A NOTE ON THE VERMIFORM APPENDIX

H. MAISEL, M.B., Ch.B., Casualty Officer, Groote Schuur Hospital, Cape Town

The appendix is a vestigial organ serving no useful purpose (Ackermann 1914). This statement appears in many textbooks and, moreover, is held to be true by many teachers of medicine. As early as 1903, Metchnikoff in his famous book 'The Nature of Man' wrote, 'It is no longer rash to say that not only the rudimentary appendix and caecum, but the whole of the large bowel are superfluous and that their removal would be attended with happy results'. As recently as 1953 Patten stated that the appendix was a phylogenetically decadent structure. The purpose of this article is to re-examine some of the facts and renew interest in a maligned but persistent phylogenetic organ.

Embryology

Primary differentiation of the appendix from the caecum occurs at the 7th-8th week of embryonal life, when growth in the most dependent part of the caecum tends to lag, that part actually decreasing in size. In the 6th-month foetus the future appendix is a third of the diameter of the large bowel. At birth, the differentiation of caecum and appendix becomes more striking as the longitudinal muscle bands separate and the circular muscles of the colon expand to form the colonic haustra. After birth the caecum tends to expand not only because of its inherent growth, but also because as the individual assumes an upright posture gravity tends to hold the pre-faecal contents in the caecum. At maturity the ratio of diameter of appendix to that of caecum is reduced to about 1:8.

A description of a 'transient appendix' by Kelly and Hurd (1905) is rarely featured in embryological studies. They studied the developing caeco-appendix in over 50 young human embryos and found 'a remarkable growth from the tip of the caecum, which simulates in its position and form the true appendix'. This grows during the 6th week and atrophies afterwards toward the end of the 7th week or so. Here then is a definite embryological origin for the development of a supernumerary appendix.

Comparative Anatomy and Evolution of the Appendix

Berry (1900) in his classical paper showed that the vermiform appendix of man is a specialized part of the alimentary canal. He found in his study of many vertebrate types that the amount of lymphoid tissue in the caecum is largely in excess of that contained in other parts of the large intestine. In fact the tendency for lymphoid tissue to be specially collected together into a differential part of the alimentary canal becomes more marked in certain groups of the vertebrate series. In the pigeon, goose and fowl, the lymphoid tissue occupies the whole length of the caecal wall. In the mouse and rat there is an attempt at constriction in the caecum, and the lymphoid tissue is confined to the apical part. In the rabbit this constriction has become much more clearly defined, there being both a caecum and an appendage, the latter containing large quantities of lymphoid tissue, whilst the caecum has but little.

In the primates an appendix is found in both major subdivisions. In the Strepotheriini the caecum is large and ends in a process simulating a vermiform appendix, both macro- and microscopically and histologically, although it is not always sharply demarcated from the rest of the organ. In the Haplorhini the caecum is short, and only in Hominid (modern and extinct man), Pongidae (gorilla, chimpanzee) and Hylobatidae (gibbon) is the apex specially modified to form a vermiform appendix. Nevertheless, in all the other sub-groups there is specialized development of lymphoid nodules in the apical region of the caecum.

From the above data two facts are clear:

1. Although an appendix is found in almost all the primates, it appears in its highest form of development in those that have assumed the upright posture, culminating in man.
2. We know from their fossil remains that the great anthropoids are of extreme geological antiquity; was the appendix injurious or vestigial in them, there has been ample evolutionary time to accomplish its suppression. Keith (1912) supported this contention. He stated: 'So like are the caecum and appendix of the gorilla and chimpanzee to the same structures in man, that I know of no character by which an expert could tell them apart. In the anthropoid as in man the caecum and appendix undergo the same peculiar changes in passing from infancy to adult age.'

Johnston (1920) maintained that the human caecum was in a state of retrogression. Nevertheless, he admitted the appearance of the vermiform appendix as a structure mainly lymphoid in nature and specially developed. Romer (1955) also denies that the appendix is vestigial in nature. In short, all evidence suggests that, contrary to its being a vestigial
organ, the appendix is in fact a specialized part of the human bowel.

The chief stumbling block to the acceptance of this theory has been the failure to ascribe any definite function to the appendix.

**Physiology**

However, Wangensteen et al. (1937) have shown that the appendix secretes 1-2 c.c. of fluid daily, this being a secretion and not a filtrate, since it can be collected from an unobstructed appendix. Mucus, calcium, phosphates, and digestive enzymes are present in the secretion. Not much is known about its movements. Peristalsis due to stimulation *in situ* has been observed by some. If an exteriorized appendix is stimulated it shows slow contractions lasting several minutes; the longitudinal muscle contracts first to cause shortening, then circular muscle contracts, reducing the size of the lumen.

These experiments serve to indicate that the appendix is an active, functioning organ, structurally and physiologically equivalent to the adjacent intestine, and hardly a 'vestige' in the true sense.

**Discussion**

From a consideration of all the evidence it can be reasonably assumed that the vermiform appendix of man is neither vestigial nor in a state of regression, but that it is in fact a specialized lymphoid structure with all the functions of lymphoid tissue elsewhere in the body. It appears to be a sentinel gland situated at the commencement of the large bowel. At the ileocecal junction the alimentary tract changes from a relatively sterile structure to one laden with bacteria. The appendix may well be a barrier against the retrograde invasion of the small bowel by such colonic bacteria.

Young (1957) considered that the appendix in mammals is concerned with the neutralization of bacterial toxins. Furthermore he states that 'in man and other mammals with a reduced caecum, the appendix perhaps retains some anti-bacterial functions, though it can be removed without any evident ill-effects'.

**SUMMARY**

1. Comparative anatomical studies indicate that the appendix is a specialized organ.
2. Notes on the embryology and physiology of the appendix are included

I am indebted to Dr. R. Singer, of the Department of Anatomy, University of Cape Town, for his helpful criticism and assistance.

**REFERENCES**