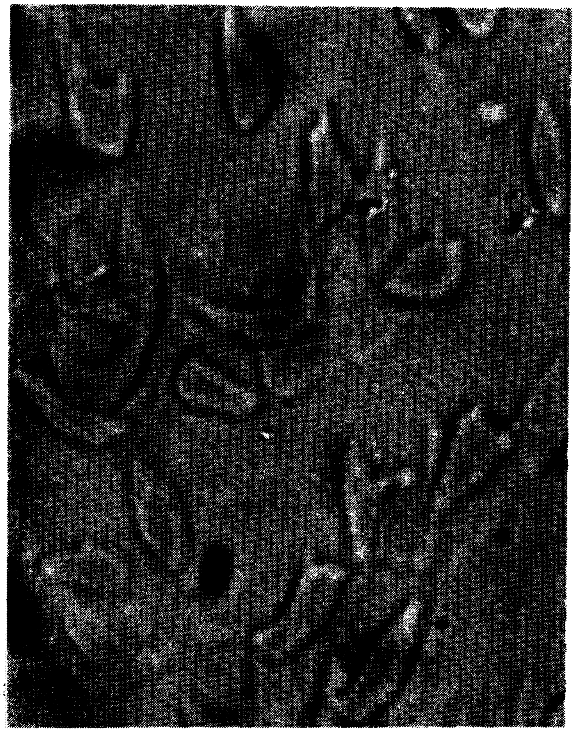

FIG. 3. Sickle and distorted forms of red blood cells produced with normal blood and glue solutions. (Microphotograph courtesy of George J. Anday.)

"pencil" shapes (elongated, with parallel sides, the length five or more times the width). Cells of this shape appear in a fractional percentage in blood of individuals who suffer from chronic hemorrhage.

This observation adds another form that normal red blood cells may characteristically assume under artificial conditions: spherical (including semispherical), crenated, and sickle-shaped. These differ from the more or less permanent abnormal forms, such as oval-shaped, "pencil" forms, grossly distorted forms, cells pointed at one end or at both ends (amphioxic), and "target" cells.

Whether this change in shape of the red blood cells has any relation to the condition in sickle cell trait or anemia remains to be elucidated by further study. In sicklemia there is apparently an intrinsic change in the red blood cells, whereas with glue the change is brought about by extrinsic factors.

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Synthesis of Anthracene-9-C_1^{14}

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Anthracene-9-C_1^{14} has recently been prepared in our laboratory for further experimental use as self-exciting crystal-counter material. Because the synthesis may be of interest to others, we wish to report the method used.

o-Toluic acid-carbonyl-C_1^{14} was prepared by carbonating a twofold excess of Grignard reagent obtained from *o*-bromotoluene with 10 millimoles of carbon dioxide containing 2 mc of C^{14}. After the reaction mixture was decomposed with ice and dilute sulfuric acid, and an ether solution of *o*-toluic acid obtained, the *o*-toluic acid was extracted into a threefold excess of 1 *N* sodium hydroxide. The *o*-toluic acid was then oxidized to phthalic acid by the addition of a 10% excess of 5% potassium permanganate solution. The excess permanganate was destroyed with ethanol, and the solution was filtered. The colorless filtrate was put in a small evaporating dish, and its volume reduced to 5 ml by warming in a current of air. Concentrated hydrochloric acid was added to precipitate the phthalic acid, which was filtered off. In order to obtain a more complete recovery of the labeled phthalic acid, ½ g of inactive phthalic acid was dissolved in the filtrate by heating, and a second quantity of phthalic acid was obtained on cooling. The combined acids were recrystallized from water and dried at 120° C. Yield was 1.9 g.

To convert the phthalic acid into anhydride, it was refluxed with twice its weight of thionyl chloride for 1 hr, after which 3 successive portions of benzene were distilled from the anhydride to free it from excess thionyl chloride. Benzoyl-benzoic acid was prepared from the anhydride by a Friedel-Crafts reaction using 10 ml of benzene and 3.8 g of aluminum chloride. The crude acid obtained was dissolved in dilute ammonium hydroxide, a small amount of diatomaceous earth was added, and the solution was filtered. Acidification with hydrochloric acid precipitated the benzoyl-benzoic acid as an oil, which crystallized on standing.

Anthraquinone was obtained from the benzoyl-benzoic acid according to the method of Dougherty and Gleason (*1*). The benzoyl-benzoic acid obtained was dissolved in 30 ml of 96% sulfuric acid and heated in an oil bath at 120° C for 1 hr. The reaction mixture was then poured into excess cold water, and the slurry digested on a hot plate. The anthraquinone was filtered, washed with warm dilute ammonium hydroxide, and dried at 120° C. Yield of anthraquinone was 2.1 g.

The anthraquinone was reduced to anthracene by a two-step reduction. Anthrone was prepared by the method of Meyer (*2*), using 50 ml of glacial acetic acid and 5 g of mossy tin. After being refluxed for 1½ hr, the solution was diluted with 25 ml of water, filtered hot, and allowed to stand overnight in a refrigerator. The anthrone, filtered and washed with water, was reduced to anthracene with copper-activated zinc and sodium hydroxide (*3*). To 10 g of zinc dust in a 200-ml, round-bottom flask, was added 10 ml of copper sulphate solution containing 0.04 g of $CuSO_4 \cdot 5H_2O$. After a few minutes, the solution was decanted, and the activated zinc was washed once with water by decantation. The anthrone from the preceding preparation, 80 ml of 2 *N* sodium hydroxide, and 20 ml of toluene were added. This mixture was refluxed for 24 hr. After cooling slightly, 20 ml of warm benzene was added, the liquid layers were decanted into a separating funnel, and the zinc was washed with another 20 ml of hot benzene.

The benzene-toluene layer was run into a flask, brought to a boil with 1 g of decolorizing charcoal, and filtered. The solvents were evaporated by a jet of nitrogen. The anthracene was then crystallized from 15 ml of toluene and was obtained as colorless, fluorescent flakes, mp 215° C. Yield was 1.3 g of anthracene having an activity of 0.9 μc/mg. When observed in a photographic darkroom after one's eyes are dark-adapted, this anthracene is seen to glow with a greenish-blue light.

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Applications of Nylon Catheters in Physiology of the Circulation[1]

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Recent years have seen the introduction of plastic materials into all phases of biological research. Of the innumerable plastics available, polyethylene (*1, 2, 3, 4*) and polyvinyl resins (*5, 6*) have been most widely used for catheters in circulatory research. As a result of extensive use of plastic catheters designed to be indwelling in blood vessels of various diameters, it was felt that an ideal catheter for vascular work should possess: flexibility; relative noncompressibility under manual pressure; ductility; suitability for chemical sterilization; translucency; suitability for use without special preparation; a nonwetting, smooth surface; radiopacity; nonirritability; availability; and low cost.

With the exception of radiopacity, which is seldom required, nylon catheters[3] have been found to possess all the desirable characteristics of the ideal catheter. Nylon catheters can be sterilized in cationic detergents prior to use, with no impairment of their desirable properties. They are translucent, and one can therefore easily follow the flow of blood or perfusing solutions. In addition, they are ready for immediate use and require no special preparations. They can be stretched to any specified length on a lathe, and their diameters thereby adjusted to pass through smaller-diameter needles if desired. In striking contrast to nylon, polyethylene tubing has been completely unsatisfactory for arterial work in that it is too soft, can be completely compressed, cannot be easily stretched, and does not yield a satisfactory pulse wave because of its flexibility. Polyvinyl is also inferior to nylon in that it requires special baking procedures to attain desired stiffness and it is usually not translucent after baking.

Nylon catheters have been used in experiments on unanesthetized dogs in which it was necessary either to draw repetitive arterial blood samples of 10–50 ml or to take continuous blood pressure recordings over a 4–5 hr period. The catheters were threaded up into the femoral artery through a 17-gauge needle used to make the initial arterial puncture. A wire stylet (type 302, spring temper) was inserted into the catheter to afford additional rigidity during insertion and was subsequently removed to permit the drawing of blood samples. To prevent extensive extravasation of blood through the puncture hole in the artery, intense manual pressure must be maintained over the area after insertion of the catheter. Even with removal of the wire stylet, no degree of direct manual pressure over the bleeding point can compress or kink the nylon catheters. Following insertion of the catheter into an artery, a blunt 20-gauge needle was threaded over the wire stylet and gently forced into the catheter with a slow rotary motion. It is essential that a catheter be somewhat elastic to permit the insertion of this needle adapter. With manual pressure maintained over the puncture area, the wire stylet was removed and a rubber-capped, modified luer-lock adapter (*7*) was attached to the 20-gauge needle and taped securely to the animal's leg. The nonwetting smooth surfaces of the catheters discourage platelet breakdown and coagulation of blood. Catheters have been left indwelling within arteries for up to 5 hr without significant plugging by clotted blood. The catheter assembly described is illustrated in Fig. 1. Catheters[4] with an outer diameter of 0.95 mm (0.037 in.) and an inner diameter of 0.51 mm (0.020 in.) were found to be most useful for both drawing of blood samples and recording of blood pressure. With repeated intra-arterial use of the catheters, there has been no evidence of tissue toxicity in a series of some 10 dogs. Arteries have healed adequately without obliterative thrombosis.

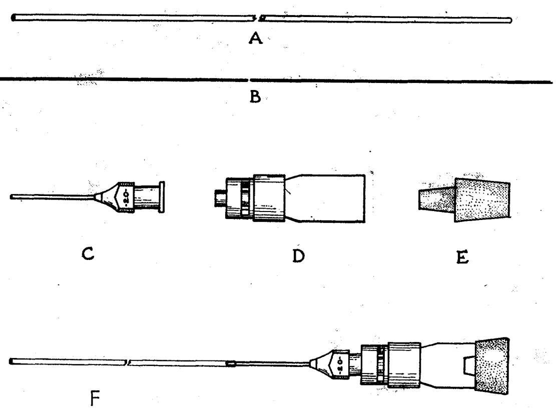

FIG. 1. Nylon catheter assembly. *A*, nylon catheter; *B*, wire stylet; *C*, blunt-end, 20-gauge needle adapter; *D*, short luer-lock glass adapter; *E*, serum cap; *F*, complete assembly.

[1] Aided by grants from the Office of the Surgeon General, Department of the Army, and the Chicago Heart Association.

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