the first advantage of the nuclear coincidence method, namely, that it is a means of absolute calibration of the strength of a source.

A second advantage of this method is that one can determine directly whether the intermediate state is being populated or depopulated by a mechanism other than the radiative transitions observed, since true coincidences occur only between these two radiative transitions. If a fraction K of the atoms which enter state E_1 from E_2 by a radiative transition perform the radiative transition to E_0, this appears in the true coincidence-rate as $C_t = K N \varepsilon_1 \varepsilon_2$. Thus relative transition probabilities can be measured.

Finally, the life-time of the intermediate state can be measured[3] by delaying the pulses from the channel observing the first transition, before feeding to the coincidence stage.

Experimentally it is necessary (*a*) to maintain a low strength of source $\left(\text{about } \frac{1}{2\tau}\right)$ to keep C_t/C_r high, and (*b*) to maintain ε_1 and ε_2 high by good geometry.

This direct application of nuclear coincidence techniques allows one to measure (1) absolute source strengths, (2) efficiency of the detection apparatus, (3) relative transition probabilities, (4) rates of mechanisms which populate an intermediate level, (5) life-times of intermediate states, and (6) angular correlations between the directions of emission of photons in cascade transitions.

Note added in proof. By this method the life-time of the 7^3S_1 state of mercury has been found to be $1{\cdot}12 \pm 0{\cdot}02 \times 10^{-8}$ sec. The upper transition arose from the ionization continuum and the lower transition was $7^3S_1 \rightarrow 6^3P_1$ (λ 4358·34 A.).

This work is being carried out as part of a project sponsored by the Geophysics Research Directorate, Air Force Cambridge Research Center, under Contract *AF* 19(122)–470.

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Small-Angle X-Ray Diffraction Patterns of Collagen

In the investigation briefly reported here, the collagen fibres used were from beef achilles tendon. The diffraction patterns were obtained with an evacuated camera and a rotating anode X-ray tube having a copper or chromium target. The results discussed refer only to copper $K\alpha$ radiation; the chromium target was used solely for confirming intensity measurements. The observations on dry collagen were made with vacuum-dried fibres which remained *in vacuo* throughout the experiments, whereas wet fibres were mounted in a cell with beryllium windows and remained in a saturated atmosphere for the duration of the exposure. Photographs were obtained from which measurements were made of the intensities of twenty-five orders in the pattern for wet fibres, and twenty-three orders in the case of dry fibres. Exposure times involved may be indicated by giving the times required to give an intensity in the first order of $D = 1{\cdot}0$ above the background. For dry achilles tendon this time was 2·5–3 hr., whereas for wet fibres the time was about thirty minutes, the apparatus running under identical conditions with the tube operated at 30 kV., 80 m.amp. The long spacing d of the dry fibres was 635 A. and for the wet fibres 670 A.

A particularly interesting feature of the diffraction patterns was the appearance of relatively strong reflexions at the nineteenth and twentieth orders for dry fibres and at the twentieth and twenty-first orders for wet fibres. These results are set out in Table 1, in which the intensity scale is such that the first-order intensity is 1,000.

Table 1

Order n	Dry fibres		Wet fibres	
	Intensities	d/n	Intensities	d/n
18	7	35·2	1	37·2
19	10	33·4	0·5	35·2
20	10	31·8	5	33·5
21	7	30·2	4	31·9
22	4	28·8	2	30·4

It may be remarked that the nineteenth to twenty-first orders were well resolved, and there is no indication that the enhancement of the intensities is due to superposition on a diffuse line covering the two adjacent orders of the small-angle pattern. Apparently the Fourier transform of the electron density distribution along both wet and dry fibres has a pronounced maximum corresponding to a spacing of 31–34 A., centred approximately on 32·8 A. There is therefore a suggestion that, although the long spacing of collagen may vary considerably, there is nevertheless a constant structural unit of about 32·8 A. in length.

Some attempts have been made to label specific amino-acids with heavy atoms and to observe the resulting small-angle diffraction patterns. According to Grassmann and Kusch[1], histidine combines with silver when collagen fibres are treated with silver nitrate, and with lead when treated with lead acetate. We found that the silver treatment considerably modified the small-angle pattern, but the lead treatment had no effect. On the other hand, the wide-angle pattern is not affected by silver, but shows rings which may be attributed to the deposition of granules of lead acetate on the fibres. It appears that silver does in fact enter into chemical combination with the protein, but not lead. Treatment with iodine dissolved in potassium iodide solution, which may be expected to result in attachment of iodine to tyrosine, has also been found to modify considerably the small-angle pattern. Patterson functions are being calculated for the different patterns observed; but so far it appears that silver is not a sufficiently heavy atom to show up clearly in the Patterson plot.

A full account of this work will appear in due course when observations on kangaroo tail tendon fibres have been completed.

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