

**LOCALIZATION OF MAST CELLS AND CARBONIC
ANHYDRASE IN MOUSE GASTRIC MUCOSA**

BY

El-Sayed M. Hammouda, Usama A. Sharaf El-Din and

Fawzia El-Saati

**Department of Zoology, Faculty of Science, Al-Azhar
and Hellwan University**

Received : 24.11.1987

ABSTRACT

Various types of mast cells were ~~situated~~ just beneath the muscularis mucosa and also towards the top of the gastric glands. Carbonic anhydrase was located in the parietal cells not only in the middle and luminal layers of the fundus but also scattered in the base of the glands. Mast cells and enterochromaffin cells increase in concentration as the concentration of carbonic anhydrase increases.

INTRODUCTION

Hydrochloric acid, produced during gastric secretion is formed by the parietal or oxyntic cells situated in the fundic part of the stomach in the middle third of the gastric gland. The cells are distinguished by canaliculi which branch through the cytoplasm and are lined with microvilli. The microvilli are formed from smooth surfaced vesicles in the cytoplasm and become longer and more numerous on

Delta J.Sci.(11)(3)1987

Localization of mast cells and carbonic anhydrase

stimulation and during secretion. When secretion ceases, the microvilli become shorter with less surface area and the vesicles reappear [1,2]. The canaliculi stain prominently for carbonic anhydrase which is found on the outside of the microvilli lining the canaliculus but not in the smooth surfaced vesicles in cytoplasm [3]. The localization of carbonic anhydrase on the outer surface of membranes through which ions pass may indicate a role of carbonic anhydrase in ion transport or a protective function in the maintenance of cellular PH levels [4].

Considerable concentrations of histamine are found in the stomach of all higher vertebrates including man [1]. Histamine is found on close proximity to the parietal cells generally stored in mast cells [5]. It is also present in the muscularis mucosa and arterial walls [6]. The role of histamine in gastric secretion has been implicated. The first is the acetyl choline as the neurochemical transmitter of vagal impulses the second is the gastric released from cells in the pyloric antrum and finally histamine itself. Babkin [7] stated that acetyl choline might be released by vagal stimulation cells. McIntosh [8] proposed that histamine might be the local mediator for stimulation of acid secretion. This paper describes the localization of mast cells and carbonic anhydrase in gastric mucosa of the mouse as a mammalian animal.

Delta J.Sci.(11)(3)1987

El-Sayed M. Hammouda et al.

MATERIAL & METHODS

10 males and females mouses (Mus musculus) were used. The animals were sacrificed by stunning and decapitation. The stomach was excised within five minutes after death of the animal. The specimens were fixed in acetone and incubated in Hausler's medium [9] for 1 hour as described in Cross [3] for detection of carbonic anhydrase. Other specimens were fixed in conc. formaldehyde solution 40% 100 ml, distilled water 900 ml, 5% acetyl pyridium chloride 5 gm. Washing of the specimen was under taken with tap water for 24 hours. Dehydration clearing infiltration and embedding in paraffin wax done as usual. Thin sections of 8 M thickness were prepared. Four sections from each specimen were taken. The first 2 slides were examined for the distribution and intensity of carbonic anhydrase. The other 2 slides were stained with 1% toluidine blue in 40% alcohol [10].

RESULTS

It was found that mast cells increase as the intenisty of carbonic anhydrase increases.

Mast cells were situated just beneath the muscluaris mucosa and also towards the top of the glands especially near the junction with the lumen (Fig. 1) also it was found that mast cells assumed various shapes. They appear

Delta J.Sci.(11)(3)1987

Localization of mast cells and carbonic anhydrase

as round or oval shaped stellate or almost filiform sometimes they form rows of few cells either close together or separated.

Hausler's technique for carbonic anhydrase was used to demonstrate the distribution of the parietal cells in mouse stomach. This technique displayed the canaliculi very well and showed that there were clearly recognizable parietal cells not only in the middle and luminal layers of the fundus but also scattered in the base of the glands, although the basal parietal cells were not so prominent for carbonic anhydrase (Fig. 2). Enterochromaffin cells acquired a dark colour on staining with toluidine blue.

DISCUSSION

Staining for carbonic anhydrase was used to display the distribution of the parietal cells in this study. It was interesting to find parietal cells in considerable numbers in the basal part of the glands although the staining for carbonic anhydrase was much weaker in the basally situated cells. In the area of cell division in the neck of the gland the basal parietal cells could be older than those in the middle of the gland [11]. It has been claimed that the basal parietal cells act as storage sites for histamine [12]. Most investigators believe that

Delta J.Sci.(11)(3)1987

El-Sayed M. Hammouda et al.

histamine in the basal third of the rat mucosa is stored in enterochromaffin-like cells [13]. This finding agree with that obtained in the present study. Mast cells and enterochromaffin cells contain histamine increase in concentration as the concentration of carbonic anhydrase increases. Therefore histamine increases the gastric acidity.

REFERENCES

- 1- Pflieger, K. (1968) : The metabolism & function of histamine in the stomach. Life Sci. 6 : 759 - 766.
- 2- Hirschowitz, B.I. (1974) : Ultrastructural studies on gastric parietal cells. Gastroenterology 67(3): 477 - 485.
- 3- Cross, S.A.M. (1970): Ultrastructural localization of carbonic anhydrase in rat stomach parietal cells Histochem. 22 : 219 - 225.
- 4- Narumi, S. & Kanno, M. (1973) : Effect of gastric acid stimulants and inhibitors in rat gastric mucosa. Biochem. Biophys Acta. 311 : 80 - 89.
- 5- Werle, E & Lorenz, W. (1964) : Histamine and histidine-decarboxylase in speichel and Magengewebe. physiol Chem. 338 : 251.
- 6- Juhlin, R & Shelly, A (1966) : Detection of histamine by fluorescent stain. J. Histochem. Cytochem. 14 : 215 - 219.

Delta J.Sci.(11)(3)1987

Localization of mast cells and carbonic anhydrase

- 7- Babkin, B.P. (1973) : The abnormal functioning of gastric secretory mechanism as possible factor in pathogenesis of peptic ulcer. Can. med Ass. J. 38, 421 - 429.
- 8- McIntosh, F.C. (1968) : Histamine as normal stimulant of gastric secretion. Q.J exp. physiol. 28 : 87 - 98.
- 9- Hausler, s (1958) : Zur technik und spezifitat des histochem. carbohydrasenachmeises in model-luereich und in gewbsschnitten von rattennie-ven. Histochem. I. 29 - 47 (English summ.).
- 10- Boselia, A-W.A (1959) : Identification and counting of basophil leucocytes. Stain Technol. 34 : 325.
- 11- Stevens, C.E. & Leblond, C.P. (1953) : Renewal of the mucous cells in the gastric mucosa of the rat. Anat. Rec. 115 : 233.
- 12- Pentilla, A & Hirvonen. (1969) : Fine structure of oxyntic cell. Anat. Rec. 115 : 231.
- 13- Hakanson.R. Larsson, L,J & Varg, j ; (1976) : Effect of enterectomy on histamine storing endocrine-like cells in rat mucosa. J. Physiol 257 : 785 - 800.



Fig. 1.T.S of mouse stomach showing the distribution of mast cells (X 250)

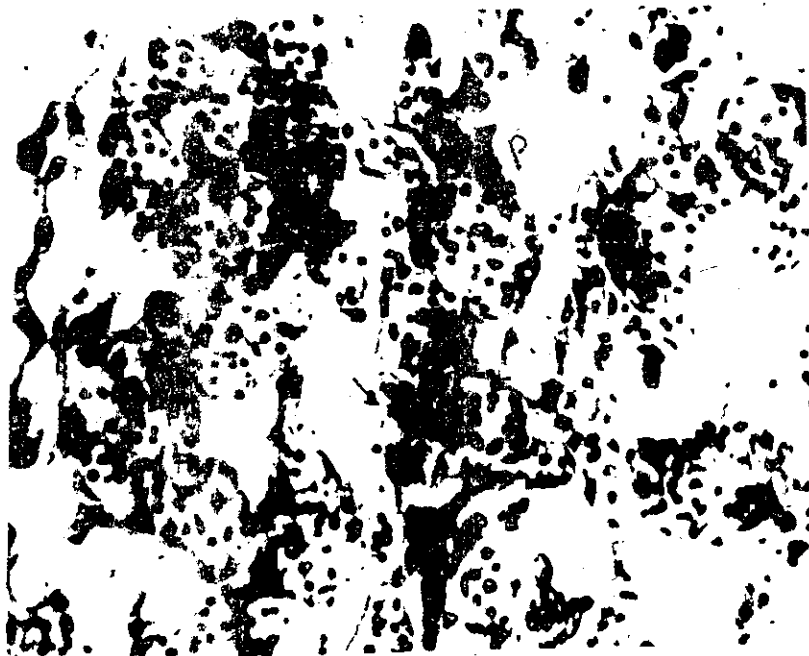


Fig. 2 Carbonic anhydrase staining in mouse parietal cells (P), arrow refers refers to canaliculi; X 450

**الخلايا المارية وانزيم الكربونك انهيدريز فى الغشاء المبطن للمعدة
فى القار الابيض الصغير**

السيد محمد حموده- اسامة احمد شرف الدين- فوزية الساعاتى
قسم علم الحيوان - كلية العلوم - جامعة الازهر وحلوان

توجد اشكال مختلفة من الخلايا المارية تحت الطبقة المخاطية
وايضا تجاه قمة الغدد - انزيم الكربونك انهيدريز يوجد فى الخلايا المحيطة.
الخلايا المارية وخلايا انثروكروموفين تزيد فى التركيز كلما زاد تركيز
انزيم الكربونك انهيدريز .