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生物专业英语文选

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南京大学外文系普通英语教研组编



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內 容 提 要

生物专业英語文选下册，和上册一样，系由南京大学外文系普通英語教研組根据不同的原文書經過編选注释而成。本書共三十課，每課有課文、詞汇、詞組及語法分析四部分，書末附有总詞汇表。下册每課的篇幅和内容深度都較上册有所增加，除对动植物的分类、生活特征加以系統的叙述外，并以頗大的篇幅介紹了关于演化論、达尔文主义和米丘林的学說等方面的知識。

本書原稿曾以講義的形式試用过二年，它适于用作大学生物专业的英語教材，也可供一般研究生物学的英語讀者作为自修讀本。

生物专业英語文选

下 册

南京大学外文系普通英語教研組編

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本書所用語法術語略語表

<i>a.</i>	adjective (形容詞)
<i>adv.</i>	adverb (副詞)
<i>conj.</i>	conjunction (連詞)
<i>n.</i>	noun (名詞)
<i>p. a.</i>	participial adjective (分詞形容詞)
<i>pl.</i>	plural (复数)
<i>pref.</i>	prefix (前綴)
<i>prep.</i>	preposition (前置詞)
<i>pron.</i>	pronoun (代詞)
<i>sing.</i>	singular (单数)
<i>suf.</i>	suffix (后綴)
<i>v. aux.</i>	auxiliary verb (助動詞)
<i>v. i.</i>	intransitive verb (不及物動詞)
<i>v. t.</i>	transitive verb (及物動詞)

I. PARAMOECIUM (I)

Paramoecium lives in fresh-water ponds and streams, and is very easily obtained. Cultures prepared for Amoeba will in most cases sooner or later contain a host of Paramoecia.

General Morphology.—If a drop of water containing Paramoecia is placed on a slide, the animals may be seen with the naked eye moving rapidly from place to place. Under the microscope they appear cigar-shaped. A closer view reveals a depression extending from the end directed forward in swimming, obliquely backward and toward the right, ending just posterior to the middle of the animal. This is the oral groove. The cytostome is situated near the end of the oral groove. It opens into a funnel-shaped depression called the cytopharynx or gullet, which passes obliquely downward and posteriorly into the endosarc. The oral groove gives the animal an unsymmetrical appearance. Since Paramoecium swims with the slender but blunt end foremost, we are able to distinguish this as the anterior end. The opposite end, which is thicker but more pointed, represents the posterior end, while the side containing the oral groove may be designated as oral or ventral, the opposite side aboral or dorsal. The motile organs are fine thread-like cilia regularly arranged over the surface. Two layers of cytoplasm are visible, as in Amoeba, an outer comparatively thin clear area, the ectosarc and a central granular mass, the endosarc. Besides these a distinct pellicle or periplast is present outside of the ectosarc. Lying in the ectoplasm are a great number of minute sacs, the trichocysts, which discharge long threads to the exterior when properly stimulated. One large contractile vacuole is situated near either end of the body, close

to the dorsal surface, while a variable number of food vacuoles may usually be seen. The nuclei are two in number, a large macronucleus and a smaller micronucleus; these are suspended in the ectoplasm near the mouth opening. The anal spot can be observed only when solid particles are discharged. It is situated just behind the posterior end of the oral groove.

Cytology.—The endoplasm of *Paramoecium* occupies the central part of the body. It is supposed to be alveolar in structure. Most of the larger granules contained within it are shown by microchemical reactions to be reserve food particles; they flow from place to place, indicating that the protoplasm is of a fluid nature.¹ The ectoplasm does not contain any of the large granules characteristic of the endoplasm, since its density prevents their entrance. In this respect the two kinds of cytoplasm resemble the ectoplasm and endoplasm of *Amoeba*. If a drop or two of 35 per cent alcohol is added to a drop of water containing *Paramoecia*, the pellicle will be raised in some specimens in the form of a blister. Under the higher powers of the microscope the pellicle is then seen to be made up of a great number of hexagonal areas produced by striations on the surface.² These striations are really very fine grooves which cross one another obliquely.

The distribution of the motile organs, the cilia, corresponds to the arrangement of the striations on the cuticle, since one cilium projects from the center of each hexagonal area. These thread-like structures occur on all parts of the body, those at the posterior end being slightly longer than elsewhere. A cilium may be compared to a very fine pseudopodium which has become a permanent structure. It is an outgrowth of the cell protoplasm, coming from a basal body called a microsome which appears to arise from the nucleus. A fusion of cilia has occurred within the mouth cavity,

producing the undulating membrane. This is attached to the dorsal wall of the mouth, and guides the food particles that are swept within its reach.

Just beneath cilia, embedded in the cortical layer of the ectoplasm, is a uniform layer of spindle-shaped structures $\frac{1}{1000}$ mm. in length lying with their long axes perpendicular to the surface. These are trichocysts. They appear to be cavities in the ectoplasm filled with a semi-liquid homogeneous substance which is very refractive. They arise in the neighborhood of the nucleus. A small amount of osmic or acetic acid, when added to a drop of water containing *Paramoecia*, causes in some cases the discharge of the trichocysts to the exterior through very small canals.³ This explosion is due to the pressure derived from the contraction of the cortical layer of the ectoplasm. After the explosion, the trichocysts appear as long threads which have been extended to about eight times their former length. Trichocysts are supposed to function as weapons of offense and defense. It is said that their contents are discharged with considerable force and that they contain a poison strong enough to paralyze any single-celled animal. Evidence that the trichocysts are weapons of defense is furnished when *Paramoecium* encounters another ciliate *Didinium*. If the seizing organ of this protozoon becomes fastened in the *Paramoecium*, a great number of trichocysts near the place of the injury are discharged. These produce a substance which becomes jelly-like on entering the water; this tends to force the two animals apart, and, if the *Paramoecium* is a large one, it frequently succeeds in making its escape.

Two contractile vacuoles are present, occupying definite positions, one near either end of the body. They lie between the ectoplasm and the endoplasm, close to the dorsal surface, and communicate with a large portion of the body by means of a system of radiating canals, six to ten in number.⁴ The

vacuoles grow in size by the addition of liquid which is excreted by the protoplasm into the canals and is then poured into them. When the full size is reached, the walls contract and the contents are discharged to the exterior, probably through a pore. The two vacuoles do not contract at the same time, but alternately, the interval between successive contractions being ten to twenty seconds. The expulsion of the fluid contents of the contractile vacuoles may be seen in the following way. *Paramoecia* should be mounted in water into which has been rubbed up a stick of India or Chinese ink. They then appear white against a black background.⁵ Part of the water should be withdrawn from beneath the cover glass, thus slightly compressing them. If now a specimen in profile is found and watched, the discharge produces a bright spot outside in the opaque liquid; this lasts from one to two seconds, and is then driven off by the cilia.

In *Paramoecium trichium* the two contractile vacuoles are permanent structures with vesicles that collect and pour fluids into them and with a long convoluted excretory tubule ending in an excretory pore opening on the aboral surface.⁶ The duration of the systole is long compared with that of the diastole due probably to the presence of the excretory tubule. What has been said of the function of the contractile vacuole in *Amoeba* applies as well to that of *Paramoecium*, i. e. it acts as an organ of excretion and respiration, and is probably hydrostatic. Most of the nitrogen secreted by *Paramoecium* is in the form of urea and this substance has been detected in the contractile vacuole. However, the greater part of the excretory matter, including urea, apparently passes by dialysis directly to the exterior through the pellicle. That the primary function of the contractile vacuole is to regulate the water content of the protoplasm is indicated by the correlation between the frequency of pulsation and

the rate water is taken in.⁷ For example, most long periods between pulsations, up to six minutes when actively swimming, occur when little water is ingested, and most short periods occur when the animals are at rest.⁸

Certain granules and associated fibrils have been described in *Paramoecium* and considered to constitute a neuromotor apparatus sensory in function and of use in coordinating motion. Longitudinal ciliary fibrils, transverse commissural fibrils, and internal neurofibrils are present connected to the granules at the base of the cilia. These granules are connected near the periphery by the longitudinal ciliary fibrils and transversely by the commissural fibrils. The neurofibrils extend a short distance into the endoplasm and are perpendicular to the peripheral fibrils; they unite with each other and form a fan-like system.

Locomotion. — The only movements of *Paramoecium* that in any way resemble those of *Amoeba* are seen when the animal passes through a space smaller than its shorter diameter; it will then exhibit an elasticity which allows it to squirm through. In a free field *Paramoecium* swims by means of its cilia. These are usually inclined backward, and their stroke then drives the animal forward. They may at times be directed forward; their stroke then drives the animal backward. The direction of their effective stroke may indeed be varied in many ways, as we shall see later. In addition to its forward or backward movement *Paramoecium* rotates on its long axis. This rotation is over to the left, both when the animal is swimming forward and when it is swimming backward. The revolution on the long axis is not due to the oblique position of the oral groove, as might be supposed, for if the animal is cut in two, the posterior half, which has no oral groove, continues to revolve.

The cilia in the oral groove beat more effectively than those elsewhere. The result is to turn the anterior end

continually away from the oral side, just as happens in a boat that is rowed on one side more strongly than on the other. As a result the animal would swim in circles, turning continually toward the aboral side, but for the fact that it rotates on its long axis.⁹ Through the rotation the forward movement and the swerving to one side are combined to produce a spiral course. The swerving when the oral side is to the left, is to the right; when the oral side is above, the body swerves, downward; when the oral side is to the right, the body swerves to the left, etc.¹⁰ Hence the swerving in any given direction is compensated by an equal swerving in the opposite direction; the resultant is a spiral path having a straight axis.¹¹

Rotation is thus effective in enabling an unsymmetrical animal to swim in a straight course through a medium which allows deviations to right or left, and up or down.

詞 汇

Paramoecium [ˌpærəˈmiːsiəm] *n. sing.*

草履虫

slide [slaid] *n.* 承物玻璃片

elgar-shaped [siˈgɑː] *a.* 雪茄形的

depression [diˈprefən] *n.* 凹陷

posterior [posˈtiəriə] *a.* 后面的; *n.* 后部

oral groove [ˈɔːrəl gruːv] *n.* 口槽

cytostome [ˈsaitestoum] *n.* 胞口

funnel-shaped [ˈfʌnl] *a.* 漏斗状的

cytopharynx [ˌsaɪtəˈfæriŋks] *n.* 胞咽

gullet [ˈgʌlɪt] *n.* 食道

endosarc [ˈendəsɑːk] *n.* 内质

slender [ˈslendə] *a.* 细长的

unsymmetrical [ˌʌnsɪˈmetrɪkəl] *a.* 不

对称的

blunt [blʌnt] *a.* 钝的

foremost [ˈfɔːmoust] *a.* 最前的; *adv.*

在最前面

anterior [ænˈtiəriə] *a.* 前面的; *n.* 前

部

aboral [əˈbɔːrəl] *a.* 远口的, 反口的

cilia [ˈsɪliə] *n. pl.* 纤毛

cilium [ˈsɪliəm] *n. sing.* 纤毛

ectosarc [ˈektəsɑːk] *n.* 外质

pellicle [ˈpelɪkl] *n.* 表膜, 薄膜

periplast [ˈperiplɑːst] *n.* 核外浆, 核

围原浆

trichocyst [ˈtrɪkəsɪst] *n.* 棘胞

discharge [dɪsˈtʃɑːdʒ] *v. t.* 放出

anal spot [ˈeɪnəl spɒt] *n.* 肛点

suppose [səˈpəʊz] *v. t.* 假定

alveolar [ˈælvɪələ] *a.* 蜂窝状的

reserve [rɪˈzəːv] *a.* 储存的

entrance [ˈentrəns] *n.* 进入

blister [ˈblɪstə] *n.* 水泡

hexagonal [hekˈsæɡənəl] *a.* 六边形的

striation [straɪˈeɪʃən] *n.* 条纹

cuticle [ˈkjuːtɪkl] *n.* 表皮

project [prəˈdʒekt] *v. t.* 突出

basal body [ˈbeɪsl ˈbɒdi] *n.* 基体

microsome ['maikrəsum] *n.* 微粒体
 undulating ['ʌndjuleitiŋ] *membrane*
 波动膜
 embed [im'bed] *v. t.* 埋入, 嵌入
 cortical ['kɔ:tikəl] *a.* 外皮的
 spindle-shaped ['spindl-] *a.* 紡錘形的
 axes ['æksi:z] *n. pl.* 軸
 axis ['æksis] *n. sing.* 軸
 perpendicular [,pə:pən'dikjələ] *a.* 垂直的
 homogeneous [,homo'dʒi:nias] *a.* 同質的, 均質的
 refractive [ri'fræktiv] *a.* 有折射力的
 osmic acid ['ɔsmik] *n.* 鉻酸
 explosion [iks'plouzən] *n.* 破裂, 炸裂
 offense [ə'fens] *n.* 攻击
 defense [di'fens] *n.* 防御
 paralyze ['pærəlaiz] *v. t.* 使麻痺, 使无力
 furnish ['fə:nɪʃ] *v. t.* 供給, 提供
 encounter [in'kauntə] *v. t.* 遭遇
 ciliate ['silieit] *a.* 有纖毛的; *n.* 纖毛动物
 seize [si:z] *v. t.* 捕捉
 fasten ['fɑ:sn] *v. t.* 固定, 釘牢
 injury ['indʒəri] *n.* 伤害
 jelly-like ['dʒeli] *a.* 胶状的
 force [fɔ:s] *v. t.* 迫使
 occupy ['ɔkjupai] *v. t.* 佔据
 radiating ['reidiəitiŋ] *p. a.* 輻射狀的
 pour [pɔ:] *v. t.* 傾注
 pore [pɔ:] *n.* 細孔
 alternately [ɔ:l'tə:nitli] *adv.* 輪流地, 交替地
 interval ['intəvəl] *n.* 空隙, 間隔
 successive [sək'sesiv] *a.* 相繼的
 expulsion [iks'pəlʃən] *n.* 排斥, 驅逐
 expel [iks'pel] *v. t.* 排斥, 驅逐
 mount [maunt] *v. t.* 安置, 裝置
 stick [stik] *n.* 条, 根, 棒
 withdraw [wið'drɔ:] *v. t.* 縮回, 收回
 compress [kəm'pres] *v. t.* 壓縮
 profile ['prəufi:l] *n.* 側面

vesicle ['vesikl] *n.* 泡; 囊
 convoluted ['kɒnvəlʊtɪd] *p. a.* 盤旋形的
 tubule ['tju:bju:l] *n.* 小管
 duration [djʊə'reɪʃən] *n.* 持續期間
 systole ['sistəli] *n.* 收縮
 diastole [dai'æstəli] *n.* 舒張
 hydrostatic [haidrə'stætik] *a.* 靜水的, 靜水压的
 detect [di'tekt] *v. t.* 檢出, 覺察
 dialysis [dai'ælisɪs] *n.* 滲析
 frequency ['fri:kwənsi] *n.* 頻率
 pulsation [pəl'seɪʃən] *n.* 搏動
 ingest [in'dʒest] *v. t.* 攝取, 咽下
 neuromotor apparatus ['nju:rəməʊtə ,æpə'reɪtəs] 機動器官
 sensory ['sensəri] *a.* 知覺的
 longitudinal [,lɒndʒi'tju:dɪnl] *a.* 縱的
 transverse [træns've:s] *a.* 橫切的
 commissural [kə'mɪsjʊərəl] *a.* 合縫的, 接合的
 neurofibril [nju:rə'faɪbrɪl] *n.* 神經原纖維
 peripheral [pə'rɪfərəl] *a.* 周圍的
 fan-like [fæn-] *a.* 扇狀的
 squirm [skwə:m] *v. i.* 蠕動
 incline [in'klaɪn] *v. i.* 傾斜, 偏向
 stroke [strɒk] *n.* 振動, 打撃
 rotate [rou'teɪt] *v. i.* 旋轉
 rotation [rou'teɪʃən] *n.* 旋轉
 revolution [,revə'lu:ʃən] *n.* 旋轉
 boat [bəʊt] *n.* 小舟
 row [rou] *v. i.* 划
 circle ['sɜ:kl] *n.* 圓圈
 swerving ['swɜ:vɪŋ] *n.* 彎轉
 spiral course ['spaɪərəl 'kɔ:s] 螺旋形的路綫
 compensate ['kɒmpenseɪt] *v. t.* 补偿, 抵償
 resultant [ri'zʌltənt] *n.* 結果
 deviation [,di:vi'eɪʃən] *n.* 偏向, 偏離

詞 組

- a host of 大群, 許多
- to open into 通到
- a variable amount of 不定數的
- to be supposed to be 被假定為
- to cross one another 互相交叉
- to correspond to 和...相應的, 相當于
- within one's reach 在能達到的範圍內
- to function as 用作, 起...的作用
- to become fastened on 牢系于...
- to succeed in (doing) 成功, 完成; (做)成
- to force apart 迫使分開
- to make one's escape 逃脫
- to rub up 拌和
- in profile 側面的
- to take in 吸收
- at rest 靜止, 休息
- in any way 在任何方面
- at times 有時候
- but for 要不是, 如果不是由于

課 文 注 釋

1. Most of the larger granules contained within it are shown by micro-chemical reactions to be reserve food particles; they flow from place to place, indicating that the protoplasm is of a fluid nature. 微量化學反應顯示內質所包含的較大顆粒大部分為留存的食物微粒; 它們到處流動, 表示出原生質是流體性質的。本句是並列複合句, 由分號連接兩個分句; 前一分句中 contained within it 為過去分詞短語, 作定語用, 修飾 granules; 不定式短語 to be reserve food particles 為主語補足語; 后一分句中, 現在分詞短語 indicating that... 作狀語用, 表示附帶說明, that... 為賓語從句, 是分詞 indicating 的賓語。
2. Under the higher powers of the microscope the pellicle is then seen to be made up of a great number of hexagonal areas produced by striations on the surface. 在高倍數的顯微鏡下可以看出表膜是由在表面上的條紋產生的許多六邊形平面組成的。這是一個簡單句, 主語是 pellicle, 謂語是 is seen, 不定式短語 to be... areas 為主語補足語; produced ...surface 為過去分詞短語, 修飾 areas。
3. A small amount of osmic or acetic acid, when added to a drop of water containing Paramoecia, causes in some cases the discharge of the trichocysts to the exterior through very small canals. 當少量鉍酸或醋酸加入含有草履蟲的水滴時, 有時會使絲胞由很小的孔道排出體外。when... Paramoecia 是一個省略的時間狀語從句, 主句的主語是 a small amount of

osmic or acetic acid, 謂語是 causes, 賓語是 discharge; 前置詞短語 of the trichocysts, through very small canals 和 to the exterior 都用以修飾 discharge.

4. They lie between the ectoplasm and the endoplasm, close to the dorsal surface, and communicate with a large portion of the body by means of a system of radiating canals, six to ten in number. 它們位于外質和內質之間, 接近背面, 并且借助六个到十个放射状管系而与大部分体部相通. 本句謂語是 lie 和 communicate. between... endoplasm 和 close to the dorsal surface 用作狀語. six to ten in numbers 修飾 canals.
5. They appear white against a black background. 它們在黑色的底子的衬托下显得是白色的了. appear 起着联系動詞的作用; white 是表語, against... background 是狀語.
6. In *Paramoecium trichium* the two contractile vacuoles are permanent structures with vesicles that collect and pour fluids into them and with a long convoluted excretory tubule ending in an excretory pore opening on the aboral surface. 在旋毛草履虫中, 两个伸缩泡是永久組織, 它們具有能聚集液質并使其流入伸缩泡的囊. 以及一个长的旋捲的排泄細管, 細管末端有开向反口面的排泄孔. 前置詞短語 with vesicles... them 和 with...surface 都修飾 structure, 作定語用, 前者带有一个定語从句, 即 that... them, 修飾 vesicles; 后者带有分詞短語 ending in an excretory pore 修飾 tubule. opening on the aboral surface 修飾 pore.
7. That the primary function of the contractile vacuole is to regulate the water content of the protoplasm is indicated by the correlation between the frequency of pulsation and the rate water is taken in. 伸缩泡的主要作用是調节原生質的水含量, 这一点可由伸缩泡搏动的頻率和水分吸入的速率之間的相互关系所表明. That... protoplasm 为主語从句, between... in 修飾 correlation, water is taken in 是定語从句, 修飾 rate, 句首省略 at which.
8. For example, most long periods between pulsations, up to six minutes when actively swimming, occur when little water is ingested, and most short periods occur when the animals are at rest. 例如当草履虫不断游泳时只嚥下很少水分, 搏动的間隔時間最长, 达六分鐘, 但当它靜止时, 搏动的間隔時間最短. 本句是并列复合句. 前分句中主語是 periods, 謂語是 occur, 時間狀語从句 when... ingest 修飾 occur, 前置詞短語 up to six minutes 修飾 periods, when actively swimming 是省略的時間狀語从句. 即 when the animals are swimming, 也修飾 occur.
9. As a result the animal would swim in circles, turning continually toward the aboral side, but for the fact that it rotates on its long axis. 如果不是由于草履虫沿着长軸旋轉, 結果就会打圈游行, 不断轉向反口側.
10. The swerving when the oral side is to the left, is to the right; when the oral side is above, the body swerves downward, when the oral side is to the right, the body swerves to the left, etc. 口側在左边时身体就轉向右方, 口側在上时身体轉向下, 口側在右方身体則轉向左方.
11. Hence the swerving in any given direction is compensated by an equal swerving in the opposite direction; the resultant is a spiral path having

a straight axis. 因此, 任何按一定方向的弯轉就为方向相反的同等的弯轉所抵償, 合成的結果是一條具有直軸的螺旋形路線.

2. PARAMOECIUM (II)

Nutrition. — The food of *Paramoecium* consists principally of bacteria and minute protozoa. The animal does not wait for the food to come within its reach, but by continually swimming from place to place is able to enter regions where favorable food conditions prevail. The cilia also aid in bringing in food particles, since a sort of vortex is formed by their arrangement about the oral groove which directs a steady stream of water toward the mouth.

The formation of a food vacuole is as follows. Food particles that are swept into the mouth are carried down into the cytopharynx by the undulating membrane; they are then moved onward by the cilia lining the cytopharynx and are finally gathered together at the end of the passageway into a vacuole which gradually forms in the endoplasm. When this vacuole has reached a certain size, it is pinched off from the extremity of the cytopharynx by a contraction of the surrounding protoplasm, and the formation of another vacuole is begun. A food vacuole is a droplet of water with food particles suspended within it. As soon as one is separated from the cytopharynx, it is swept away by the rotary streaming movement of the endoplasm known as cyclosis. This carries the food vacuole around a definite course which begins just above and behind the cytopharynx, passes backward to the posterior end, then forward near the dorsal surface to the anterior end, and finally downward and along the ventral surface toward the mouth. During this journey digestion takes place.

Unlike *Amoeba* a special anal spot or cytopyge is present in *Paramoecium* through which indigestible solids are

discharged to the outside. This opens on the ventral surface just behind the mouth. It can be seen only when material is cast out. It is not yet known whether the anal spot is a permanent orifice whose lips are so tightly closed as to be invisible to us or whether a fresh opening is made at each discharge. The processes of digestion, absorption, dissimilation, excretion, respiration, and growth are so similar to those described for *Amoeba* that they need not be considered further at this place.

Reproduction — *Paramoecium* reproduces only by simple binary division. This process is interrupted occasionally by a temporary union (conjugation) of two individuals and a subsequent mutual fertilization.

Binary fission — In binary fission the animal divides transversely. The first indication of a forth-coming division is seen in the micronucleus, which undergoes a sort of mitosis, its substance being equally divided between the two daughter nuclei; these separate and finally come to lie one near either end of the body. Then we can see two dividing micronuclei; there are two of these in *Paramoecium aurelia*. The macronucleus elongates and then divides transversely. The cytopharynx produces a bud which develops into another cytopharynx; these two structures move apart, the old cytopharynx advancing to the ventral middle line of the forepart of the body, and the new one to a similar position in the posterior half. The undulating membrane remains with the old cytopharynx while a new one arises in connection with the new cytopharynx. A new contractile vacuole arises near the anterior end of the body, another just back of the middle line. While these events are taking place a constriction appears near the middle of the longitudinal diameter of the body; this cleavage furrow becomes deeper and deeper until only a slender thread of protoplasm holds the two halves of the body together. This connection

is finally severed and the two daughter Paramoecia are freed from each other. Each contains both macro- and micronuclei, two contractile vacuoles, and a cytostome with cytopharynx. The entire process occupies about two hours. The time, however, varies considerably, depending upon the temperature of the water, the quality and quantity of food, and probably other factors. The daughter Paramoecia increase rapidly in size, and at the end of twenty-four hours divide again if the temperature remains at from 15° — 17°C. ; if the temperature is raised to 17° — 20°C. , two divisions may take place in one day.

Encystment of Paramoecium has been described, but if it really occurs, it apparently is a rare phenomenon.

Conjugation — At a certain time in the life cycle of Paramoecium conjugation occurs. The conditions that initiate this process are not yet known, but the complicated stages have been quite fully worked out. When two Paramoecia, which are ready to conjugate, come together, they remain attached to each other because of the adhesive state of the external protoplasm. The ventral surfaces of the two animals are opposed, and a protoplasmic bridge is constructed between them. As soon as this union is effected, the nuclei pass through a series of stages which have been likened to the maturation processes of metazoan eggs. Two micronuclei are present in this species. The micronuclei grow larger, their chromatin breaking up into granules which radiate from a division center at one end. The nucleus then lengthens, forming a spindle, and subsequently divides into two. These immediately divide again without the intervention of a resting stage. The resultant eight nuclei have been compared to the sperms produced by primary spermatocytes or to eggs with their polar bodies, and the divisions are considered as the first and second maturation mitoses. Reduction occurs, at least in part, at the second maturation division. Seven