

Histology of the Acupuncture Point

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Abstract: A concentrated effort to observe any histological differences between non-acupuncture points and bioelectrically-located acupuncture points has revealed that there are consistently twice as many dermal papillae within the area of the acupuncture point in human specimens. The one-tailed *t*-test and the Fisher's Exact test supported the findings to be significant. Other observed differences are currently being investigated. It is reasonable to speculate that the increase in concentration of dermal papillae containing capillary loops with sympathetic wrappings, along with the contained nerve endings within the locus of the acupuncture point, can account for anatomical differences that are possibly responsible for an increase in conductivity of the overlying skin. Continuing studies of specific ion localization within these structures will hopefully elucidate the nature of this bioelectrical activity.

WESTERN MEDICINE is beginning to more readily accept acupuncture as scientific confirmation accumulates on existence of the acupuncture loci and how treatment of these loci eliminate pain. Demonstration of the release of methionine enkephalin, leucine enkephalin and β -endorphin by the

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peri-aqueductal gray matter in response to acupuncture treatment was significant in elucidating the manner in which such treatments can reduce and/or eliminate pain.¹⁻⁴

Electrical activity at the acupuncture point has been a subject of much research, giving us insight into the existence of meridians and an inquisitiveness as to why there is increased electrical activity at the acupoints. Evidence of increased electrical conductivity (lowered electrical resistance) at the acupuncture points has been well established.⁵⁻¹¹

Since 1959, research efforts have been published attempting to equate anatomical-biochemical entities to the measurable bioelectrical activities within these known acupuncture loci.

The sequential development of these various theories is listed in Table 1. A detailed explanation can be obtained by referring to the citation of each author's work in the reference section of this article.

Attempts to elucidate where acupuncture points are located, and what causes their electrical activity, have led to the discovery that they are active in monkeys,¹⁸ dogs,¹⁹ horses,²⁰ goats²¹ and pigs.²² Studies have also shown that the acupuncture points

Table 1.
Topic outline of theories for electrical activity at acupuncture points

Date	Investigator	Topic Synopsis
1959	Ishikawa ¹²	Reflex changes in subcutaneous blood vessels lead to an increase in vascular permeability
1971	Ionescu-Tirgoviste ²⁹	Pressure sensitive points are due to an accumulation of "vegetative nerves."
1972	Woolley-Hart ¹¹	Point activity is due to local micro-circulation which is under sympathetic control
1974	Hameroff, S.R. ¹³	Points along meridians are energy-conducting channels made of microtubules
1975	Voll, R ³⁰	Points are condensations of field forces formed by body energy generated by local mitochondrial energy cycles.
1977	Nakatani and Yamashita ¹⁴	Enlargement and ostial opening of sweat and sebaceous glands locally due to excitation of sympathetic nerves.
1977	Melzack, R. ¹⁵	Similar characteristics between "trigger points" and acupuncture points
1977	Gunn, C.C. ¹⁶	Type I: Motor point Type II: Sagittal plane focal meeting of superficial nerves Type III: Superficial nerves and/or plexuses Type IV: Muscle/tendon junctions
1984	Dung, H.C. ¹⁷	Points are found associated with the terminal ends of superficial cutaneous nerves.

Table 2.
Frequency of dermal papillae observed in tissue sections

Number of papillae per grid	Experimental		Control	
	frequency	%	frequency	%
8	5	8.90	0	-
7	14	25.00	0	-
6	21	37.50	3	1.80
5	12	21.43	10	5.99
4	4	7.14	49	29.34
3	0	-	43	25.75
2	0	-	38	22.75
1	0	-	16	9.58
0	0	-	8	4.79
TOTAL	56	100	167	100

are active in the dead, in both animals,²² as well as in humans.^{6,23-26} The author has found that being able to locate the acupuncture points in a cadaver specimen has "opened the door" to more possibilities in acupoint research. As well, it suggests that an emphasis be placed on some of the earlier theories and a de-emphasis be placed on others.

The purpose of this investigation was to locate acupuncture points in the cadaver, dissect a core specimen out, and selectively study for any anatomical differences that might be observed.

Materials and Methods

Using a Joanco Medical Electronics Model No. 4 neuroprobe²⁷ two Jing distal acupoints (Akabane points) were located in each hand of two cadavers. By cutting straight down around a half millimeter locus with a scalpel, core samples were extracted. Jing distal points were selected in order to minimize the number of types of tissues layered within each core sample. Areas approximately two millimeters from the Jing distal points were located where a minimal reading (galvanic skin activity) was measured and core samples were extracted to serve as control tissues.

All samples were immediately fixed in formalin and processed by use of the Technicon where they were routinely prepared until paraffin embedment. The tissues were sectioned on a microtome and mounted on glass slides in a routine manner. Various selective and control staining procedures were used to study the tissue samples. The hematoxylin/eosin staining procedure was used as the control stain. The selective staining procedures used were Bielschowsky's nerve stain, Papanicolaou stain procedure, paragon multiple stain, and Kossa's calcium staining procedure.²⁸

Results

Fifty-six experimental specimens and 167 control specimens were studied. The average number of dermal papillae within

the experimental specimens of epidermis/dermis was twice that observed in the control specimens (see Table 2 and Figures 1 and 2). Table 2 charts the number of histological sections within each group that demonstrated 8 dermal papillae; 7, 6, 5, etc. Table 3 charts the mean number of papillae in the experimental versus the control groups, along with other statistical data.

The results of the one-tailed *t*-test demonstrated a *t*-value of 16.2941 ($P < 0.0001$). A natural grouping of the data was observed: most of the experimental data were in grids with five or more papillae per grid while most of the control data were in grids with four or less papillae per grid. A Fisher's Exact test compared the proportion of grids with five or more papillae per grid in the two groups, 52/56 experimental and 13/167 control. The test was significant, $P = 0.0000$. The experimental group had significantly more grids with five or more papillae per grid.

Each observed dermal papillae in both the experimental and control tissues contained a clearly distinguishable capillary loop (see Figure 3). This was observed by all of the types of staining techniques. The wall of these capillary loops stained a heavy black in color by the Bielschowsky and paragon staining procedures suggesting a possible sympathetic nerve wrapping. The stratum germinativum layer of the epidermis and the endothelial layer of the capillaries demonstrated a heavy concentration of intracellular dark-staining granules in all specimens stained by the paragon multiple stain which was different from that seen in the Papanicolaou stain specimens. The authors are unsure as to what these granules can be and only further research can elucidate their meaning. The Kossa's calcium staining procedure demonstrated calcium precipitates to be in a similar distribution, yet not nearly as concentrated.

Discussion

The dermal papillae were found to be slightly more than twice as concentrated at

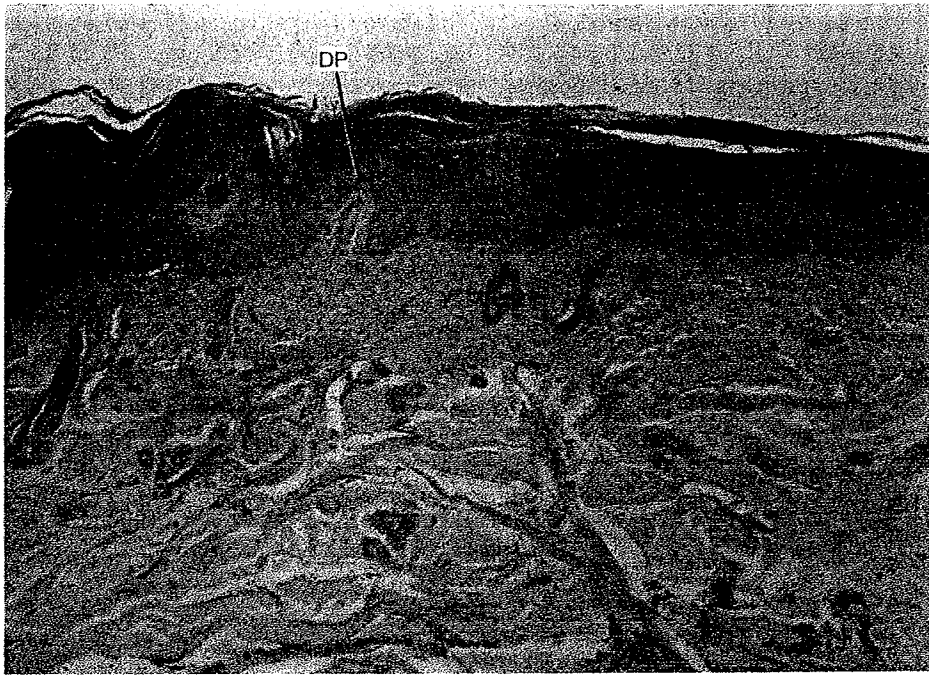


Figure 1.
Control specimen showing few dermal papillae (DP) (80x)

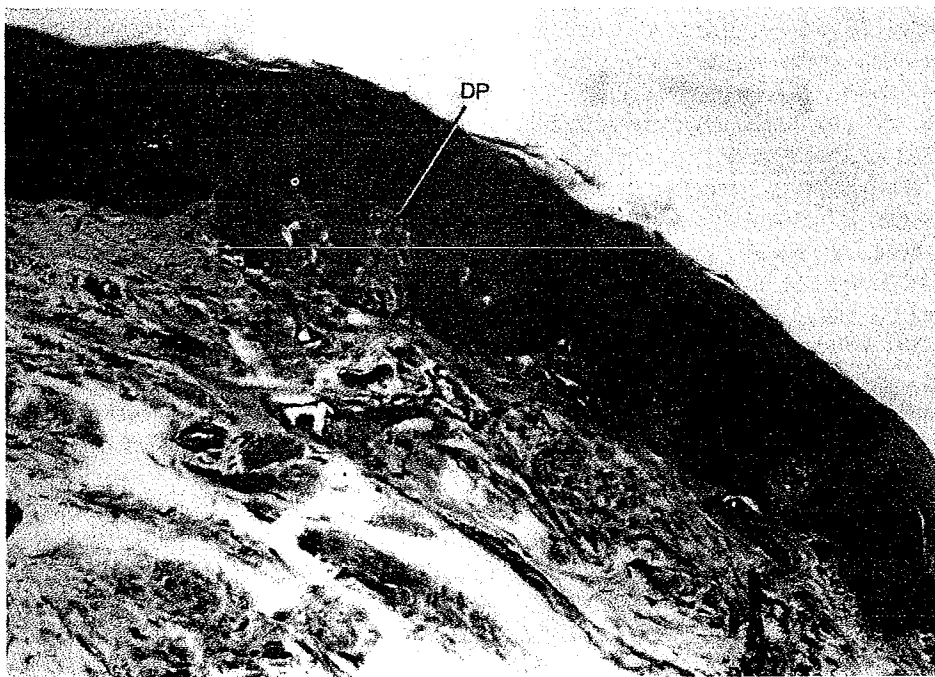


Figure 2.
Jing acupoint specimen showing increased number of dermal papillae (DP) (80x)

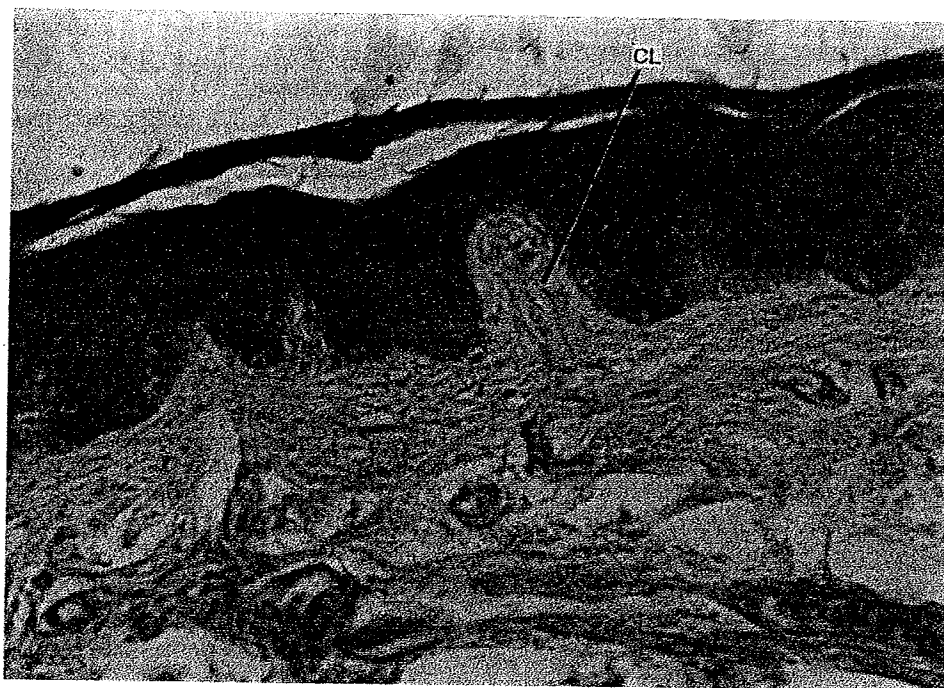


Figure 3.
Jing acupoint specimen showing capillary loop (CL) within dermal papilla (125x)

Table 3.
Statistics of frequency of dermal papillae

Item	Experimental	Control
Sample size	56.00	167.00
Mean	* 6.07	* 2.90
Standard deviation	1.06	1.32
Mode	6.0	4.00
Median	6.0	3.00
Minimum	4.0	0
Maximum	8.0	6.00

* Denotes the mean number of papillae observed in a section of experimental tissue compared to that of a control tissue.

acupuncture points, which are known to have a higher electrical conductivity than non-acupuncture points. The increased electrical conductivity at the acupuncture loci may be attributable to the increased concentration of the dermal papillae with its contained structures. Having the knowledge that the electrical activity of the acupuncture points is present in the non-living, as well as in the living, indicates that there must be certain structures within the locus of the acupuncture point that can concentrate ionic substances selectively in order to create an electrical charge differential. This research was an attempt to demonstrate such possible differences, but further research is necessary in order to understand fully the origin of the electrical difference measured at the acupuncture loci.

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