ical Society of America and to the pages of Cattell's "American Men of Science," is a fundamentalist harboring a geological nightmare. In his own words, he has made his book "a travesty on the real science of geology," a science that has been built up through the labors of the geologists of the world during more than a century of observation, study and criticism. The things that have long been accepted as the fundamentals of this science—immensely long geologic time and an orderly development of organisms from single-celled individuals into the most complex community of cells as exemplified in mammals and man—are rejected by Price and in their place is substituted his "new catastrophism." This is our old friend, the "universal deluge," which Price says was brought about by a "jar or shock from the outside." All organisms were exterminated by it, including the "godless men" of the time, the only survivors being the God-fearing ones in the little ark that also harbored a loving pair of all living species of plants and animals, a million or more in number. Back of those preserved in the ark "there must have been a direct or literal creation of the originals from which the modern forms and the fossils were alike descended." The whole of the fossil worlds "lived contemporaneously," and the attempt to establish them in successive faunas led to a "paleontological whirligig [which] has been the leading diversion of people otherwise intelligent and scientific in their habits of thought."

So much for the "new" geology. I now come to a more serious matter. Before the publication of the book under review, its author wrote to Wiley and Sons, publishers of the copyrighted Pirsson-Schuchert "Text-book of Geology," asking for permission to use 32 of its illustrations. As this number was thought excessive, his request was refused, except in the case of three of the figures. Nevertheless, careful comparison of the illustrations in the two books shows that he actually appropriated 14 figures from Pirsson's "Physical Geology," and 18 from Schuchert's "Historical Geology"!

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SPECIAL ARTICLES

THE ORIGIN OF ECTOPIC MENSTRUATING MULLERIAN TISSUE IN THE FEMALE PELVIS

A COMPLETE understanding of the origin of hemorrhagic cysts of the human ovary which contain or are lined by tissue of endometrial (Müllerian) type, is being arrived at by a steady accumulation of facts, and the substance of conclusions thus derived presents an entity of great interest to biologists in general as well as to the gynecologist and the pathologist.

Tissue of endometrial type and with the menstrual function has been observed in the human adult ovary as long ago as 1899. Such tissue until recently had been dismissed as derived either from *congenital* Müllerian rests or from the germinal epithelium through a process of metaplasia.

Sampson[1] in a series of classical studies has shown that endometrial or endosalpingeal epithelial cells cast loose at the time of menstruation or through trauma may be transported in the lumen of the oviduct to escape into the pelvis through the patent distal end of the oviduct. These cells may become implanted upon any of the pelvic structures and grow to "adenomata." And, what is of the greatest importance, all these multiple growths may be although not necessarily of the same age. Some cells attach themselves to the ovary, which becomes invaded in their proliferation, and closed spaces of Müllerian-like tissue result. Menstruation into these spaces may eventually lead to the formation of cysts which may reach fifteen centimeters in diameter. With thinning of the wall rupture may occur. When this happens there is further dissemination of epithelial seed (and possibly stroma cells) with further implantation upon many structures in the pelvis.

The writer,[2] working with rabbits seven to fourteen months old, has succeeded experimentally in producing widespread cystic growths in the pelvis by scattering promiscuously in the abdominal cavity scrapings and very finely divided bits of autologous endometrium. Some of the cysts formed come to contain blood as a result of the periodic oestrual cycles, but on account of various fundamental physiological differences between rabbit and man a well-developed hemorrhagic or "chocolate" cyst has not been attained. However, sufficient facts have been gathered by experimentation to render more secure Sampson's explanation of the genesis of ovarian hemorrhagic cysts and the frequently concomitant "adenomyomatous" reactions in the uterus, broad ligament and rectovaginal septum.

From a strictly biological point of view there is thus presented in women, most frequently between the ages of thirty and the menopause, an unique condition in which (a) normal endometrial tissue escaping through a natural opening in the oviduct into the pelvic cavity often becomes implanted on the ovaries and other pelvic structures; (b) these implants behave for a long time like normal endometrial tissue; (c) implants in the vicinity of smooth

[1] *Arch. Surg.*, 1921, iii, 245–323; *ibid.*, 1922, v, 217–280; *Boston Med. and Surg. Jour.*, 1922, clxxxvi, 445–456; *Amer. Jour. Obs. and Gyn.*, 1922, iv, 5.

[2] *Arch. Surg.*, 1922, v, 281–300; *Amer. Jour. Obs. and Gyn.*, 1923, vi, 257–262.

muscle often cause a myoplastic reaction on the part of said smooth muscle with a result that an "adenomyoma" is formed.

These ectopic endometrial growths offer themselves both before and after the menopause as foci for neoplasia. Sampson has been able to identify them as long as thirteen years after the natural menopause, although they undergo involution which, however, is similar to the histological changes present in the senile uterus. It has been shown by the writer that in rabbits the transplanted tissue persists at least five months following bilateral oöphorectomy and shows the same atrophy as the uterus.

Many of the cysts obtained in uncastrated animals are strikingly like the so-called multilocular cystadenoma of women, at least in most respects except size, and Dr. Sampson in a personal communication states that more careful examination of a series of cystadenocarcinomas of the human ovary has resulted in his finding at times small areas of apparently normal endometrial tissue in the lining of some loculi. A definite relationship between the implantation growths of Müllerian type and many of the papillary and cystic epithelial tumors of the ovary would seem to be an altogether reasonable and logical hypothesis.

While the clinical observations and the pathological and experimental studies would seem to satisfy all reasonable requirements in explaining the genesis of the menstruating cysts of the ovary and the more scattered implants, another theory for the origin of the primary ovarian lesion must be mentioned. This concerns the power of the germinal epithelium of the ovary postnatally to produce endometrial tissue. In the embryo the germinal epithelium gives rise to totipotential cells of the sex glands, but the application of this fact to the condition under discussion seems exceedingly farfetched, although it will probably always be utilized by those who find themselves unable to accept Sampson's conclusions.

Much argumentation would be obviated were it known conclusively that the germinal epithelium could give rise postnatally to ciliated epithelium. Since the endometrial cysts of the ovary are usually lined in part at least by ciliated epithelium (or to the same extent as is the uterine mucosa) and since, when rupture of such a cyst occurs, its lining may come into direct contact with the germinal epithelium in the process of healing, it becomes imperative more closely to examine any case where the peritoneum of the ovary is in continuity with ciliated cells. The writer as well as several other pathologists in large hospitals and a few biologists consulted have never seen what they could regard as an actual metaplasia of ovarian peritoneum into ciliated epithelium. Nevertheless, this change has been described by a few observers. Characteristic Müllerian stroma has not been noted as an accompaniment, however, and this is an important element in the production of the picture here described.

The strongest argument against a peritoneal origin for these menstruating "mülleriomas" is the fact that the ovary need not be involved at all in the primary dispersion of epithelium through the oviduct, but that there may be widespread "adenomata" of Müllerian type throughout the pelvis. It is not plausible to assume that this sudden crop of such growths is caused by a kaleidoscopic change in the pelvic peritoneum to ciliated epithelium with the simultaneous production of endometrial stroma.

The facts that this ectopic endometrial tissue may be found upon any pelvic structure, that it usually occurs in multiple foci, that the autotransplants have stroma typically endometrial in structure and function, and that they usually do not develop until the last fifteen years of menstrual life would seem to eliminate (a) the germinal epithelium of the ovary as their mother cells, and (b) the possibility of their being derived from *congenital* Müllerian rests rather than their being new growths acquired by implantation during the menstrual age of the individual.

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The electronic structure of organic compounds in relation to their heats of combustion: M. S. KHARASCH. Upon examination of the experimentally determined values of heats of combustion of organic compounds, certain remarkable relationships can be traced between the electronic structure of the compounds and their total energy values. If we ascribe the heat liberated in the combustion of methane to the displacement of the electrons between the carbon and oxygen atoms, then the molar heat of combustion of methane would be X times 8, if X is the amount of heat liberated by the displacement of an electron between the carbon and oxygen atoms.

The electric moments of typical organic molecules: CHARLES P. SMYTH. The electric moments of typical organic molecules calculated from the dielectric constants, together with other experimental data, are smaller than those obtained from theories of molecular structure because of the displacement of electrons within the molecules, the magnitude of the difference depending largely upon the mobility of the electrons. The moments of a number of alcohols are compared with those of water and the ethers. These values, which should agree if there were no distortion of the molecular symmetry, show that the groups attached to the oxygen repel each other, the amount of repulsion varying with their bulk