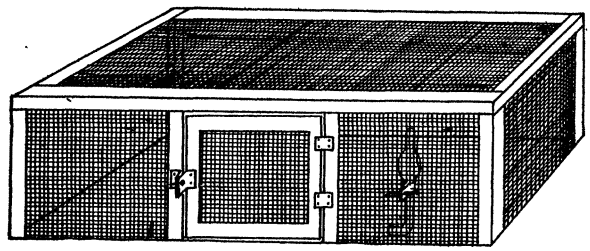
SCIENTIFIC APPARATUS AND LABORATORY METHODS

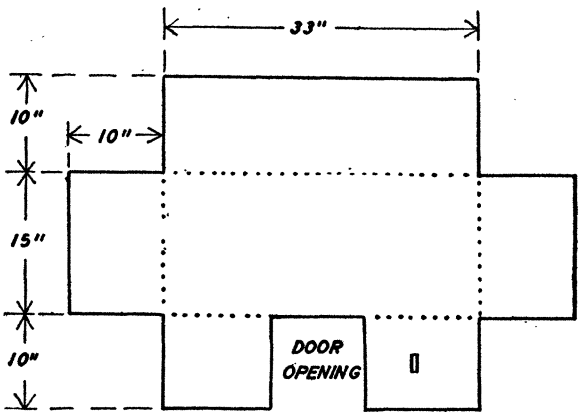
A SMALL ANIMAL CAGE WITH SANITARY FEATURES

BEING confronted with the problem of keeping a large stock of white rats in one corner of a general workroom in this laboratory, it was imperative that special attention be devoted to the sanitary features of the colony houses. Several standard types of houses were tried but none was found which would permit of easy cleaning so that odors could be avoided. The house which we have developed to meet this need should be of interest to other laboratories for three reasons: low cost, sanitary features and ease of construction.

The outstanding sanitary feature of the house is absence of seams at the bottom, so that the collection of soils in difficult-to-clean seams is avoided. All the



COLGATE SMALL ANIMAL HOUSE ASSEMBLED



PATTERN FOR CUTTING HARDWARE CLOTH
FOLD ON DOTTED LINES

walls of the house are constructed of hardware cloth with quarter-inch mesh which permits droppings to fall through the floor of the house where they are collected on drip sheets made from wrapping paper. The drip sheets are removed and destroyed three times a week.

The bottom and four sides of the cages are cut from a single piece of hardware cloth as indicated on the drawing. The top is cut independently and riveted to the frame last to facilitate ease of construction. The frame is made from strips of heavyweight galvanized iron an inch and a half wide which have been bent at right angles lengthwise through the midline. The corner bends of the frame are riveted and the hardware cloth is riveted to the frames, washers being used between the head of the rivet and the hardware cloth. Two hours' work will complete a house.

The houses are used in tiers, each house being supported by five-inch hooks which project from uprights at each end of the house. There are four hooks per cage. The sets of hooks are spaced vertically so that there is two inches clearance between houses, permitting the top of a house to be used to support the drip sheet for the colony above it. Solid boards for these vertical supports serve also to lessen drafts on the animals.

Every fortnight the houses are washed in hot oakite solution and rinsed. Coarse cedar shavings which can be secured at any pet shop are used for nests. Glass drinking tubes from the Emil Greiner Company are used. The food dishes used are of non-spillable type.

Six full-grown white rats are given ample exercising room in these cages, and for breeding special cages have been built after this same general plan but with two doors and a hardware cloth partition separating it into two compartments.

We have used this type of cage for more than a year with almost a complete absence of odor and with the time required for maintaining them in a fresh condition reduced to about ten minutes per cage per fortnight. Since they are galvanized throughout destructive rusting is avoided. The materials for a single cage cost about one dollar.

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SPECIAL ARTICLES

SOLUBILITY OF URIC ACID IN THE BLOOD

DURING the course of a prolonged investigation on the excretion of uric acid by the fowl, attention was attracted to the question of its solubility both in the blood and urine. Not infrequently urine of a fowl taken directly from the ureter is in the form of a clear or opaque mucoid-like material in which are usually found white lumps of uric acid. The mucoid-like material has given rise to the idea that the fowl's urine contains mucus, but histological examination of the kidney and ureter shows no evidence of any such mucous glands. Furthermore, if one allows a

clear specimen of this material to stand, it gradually becomes opaque and deposits uric acid, thus behaving like fowl's urine in general. Microscopic examination of these deposits shows that they consist either of amorphous particles or of crystals. Crystalline deposits usually have a somewhat grayish appearance in bulk, whereas amorphous are often creamy white in appearance. If one warms fowl's urine containing deposits not infrequently they dissolve completely. This only occurs, however, if they be amorphous in character and recently formed. Crystalline deposits do not dissolve on warming. It became clear that the uric acid excreted by the kidney was in a different form from the insoluble kind which deposits on standing. Light was thrown on this subject by a few experiments into the formation of uric acid gels.[1] These are quite readily formed and behave in a similar manner to fowl's urine; that is to say, they contain a high percentage of uric acid which, in spite of the fact that when cold may actually gel, will filter quantitatively through a celloidin membrane and thus are clearly not colloidal. It is true that fowl's urine has not been observed actually to gel, but the mucoid-like material which may appear can probably be regarded as a close attempt.* Such a gel-forming solution if kept warm (*i.e.*, fluid), or diluted, and allowed to stand, deposits uric acid which may be amorphous or crystalline, and like the fowl's urine this may either redissolve on warming, or not, according to the character of the deposit.

Naturally these results led to the question of the state of uric acid in the blood. It is certainly being secreted by the kidney in some special soluble form as the remarkably high percentage achieved in the fowl's urine most clearly demonstrates. In order to study this question it was attempted to produce uric acid in a soluble form from one of the gel-forming solutions. This turned out to be an easy procedure since, if one merely takes a quantity of a known gel-forming solution and adds ten times its volume of pure acetone, the uric acid complex immediately appears as a white flocculent precipitate. This may be collected and dried *in vacuo*, the resulting material being readily soluble in distilled water. It should be noted that an alkaline solution of uric acid dissolved in soda does not behave in the same way; furthermore, these gel-solutions may be prepared with a fairly wide range of reaction, varying from strongly acid to litmus to mildly alkaline. Attention was then directed to the blood. As has been shown elsewhere following the simple procedure of tying the fowl's ureters, very high quantities of uric acid appear in the blood.[2] It will be noted that the figure mentioned in this paper, 120 mgs per cent., is higher than the solubility of uric acid in serum, taking the lowest figure that has been so far discovered (1 in 1,000).[3] Actually, in the course of this experiment the higher figure of 170 mgs per cent. was achieved, which was due to the fact that the bird was allowed to live for a long period before being bled. The blood obtained from the bird and rendered incoagulable by either heparin or oxalate was centrifuged, the clear plasma was then placed in a celloidin sac and filtered under air pressure. The resulting filtrate was a clear, colorless, protein-free solution. Some of this, which was allowed to stand over night, deposited crystals of uric acid which were insoluble on warming; to the remainder was added ten volumes of pure acetone. A copious white precipitate immediately developed which was centrifuged off. This proved to be an impure but soluble uric acid complex. Two experiments were conducted, both with identical results. There is no doubt, therefore, that the blood of the fowl contains uric acid in a specially soluble form. It is possible, even probable, that the blood of the human may also carry uric acid in this form.

The results obtained from this work show the importance of determining in what form uric acid exists in human blood, since it seems possible that if it normally occurs as a soluble complex, then, in order to explain gouty deposits, an investigation into the factors which cause such soluble forms to become insoluble might be very profitable. In any case, this work indicates the necessity for such an investigation before the introduction into therapeutics of any new "uric acid solvents." It also tends to cast suspicion already rife amongst pharmacologists on the therapeutic value of such substances, and, indeed, should it be shown that human uric acid has a blood form similar to fowl uric acid, these substances are entirely superfluous.

An investigation into the nature and behavior of this form of uric acid occurring in fowl's blood is to be made by my biochemical colleague, Professor E. Gordon Young.

CONCLUSIONS

Direct evidence is given which shows that the uric acid occurring in fowl's blood is in a specially soluble form.

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[1] H. Schade and E. Boden, *Zeit. für Physiol. Chem.*, 1913, 33: 347.

* Since this was written Professor Young has manufactured a uric acid solution which has a very similar mucoid-like appearance.

[2] O. S. Gibbs, *Journ. Pharmacol. and Expt. Therap.*, 1929, 35: 49.

[3] Alonzo-Englebert Taylor, *Journ. Biol. Chem.*, 1905–06, 1: 177.