TRICHOME STRUCTURE FOUND ON DRUGS OF THE UNITED STATES PHARMACOPOEIA

By

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The word trichome is derived from the Greek word 'Trichos' meaning a hair. Under the name trichome, are comprised the hairs and similar outgrowths, as scales, glands, prickles or bristles which are developed from the superficial cells of plants.(8)

On each hair-structure may be distinguished the body and foot. The former is the part which protrudes outward above the epidermal surface. The latter is the part which lies beneath the body; it usually differs in form from the surrounding epidermal cells. It frequently exceeds them in height, and in other cases is depressed beneath the surface.(4)

The trichomes may contain protoplasm with a cell nucleus,(6) and sometimes crystals of lime salts. They may contain secretions and are then known as glandular hairs.(6) In roots the single celled outgrowths are known as root-hairs. They are not included in this paper.

Secretion hairs are found in the intercellular spaces of certain plants, as in the rhizome of the Male Fern,(11) but since they are not considered in this article, only mention will be made of them.

Trichomes may be varied in form and function but morphologically they have a common origin. The development of hair

structures both in the case of unicellular and multicellular hairs, begins in all certainly investigated cases, from one cell, the so called initial cell.(2) This cell protrudes beyond the outer surface of the surrounding cells, the part within this surface develops into the foot and the protuded portion into the body of the hair.(2) It is obvious that in all forms consisting of more than one cell, divisions accompany growth, and the successive division-walls appear in definite number and position for each case; further that the definite form and articulation depends upon the successive divisions, and the growth of the cells after the division is complete(2).

The origin of the hair-structures on the stem and leaf begins at a very early age; on the stems as a rule not above the point of insertion of the youngest leaf. On the same surface, their formation begins at an earlier stage of development than that of the stomata.(3)

Being outgrowths of the epidermis, trichomes are generally found wherever primary epidermis exists, as in the leaf and young stem. They are not found in old stems for the reason that the primary epidermis is pushed off by the formation of cork tissue.

Trichomes have various functions; some serve as a protec-

tion for the plant against distruction by animals. The prickles or stinging hair of the common thistle is a good illustration of this kind. Some serve as a storage for valuable plant products, such as the plant oils, as in Mentha piperita , Plate I, Figs. II_2, II_3.

In many cases they are thin walled and their function is that of absorption of moisture holding mineral salts in solution.(6) In some plants they grow very close together around the stalk, pointing downward, forming an umbrella like structure, so that small insects cannot crawl up to the leaves and destroy them. In other plants they are coated with a sticky substance so that the insects adhere to them.

On the seed they assist in the distribution. In hot climates they protect the leaf and stem from too rapid evaporation caused by the direct rays of the sun.

For pharmacognostical purposes plant hairs are of great importance as they form the diagnostic features by which certain ground drugs, especially those made from leaves and herbs, may be recognized.

The brief classification of plant trichomes in Rusby and Jelliffe(7) is hardly sufficiently complete to be of value in identifying plant powders.

In the following classifications, two methods have been

followed; first, the mature trichomes have been classified according to their form and structure; secondly, the trichomes found on each particular drug have been grouped in the plates. The aim has been to work out a scheme which will aid in identifying powdered drugs or detecting adulterations in them.

References.

1.Comparative Anatomy of the Phanerogamss and Ferns, De Bary, p.30-66.

2.Comparative anatomy of the Phanerogamss and Ferns, De Baryy, p.56.

3.Comparative Anatomy of the Phanerogamss and Ferns, De Bary, p.57.

4.Comparative Anatomy of the Phanerogamss and Ferns, De Bary, p.55.

5.Morphology and Histology of Plants, Rusby and Jelliffe, p.148 and 302-305.

6.Morphology and Histology of Plants, Rusby and Jelliffe, p.302.

7.Morphology and Histology of Plants, Rusby and Jelliffe, p.304.

8.The Druggists Circular, Vol.XL, p.93-96.

9.Botany and Pharmacognosy, Kraemer, p.47,350 and 352.

10.Botany and Pharmacognosy, Kraemer, p.350.

11.Botany and Pharmacognosy, Kraemer, p.352.

12.University Text Book of Botany, Campbell, p.28-29, 260 & 410.

13.University Text Book of Botany, Campbell, p.260.

14.University Text Book of Botany, Campbell, p.410.

15.Angewandte Pflanzenanatomie, Tschirch, p.253-271.

16.Anatomischer Atlas der Pharmakognosie, Tschirch und Oesterle.

17.Pharmakognostischer Atlas, Moeller.

General Scheme.

I.Multicellular Noncapitate Trichomes.

A.- Elongated Terminal Cell.

B.- Filiform.

C.- With five or more cells.

D.- With three or four cells.

E.- With two cells.

II.Unicellular, noncapitate Trichomes.

A.- Filiform.

B.- Filiform Terminal with large Base.

C.- Simple with one cell.

III.Glandular Trichomes.

A.- Elongated Hairs, unbranched.

B.- Elongated hairs, branched.

C.- Short or sac like.

IV.Trichomes in Clusters.

Multicellular Noncapitate.

A.- Elongated Terminal Cell.

Arnica, (VII, I_3)

Scoparius (VIII, VI)

Anthemis (VI, III)

Scutellaria (VII, II_4)

B.- Filiform.

Marrubium (IV, V, V_2)

C.- With Five or More Cells.

Mentha Piperita (I, II, II_4)

Salvia (I, I_2)

Digitalis (IV, III)

Eupatorium (V, $III_{6,4,5}$)

Tabacum (VI, I)

Chelidonium (VI, $II_{2,3}$)

Rhus Toxicodendron (IV, $IV_{1,3}$)

Arnica (VII, I_3)

Sambucus (VII, VI_2)

Stramonium (VIII, I_2)

Mentha Viridis (VIII, $II_{1,2}$)

Tanacetum (VIII, III_5)

D.- With Three or Four Cells.

Stramonium (VIII, $I_{1,3,4}$)

Mentha Viridis (VIII, II_4)

Dulcamara (VIII, IV_1)

Grindelia (VIII, VII)

Tabacum (VI, $I_{2,3,4}$)

Rhus Toxicodendron (VI, IV_2)

Chenopodium (VI, $VII_{1,2}$)

Hedeoma (V, I_1)

Melissa (V, $II_{3,4}$)

Matico (IV, $VII_{1,2}$)

Digitalis (IV, $III_{2,3}$)

Scutellaria ($VII_{1,3,4}$)

Absinthium (II, $I_{1,4}$)

Salvia (I, I_1)

Belladonna (I, III_1)

Canabis Indica (I, III_5)

E.- With Two cells.

Uva Ursi (I, $V_{2,3}$)

Cannabis Indica (I, III_2)

Matico (III, II_2)

Hedeoma (V, I_4)

Melissa (V, II_5)

Hyoscyamus (V, IV_5)

Scutellaria (VII, II_2)

Dulcamara (VIII, IV_2)

Tanacetum ($VIII_1$ III_1)

Lupulin (VIII, V_5)

Unicellular Noncapitate.

A.- Filiform.

Pulsatilla (VII, III_2)

Kousso (VII, $V_{2,4}$)

Chelidonium (VI, II_4)

Eriodictyon (III, I_2)

B.- Filiform Terminal with large Base.

Nux Vomica (IV, I_1)

Staphisagria (VI, $VI_{1,2}$)

C.- Simple, with one Cell.

Tanacetum (VII, III_4)

Lupulin (VIII, $V_{2,3,6}$)

Arnica (VII, $I_{1,4}$)

Humulus (VII, $IV_{1,2,3,4,5}$)

Sambucus (VII, VI_1)

Pilocarpus (VI, $V_{2,3}$)

Chenopodium (VII, VII_3)

Hedeoma (V, $I_{2,3}$)

Hyoscyamus (V, VII_1)

Lobelia (IV, $IV_{1,2}$)

Senna (III, III_1)

Strophanthus (III, II_1)

Eriodictyon (III, I_1)

Buchu (I, $II_{1,2,3}$)

Uva Ursi (I, $IV_{1,4}$)

Cannabis Indica (I, $IV_{1,2,3}$)

Glandular Trichomes.

A.- Elongated Hairs Unbranched.

Belladonna (I_1 II_2)

Hyoscyamus (V, III_3)

Tabacum (VI, I_2)

Arnica (VII, I_2)

Tanacetum (VIII, III_2)

B.- Elongated Hairs Branched.

Tabacum (VI, I_1)

C.- Short or Sack like Trichomes.

Kamala (III, $IV_{2,3}$)

Eriodictyon (III, $I_{3,4}$)

Hedeoma (V, $II_{1,2}$)

Melissa (V, $III_{1,2}$)

Lupulin (VIII, V_4)

Mentha Viridis (VIII, $II_{2,5}$)

Mentha Piperita (I, $II_{2,3}$).

Trichomes in Clusters.

Marrubium (IV, V_3)

Hamamelis (I, $VII_{2,3}$)

Kamala (III, IV_1)

Tabacum.....I

Chelidonium.....II

Anthemis.....III

Plate VI- Rhus Toxicodendron.....IV

Pilocarpus.....V

Staphisagria.....VI

Chenopodium.....VII

Chimaphila.....VIII

Arnica.....I

Scutellaria.....II

Plate VII-Pulsatilla.....III

Humulus.....IV

Cusso.....V.

Sambucus.....VI

Stramonium..... I

Mentha Viridis.....II

Tanacetum.....III

Plate VIII Dulcamara.....IV

Lupulin.....V

Scoparius.....VI

Grindelia.....VII

For illustrations of the trichomes found in the following drugs see book references indicated below, by the numbers.

Absinthium.....9, 15, 17.

Althaea.....16, 17.

Anthemis.....8.

Arnica Flores.....8, 16.

Belladonnae Folia.....9, 5, 8, 17.

Cannabis Indica.....9, 8, 17, 15, 16.

Chenopodium.....8.

Digitalis.....9, 8, 16, 17,

Eriodictyon.....9.

Eupatorium.....8.

Grindelia.....8.

Hedeoma.....8.

Humulus.....9, 8.

Hyoscyamus.....5, 15, 8, 16, 17.

Kamala.....9, 15, 8, 17.

Cusso.....17.

Lobelia.....8, 17.

Malva.....16, 17.

Marrubium.....8.

Matico.....8, 17.

Melissa.....8, 17.

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Asst. in Pharmacognosy

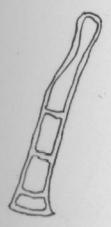
June 3, 1903.

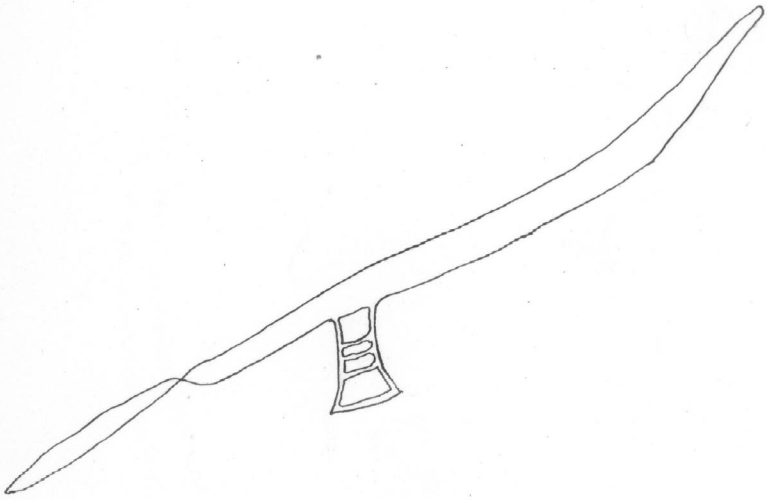
Edward Kremers
Prof. of Pharm. Chem.

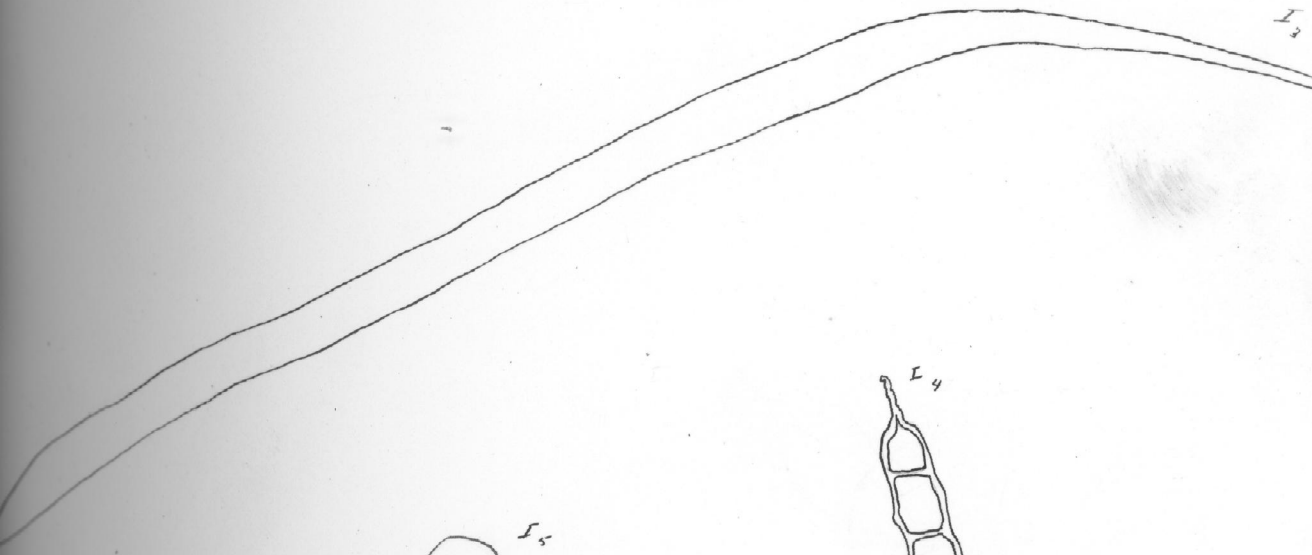
Plate I


I 1
I 2
II 1
II 2
II 3
II 4
III 1
III 2
III 3
IV 1
IV 2
IV 3
IV 4
IV 5
V 1
V 2
V 3
V 4
VI 1
VI 2
VI 3
VII 1
VII 2
VII 3

Plate II







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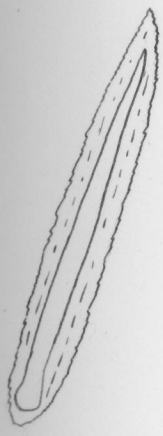
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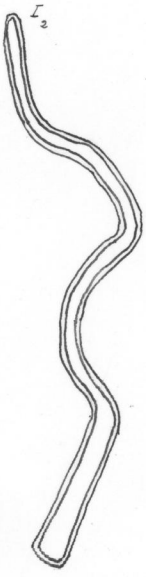
II


I,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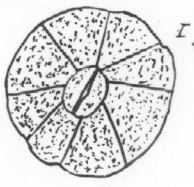
I₃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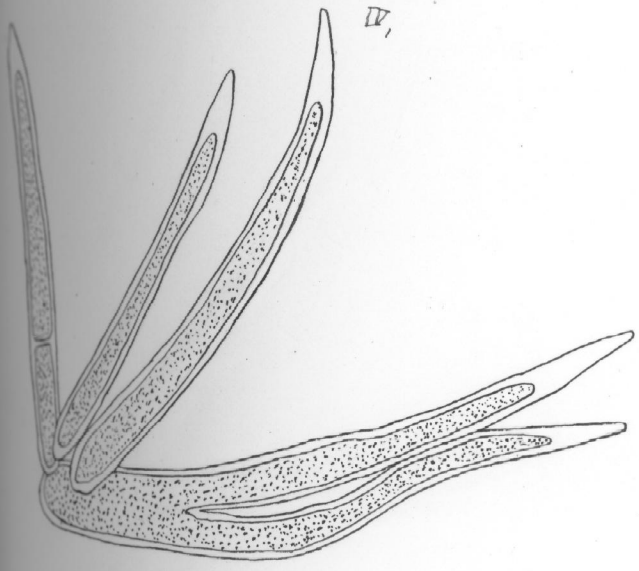
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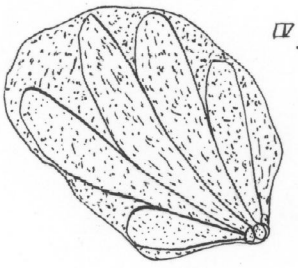
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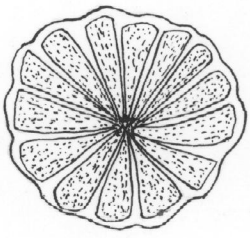
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Plate IV

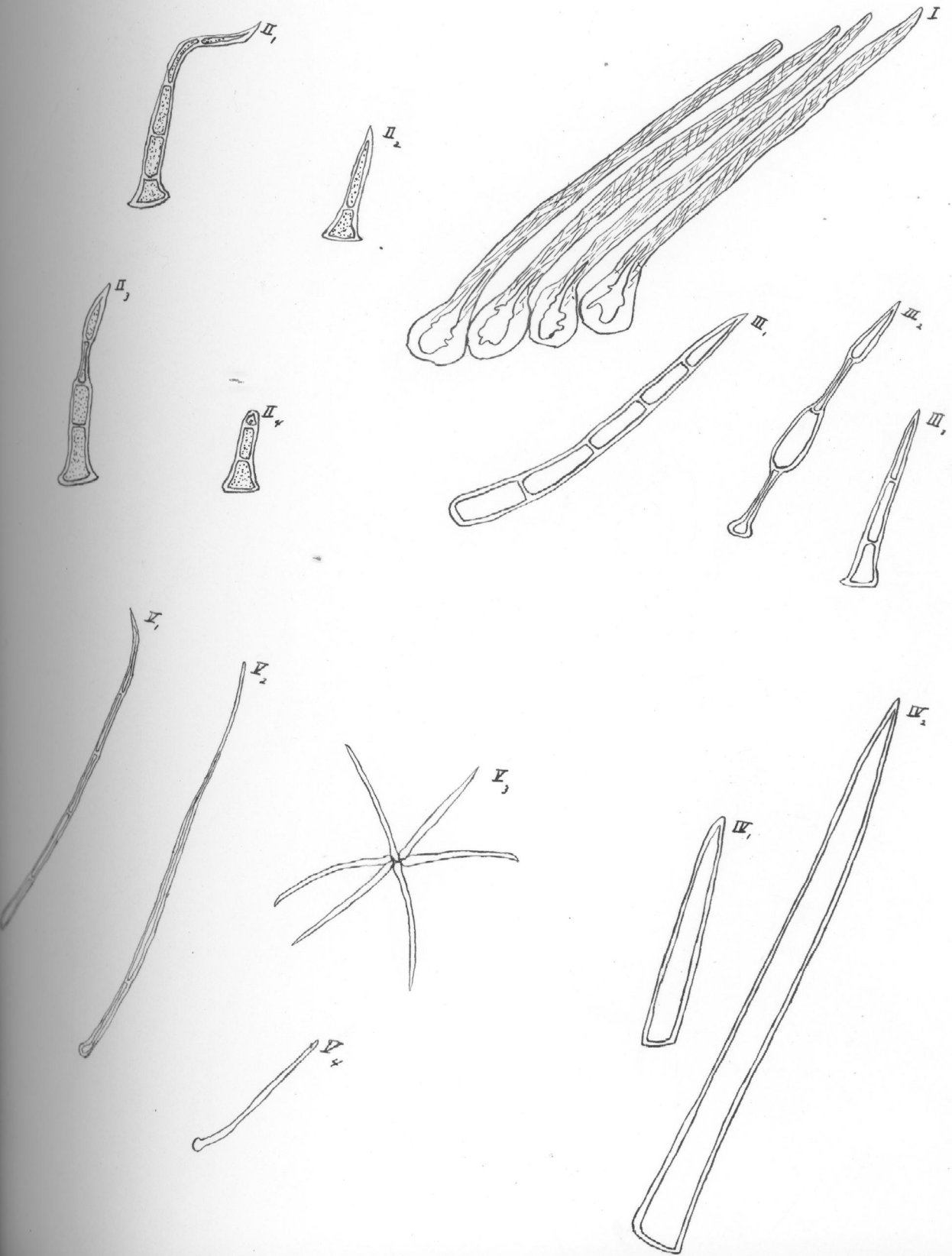

Plate V

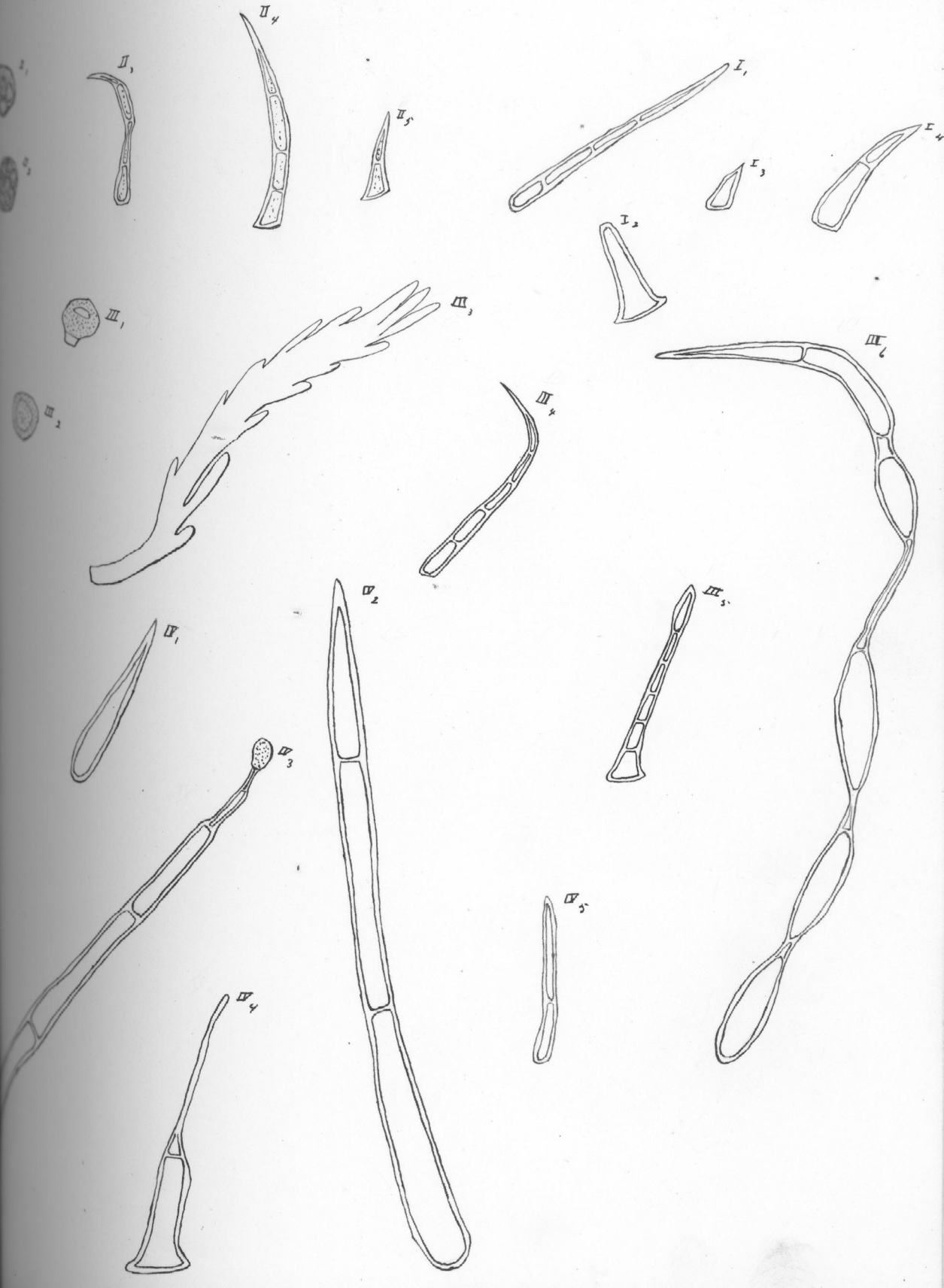
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Plate VI

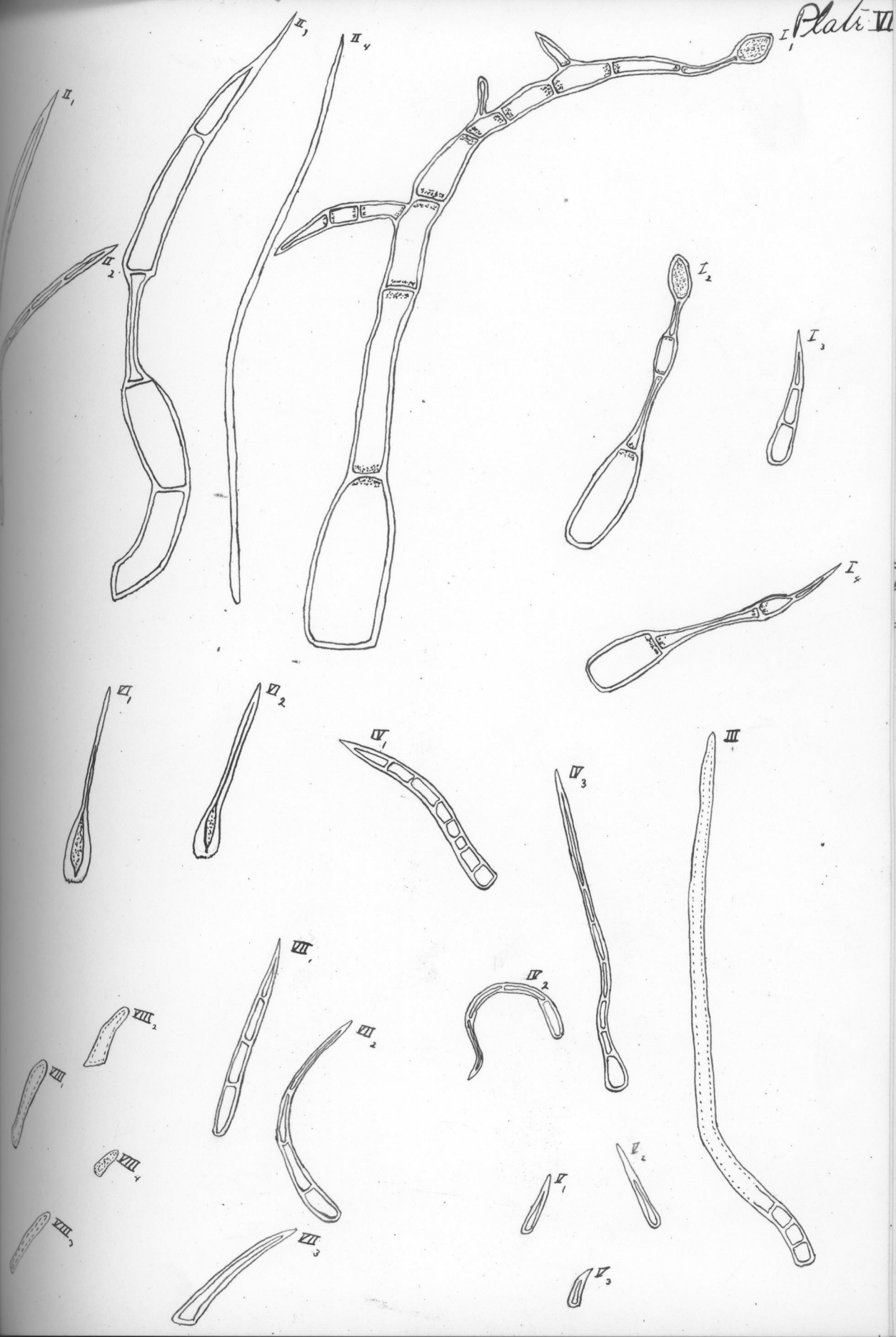
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Plate VII

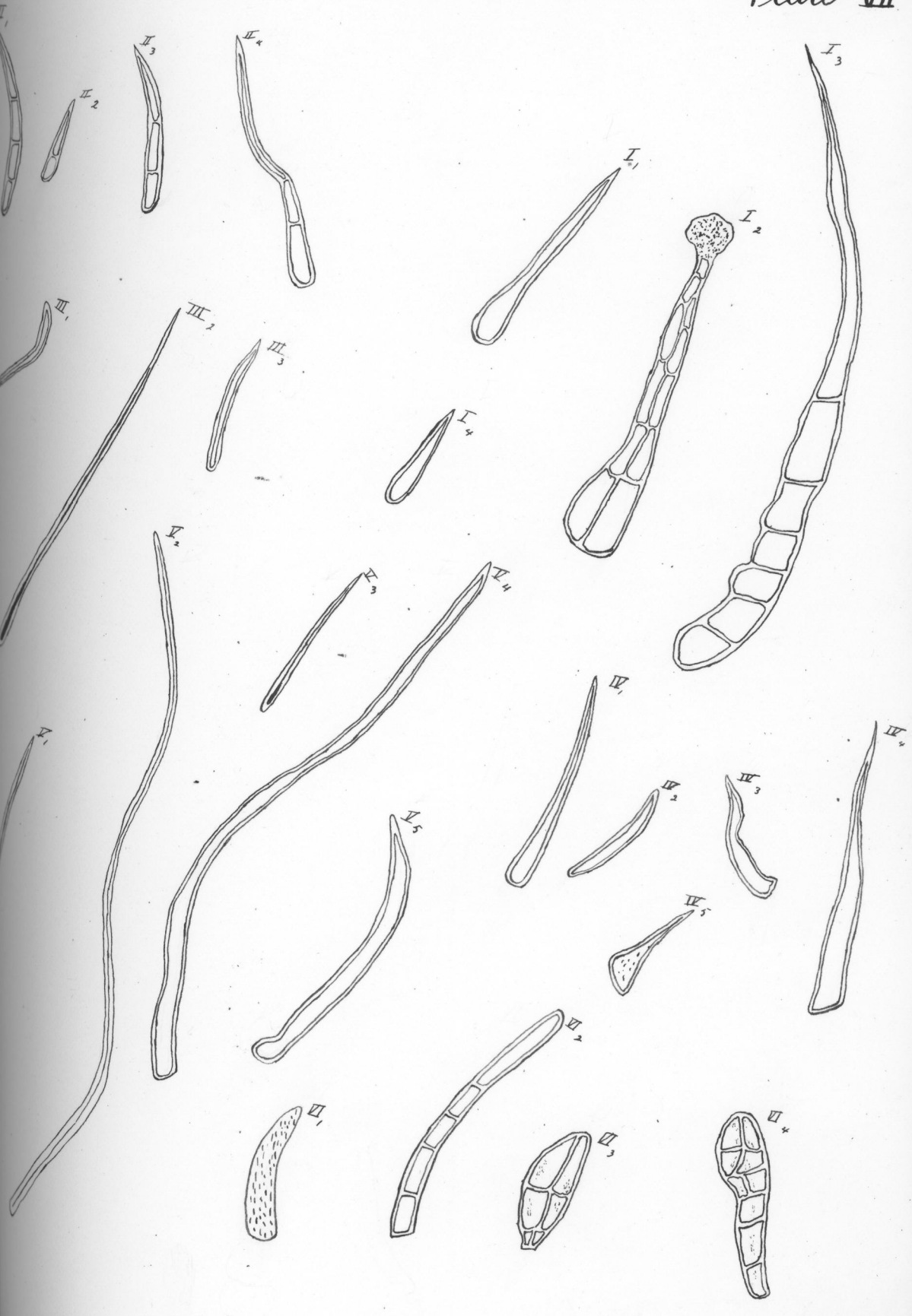
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Plate VIII