matter finally showed that the Au foil we were using as a standard was not gold at all but was, in fact, Dutch metal (Cu and Zn). Our original tests on our lot of gold foils showed a very pure product. It appears that Dutch metal foil was inadvertently included with the lot we purchased, and the possibility for this was confirmed in discussions with the vendor.

At the time of terminating this work, it seemed that the gold plating method was probably working well. However, there are no data to confirm this at this time or to delineate the conditions under which the method works best. However, the finding that significant quantities of Cu, and possibly Zn also, plate out may mean that the method is not as specific for Au as originally thought. Alternatively, the finding of Cu and Zn on the foil may indicate that it may be possible to make this method specific for these elements and especially that isotopic exchange reactions may take place efficiently with metal surfaces.

For the second case we investigated the adaptation of our new method to another element. Chromium-51 is being used for the measurement of red cell mass, and it has been shown by several groups now that enriched ^{50}Cr can also be used in conjunction with activation analysis. The disadvantage in the enriched ^{50}Cr method has been the need for extensive chemistry to isolate the activated ^{51}Cr or for a long decay period to wait for the decrease in the ^{24}Na activity so that the ^{51}Cr can be assessed instrumentally.

Our new method will allow, in principle, the simple isolation of the ^{51}Cr , the activity of which can be counted with simple equipment. Accordingly an effort was made to find a Cr compound which was compatible with the acetone-water-HCl solution, *i. e.*, had low solubility and good crystalline properties to make a satisfactory column. Of the four particular chromium compounds, CrCl_3 , $\text{Cr}(\text{NO}_3)_3$, Cr_2O_3 and $\text{Cr}_2(\text{SO}_4)_3$ immediately available in our laboratory, none had desirable characteristics. Our experiments have not been successful to date and point out that, while our method is a general one in principle, the solution for use with a particular element will require the detailed exploration of the chemical

and physical properties of compounds of that element. Two points of especial importance have been observed: 1) the solubility of compounds in the water-acetone-HCl mixture is much greater than might be inferred from limited data in handbooks, and 2) the usefulness of the physical state of the compounds (crystals, flakes, etc.) for packing into a column cannot be predicted easily and has to be determined by experiment.

Because of the need to move the laboratory and the termination of the contract these two investigations have not been explored further.

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