broth cultures gave at least 95% smooth colonies; the opaque non-spreading colonies were found in a higher percentage than the thin transparent ones. These colonies were solid regular masses of more or less lanceolate shape in deep agar.

The rough colonies were usually of a spreading type with finely fimbriated edges although many were deeply corrugated granular colonies with irregular, confined borders. The broth cultures of both showed a granular growth in the bottom of the tube with a clear supernatant broth. The colonies had a fuzzy appearance in deep agar. The only intermediate type gave a finely granular rounded colony that was deeply grooved in the center but sloped off to a smooth circular base; in broth cultures a granular sediment was covered with clear broth.

All of the colonies on blood agar were surrounded by clear zones of hemolysis. The morphology of the individual cells was quite varied; small coccoid forms and long filaments as well as the rods of usual size were found in many cultures. All strains produced spores in beef heart medium with a pH of 7.4 to 7.6.

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A Stereo X-Ray Method of Demonstrating Bronchoconstriction in Anaphylaxis and After Drugs.*

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Changes in bronchial tone in the anaphylactic guinea pig and in the unsensitized animal after the injection of bronchoconstrictor drugs have been successfully studied by 2 methods: (1) the perfusion of the isolated lung,[1, 2] and (2) the direct visualization of the bronchial tree by celloidin casts of the respiratory tract. The latter method, described by Hanzlik,[3] affords structural information of value not elicited by the physiologic technic and has the advantage of producing permanent casts for study and demonstration. The

* Supported in part by the Rockefeller Fluid Research Fund of the School of Medicine of Stanford University.

[1] Thornton, J. W., *Quar. J. Exp. Physiol.*, 1932, **21**, 305.

[2] Hurwitz, S. H., and Wessels, A. L., PROC. SOC. EXP. BIOL. AND MED., 1931, **29**, 120.

[3] Hanzlik, P. J., *Am. J. Physiol.*, 1925, **72**, 558.

stereo X-ray technic presented in this paper has many of the advantages of this method, besides the additional one of greater simplicity and refinement and of giving a detail of finer structure of the bronchi, bronchioles, and pulmonary alveoli under normal and pathologic conditions not heretofore obtainable.

Method. The composition of the injection mass was a modification of that employed by Hill[4] for studies on the vascular system. For our work, we found a 12% bismuth oxychloride (Merck) suspended in a 20% solution of acacia the most satisfactory. This represents an approximate reversal of the percentages used by Hill, these being better suited for visualizing the respiratory tract. The acacia serves as an agent to aggregate the finely divided particles of bismuth, which fills the trachea, larger bronchi, bronchioles and alveoli and yet remains confined under the visceral covering of the lung.

The mixture was strained through cheese cloth into a wide-mouthed bottle into which was fitted and tightly fixed a rubber stopper with 2 holes. A long glass tube reaching to the bottom of the bottle was inserted into one hole and connected by a piece of rubber tubing to a short glass cannula for insertion into the trachea. A short tube fitted into the other hole was joined by a T-tube to a mercury manometer for gauging the pressure and to an outlet for air under pressure. The apparatus employed was the same as used by Hanzlik for celloidin injections, the details of which will be found in his paper.[3] A pressure of 60 mm. of mercury was found by trial adequate to fill the normal lung in from 5 to 10 minutes. The same pressure and time interval were employed for the pathologic lungs.

After introducing the injection mass, stereo X-ray films were taken of the lungs by the following technic: good exposures of guinea pig lungs were obtained by using a 1.5 kilowatt tube and 40 kv., 10 ma., 20 sec., and 38 inch. Excellent stereoscopic effects may be achieved by using a 6 inch shift, this being much wider than the usual one for such work.

Results. After completing an experiment on a guinea pig the lungs and heart were carefully removed *en masse* together with the trachea as far as the larynx and the bismuth-acacia suspension injected through a cannula into the trachea, the latter being ligated close to the end of the cannula after the injection is completed.

In typical bronchoconstriction of fatal anaphylactic shock in

[4] Hill, E. C., *Johns Hopkins Hosp. Bull.*, 1929, **44**, 248.

guinea pigs sensitized to horse serum only the trachea, larger bronchi and some small nests of atelectatic alveoli were filled. In 4 shocked guinea pigs showing mild symptoms or in animals which survive shock, varying degrees of filling of the bronchial bifurcations and lobes were observed. Six sensitized animals given a simultaneous intracardiac injection of a shock dose of serum in combination with epinephrine (0.2 mg. per kilo of body weight) survived. The lungs of these animals as well as those of 4 normal guinea pigs injected with serum alone or epinephrine alone showed complete filling.

The effects of other broncho-dilators on sensitized bronchi such as atropine in combination with serum are being studied.

Histamine in doses from 0.25 to 0.4 mg. per kilo of body weight produced varying degrees of bronchoconstriction. The injected lungs of 4 of these animals showed different degrees of filling of the bronchi, bronchioles and pulmonary alveoli. In some of the stereo X-rays actual beading of the smaller bronchi could be seen, points of constriction, alternating with points of relaxation, thus indicating that not all of the bronchioles are acted upon by the histamine.

These experimental observations suggested the possibility of demonstrating and analyzing calibre-changes in the bronchi of human subjects by stereo-roentgenography. We are accordingly employing lipiodal, introduced by tracheal catheter for visualization of the bronchi of allergic patients before and after the production of bronchospasm by the subcutaneous injection of antigen (pollen, horse dander), in carefully graded doses, and under controlled conditions. Results of these observations will be reported later.

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Evidence of Excretion of Iron Salts by Proximal Convolution of the Nephron of the Frog's Kidney.

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It is becoming increasingly evident that the glomerulus and tubule constitute functionally different sites for the elimination of the various urinary constituents. Several investigators have demonstrated that the proximal convolution of the vertebrate kidney is