THESIS.

ON THE FAUNA OF DEEP WELLS.

BY

ALICE M. BARBER

FOR THE DEGREE OF

IN THE COLLEGE OF SCIENCE.

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The material for this study was obtained from seven wells in the vicinity of Champaign. The field covered was small, all of the wells being within a mile of the main University building. Many different collections were made during the winter and spring months, and life was found each time, the kind and quantity seeming to depend only upon the method of collecting.

The literature bearing on the subject is limited. Franz Vejdovsky published in 1882, "Thierische Organismen der Brunnenwässer von Prag," but in this country no naturalist has yet made a systematic study of the fauna of deep wells. Articles of great service in pursuing this line of study are to be found among the publications of Professor Forbes, who has from time to time worked on the minute animal life in Illinois lakes and streams. A list of all books and articles referred to will be given at the close of this paper.

The source of water in any well is decided by the geological conditions of the region in which the well is located. The soil of
Central Illinois consists of drift, varying in depth from 50 ft. to 450 ft., being 350 ft. in the vicinity of Champaign. Through this drift, narrow strips of gravel are intercalated. These occur at different depths and mark the successive retreats of glaciers. They are but beds of glacial streams whose waters washed out and carried away all clayey deposits. Surrounded as they are on all sides by clay, they form excellent waterways. Indeed a more perfect natural water-pipe would be hard to find, and a well sunk to one of them is sure to give water some part of the year. Many of these gravel beds come to the surface at the foot of moraines within a few miles of Champaign. This fact by itself tells something of the source of our water supply; and therefore something of the source of the life found therein. It may also explain why so many wells fail in dry seasons.

As the minute animal life of a well is largely determined by the condition of the well itself,—the material used in stoning, the kind of pump etc., a description of each well from which collections were made is given below.

No. I is an old well located in low, level grounds, a few rods south-west of the University. It is 30 ft. deep; is bricked, and has a wooden pump. The curb is of wood, is raised a few inches, and fitted closely around the pump. From this well I collected fully a hundred specimens of *Cyclops geyrinus* Forbes, numerous oligochaetous worms of the genus *Lumbriculus*, large enough to be readily seen by
the unaided eye, a few examples of Chaetonotus, Rotifers and Amoebae.

No. II is the well on the Howe place in Urbana. It was first dug 20 ft. deep and then bored 40 ft. lower. It is bricked up and the pump is of wood. There is no pump from the bored well. From II, but two collections were made, resulting in three species of crustaceans, belonging to the genera Asellus, Cyclops, and Cypris.

No. III is the well at the Experiment Station. It was dug in 1888, is 34 ft. deep; bricked up; has a tight plank curb and wooden pump, set one foot from the bottom. Many collections were made from III. Cyclops n.s. were found, not in such great abundance as C. gyrocinus, but some were brought in with each collection. This well also contained Asellus, a few young forms; Cypris quite numerous; several Nematodes too young to be determined; a few Rotifers; a number of Vorticella, and many small flagellated and ciliated Infusoria.

A crustacean was brought to me from well IV. No further examination was made.

No. V is a well in the cellar of Rev. Mr. Wilder's residence, Champaign. It is about 40 ft. deep, is bricked up, and has a chain-pump. Many specimens of Asellus were found in this well, also a specimen of Phreorocytes emissarius, a rare and lately described worm. A few specimens of Vorticella and other ciliates, and numerous small flagellate forms were also taken.

No. VI is the well on the Hart place. It is about 30 ft. deep and is bricked up.
An Asellus and a worm was found in a glass of water from the "Drill Hall" well (VII). The worm was different from any before collected, but was unfortunately destroyed in the process of mounting.

In collecting, great care must be taken, as the water brought in for examination should be kept free from any contamination. Vessels used for collecting were thoroughly washed, rinsed with alcohol, and then again with water from the well under examination. Flasks in which water was allowed to stand were first cleaned with hydrochloric acid, then carefully washed, rinsed with alcohol, and sterilized by being kept in an oven, heated to 100°C. for several hours. They were then corked with cotton which had been subjected to the same heat.

Feb. 1, a 250 c.c. flask made heavy with lead, was lowered to the bottom of well No.1, the cotton plug being removed by means of a thread, after the flask had reached the bottom. When drawn up it was again corked with sterilized cotton. The water was perfectly clear, and no life was found on examination under high powers of the microscope. The flask was left standing in the sunlight. Nearly a month later, delicate, golden brown threads were seen attached to the bottom and sides of the flask. They proved to be diatoms, showing that there were germs of life in the water at the time it was brought in. Meanwhile other methods were tried. A flask of water was taken from the surface of the same well, but in it no life was found. Feb. 2, several gallons of water were strained through a
double silk net, tied over the pump-spout. The net was then rinsed into a collecting jar, and the jar quickly closed. A number of Cyclops, an Amoeba, and two specimens of Chaetonotus were the harvest this time. Other collections were made from this well in a similar manner. More than thirty Cyclops were brought in at one time.

Feb. 26, A small tin pail, loaded with lead was dropped to the bottom of the well. The water brought up was put into three flasks. The sediment at the bottom of the flasks contained life.

Specimens of crustacea and worms were often simply pumped up.

The last method tried was that used by Mr. Geo. Rafter in his work on the micro-organisms of Hemlock Lake. (Report of Rochester Academy of Science, 1888).

An inch of sand was supported in the tube of a funnel by a piece of a fine wire netting and 500 c.c. of water filtered through it. The sand was then washed into 5 c.c. of water and examined. Some hours elapsed before the examination could be made, and the results were doubtful; but the amount of debris in the sand showed that it had been a good filter, and the method would probably have proved effectual could it have been given further trial.
Crangonyx mucronatus, Forbes. "This remarkable species is perhaps entitled to rank as the type of a new genus; but, until I have the material for a more general study of its relations than I am able to make at present, I prefer to place it with its nearest allies in the genus Crangonyx.

Colorless, blind; length 9 to 10 mm, width 1 mm. The head is a little longer than the first thoracic segment, its anterior margin concave at the bases of the upper antennae, convex between them; the posterior margin straight in the middle and curving forward on the sides. The front angles of the first thoracic segment are uncovered and produced a little forward; the hind angles of the first five segments are rounded and produced strongly backward. The first three abdominal segments have the lateral margins and all the angles broadly rounded, and the posterior angles, as well as the posterior margin of the seventh epimeron, are slightly notched and bristled. The upper antennae of the male are two-thirds to four-fifths as long as the body. The first and second joints of pedicel are sub-equal, each about as long as the basal joints of the flagellum; the third is one-third as long as the second. The flagellum is about five times the length of the pedicel, and is composed of 30 to 35 joints, each
with a few short hairs at tip, and all except the seven or eight basal joints and the last with a slender olfactory club. The secondary flagellum contains two bristled joints, together a little longer than the first of the primary flagellum. Pedicel of lower antennae longer than that of upper, the last two joints equal, each a little longer than basal joints of upper antenna. Flagellum nine or ten jointed, without olfactory clubs. Right mandible with dental laminae equal, each with five conical, obtuse, sub-equal teeth. The anterior lamina of the left mandible is much the larger and stronger, with three very strong, blunt teeth; posterior lamina with three slender and acute teeth. Palpus three-jointed; basal quadrate, about half as long as second, which is clavate and nearly twice as wide as long, with about ten hairs on its rounded hind margin which are longest and closest distally. Last joint a little longer and narrower than second, regularly convex in front on distal half, and fringed here with about 24 slender hairs, the three or four at tip becoming suddenly very much longer. A few scattered hairs on front margin of this joint.

Inner plate of anterior maxilla nearly hemispherical, about half as long as outer, with four plumose hairs on the rounded margin, which are about as long as the plate itself. Palpus two-jointed, first quadrate, one-third as long as second, which is oval pointed, tipped with two claws and some smaller spines. Laminae of basal joints of maxillipeds short, neither pair extending beyond tips of
succeeding joints.

First two pairs of feet equal. Dactyl of first pair in male curved, two-thirds as long as hand. The latter is broad-ovate, two-thirds as wide as long, the palmar and posterior margins forming a wide angle. Long hairs on posterior surface in transverse rows. Palm with about fifteen short, notched spines, each with a hair arising from the notch. Carpus sub-triangular, three-fourths as wide as propodus, hind margin very short, with one or two pectinate spines and a few long hairs. Second pair similar, propodus a little longer and narrower; carpus as wide as propodus, posterior margin longer, with about five transverse rows of long bristles, of which the distal rows are doubly pectorate on terminal third. The three posterior pairs of thoracic legs increase in size backwards, the first of these being not quite two-thirds as long as the last. The seventh epimeron is narrow, with the lower margin regularly arcuate. The tips of the first pair of anal legs extend beyond the tips of the second, and these beyond the tips of the third. The latter are therefore very short, about as long as the pedicel of the second pair. The outer ramus is ovate, truncate, half as long as the pedicel, and hairy at tip; the inner is an unarmed rudiment, one-fourth or one-fifth the length of the outer. The telson of the male is a smooth cylindrical appendage, usually about as long as the first three abdominal segments, and as large as the last joint of the pedicel of the lower antenna. It presents a very slight double curve, is obliquely
rounded at the end and tipped by a cluster of short hairs. In some cases this appendage is half as long as the body.

The female differs in the following particulars. The upper antennae are only about half the length of the body, the flagellum not more than three times as long as the pedicel, and the secondary flagellum is usually a little shorter. The propodus of the first pair of feet is similar in outline, but the palmar margin and dactyl are shorter and the posterior margin longer. The second pair are extremely like the second of the male, but are decidedly smaller than the first. The telson affords a difference so remarkable that the two sexes, at first sight, would hardly be referred to the same genus. In the female this is very similar to the telson of C. gracilis, Sm. It is flattened and slightly emarginate, a little longer than broad extending to the tips of the second pair of anal legs, and bears two terminal clusters of spines of four or five each.

This species was first discovered by me in a well at Normal, Iills., during the summer of 1875. It was subsequently found by Mr. Harry Garman in great numbers in springs, and even at the mouths of drains, after a long period of heavy rains. With the advent of dry weather it entirely disappeared from these, but still occurs sparingly in wells."

Only two specimens of this species were obtained, both females.
Order Isopoda,

Family Asellidae,

"Asellus stygius" (Packard) Forbes. "Colorless, blind, narrow, very loosely articulated, sides nearly parallel, 12 to 14 mm. by 2 to 3 mm.

The head is a little narrower and longer than the first thoracic segment, narrower in front than behind, with the front margin concave, the front angles rounded, the hind margin nearly straight. It is a little constricted behind the mandibles. The first thoracic segment is narrowed a little to the front so as to show the epimera, the sixth and seventh are also much narrower before than behind, and longer than the others. The front angles of the second and third segments are obliquely truncate, the hind angles broadly rounded. All the segments behind the first are slightly emarginations being carried gradually backward to the posterior angles. The anterior margins of the segments change gradually from concave to convex, and the posterior margins from sinuate to deeply concave. The head and all the segments are slightly pubescent above and bordered laterally with short hairs. The large abdominal segment is preceded by two very short ones. The abdomen is about as long as the last two thoracic segments, the hind angles rounded but distinct, the hind margin very slightly sinuate.

The upper antennae reach to the tip of the penultimate joint of the pedicel of the lower. Pedicel and flagellum about equal, latter
ten to twelve-jointed, bearing a slender olfactory club at tip of each of the four or five joints preceding the last. Joints of pedicel sub-equal in length, but the first twice as large as the second.

The lower antennae are about two-thirds as long as the body in the female, in the male somewhat longer. Pedicel about one-third flagellum, five-jointed, fifth and sixth joints each longer than the basal three together. The flagellum contains 75 to 80 joints. The mandibles are almost exactly as in Asellus aquaticus. The posterior dental plate of the left mandible is nearly as wide as the anterior. The hairs of the marginal fringe are more numerous on the right mandible than on the left, and the anterior eight are toothed instead of plumose.

The mandibular palpus is slender, the basal joint a little shorter than the second. On the latter the external angulation is considerably behind the middle. The distal joint is narrow, lunate, (distinctly concave on outer margin) about five-sixths the length of the preceding joint, with about 20, jointed, plumose, marginal hairs, similar to those on the distal half of outer margin of preceding joint. The two plates composing each maxilla of the first pair are equal in length. The inner is three-fourths as wide as the outer, terminating in five plumose hairs. The outer terminates in twelve strong spines, of which the five outer are stronger and simple, and the seven inner irregularly and bluntly toothed near their tips. The posterior maxillae as in Asellus aquaticus. The shorter inter-
nal hairs on the two outer plates are expanded transversely to the plane of the plate and hollowed lengthwise on the inner face, giving each hair the form of a racing-shell, while both edges of the hair are coarsely toothed. The basal joint of the palpus of the maxilliped is quadrate, the fourth joint is about as long as the second and third together. The inner margins of the fourth and fifth are provided with very long hairs. The flagellum (fouet, Sars.) is as broad as long, with about eight scattered hairs at tip and several shorter ones on external margin.

The propodus of the first pair of feet in the male is very large, broad-oval, two-thirds as wide as long. A strong curved spine is situated at the proximal end of the palm, and two truncate, stout teeth separated by a rounded emargination, near the distal end. The dactyl is strongly curved, especially at base, its inner edge serrate with six acute teeth appressed towards tip. The length of the terminal claw is more than one-third that of the entire dactyl. The convex margin of the dactyl bears a few scattered hairs, and a cluster of four or five near the tip. The carpus is small as in A. aquaticus, and spined on its distal margin. The female hand is smaller and narrower, (width to length as 1 to 1 1/4) the palmar margin concave, the pair of truncate teeth replaced by a single smaller conical one which is sometimes obsolete. The other differences are trivial. The legs become longer behind, the tip of the second pair reaching as far as the base of the propodus of the seventh.
The abdominal sexual plates of the male are in two pairs, as usual. The corresponding plates of the female are but one pair, rather narrowly ovate, ciliated at tip and on posterior two-thirds of outer margin, with a few short spines at the base of the inner edge. The external rami of the next pair --serving as a gill-cover-- bears a terminal fringe of plumose hairs and a few short spines at base on outer margin. The inner ramus—first gill—is oblong, two-thirds the length and breadth of the outer. Both the pedicel and rami of the caudal stylets are slender and cylindrical, the former about as long as the last two joints of the last pair of legs, the latter tipped each with a cluster of bristles, the inner about two-thirds as long as the pedicel, the outer varying from one-quarter to two-thirds the inner. The length of the rami varies greatly with age and sex. In many old males the inner is very long, and the outer minute. There are four pairs of incubatory lamellae in the female, each pair overlapping by their rounded inner ends, except the first, which are shorter and have the anterior internal angles emarginate.

After a long period of heavy rains during the last summer had greatly swelled the subterranean streams which these species inhabit, they appeared at the surface in springs, and even at the mouths of tile drains, in such numbers that a hundred could be taken away in an hour. A few females were observed with eggs at this time. (July).

This species was found in four of the wells examined and was very abundant in two of them. Many of the specimens were young.
Order Copepoda.

Family Cyclopidae.

*Cyclops gyrinus*, Forbes.

"A stout, heavy species, with long first segment, strongly arched cephalothorax, short furca, well-developed terminal setae, and seventeen-jointed antennae, reaching the abdomen, with acute ridge on the three distal joints, that on the last serrate.

Total length 1.8 mm, cephalothorax 1.1 mm long, .63 mm wide, and .43 mm high; abdomen and furca .7 mm long, equaling the longest bristle.

Basal segment of antennae without circlet of minute hairs, the second segment short, the third shorter, the fourth equal to the second and third together, the fifth a little longer than the second, the sixth equal to the third, the seventh slightly longer than the fifth and sixth together; segments eight to eleven sub-equal, increasing a little in length, twelve to fourteen a little longer, fifteen to seventeen much longer. Antennules with line of delicate hairs inclosing a patch on posterior surface of each segment, elongate oval on all but the proximate, where it is circular.

Labrum with twelve conspicuous teeth, the second from each end decidedly larger than the others.

The swimming legs with all the rami three-jointed. The first pair with the segments of the outer rami about as broad as long,
the terminal segment with one spine, and two spine-like setae at tip, two spines without and three setae within; the other segments all with one spine and one seta. The inner rami with one very stout spine at tip and one very slender seta not longer than the spine, one seta without and three within on the distal segment; the basal segment of this rami with one seta and the second with two.

Second pair of legs with two very stout spines and a slender seta at tip of the last segment of the outer rami, two stout spines without and four setae within. The armature of the inner rami like that of the preceding.

Outer rami of the third pair of legs with two spines and one seta at tip (the inner spine the longer), three spines without and four setae within; the inner rami as before.

In the fourth pair of legs, the outer rami has two spines and one bristle at tip (the bristle shorter than the longer spine), one spine without and four bristles within, the lower of the latter abortive. The inner rami has the last joint slender, truncate, with two stout spines at tip, the outer one the larger, with one seta without and two within.

The fifth pair of legs are jointed, the basal segment two-thirds as wide as long, its outer margin straight, its inner, convex and minutely hairy. The distal end is truncate, with very long seta at the outer distal angle. The second (terminal) segment is about as long as the preceding is wide, lobed in the middle, and
tri-setose, the outer seta shorter than the inner, and the latter about half as long as the median.

Abdomen short, the greatest breadth but twice in length, the furca short and broad, the rami half as wide as long, about as long as the two last segments of the abdomen. The inner terminal bristle three times as long as the outer, three fifths as long as the outer median, and about two fifths the length of the longest. A transverse row of spinules at the base of the outer seta; the distal end of the last abdominal segment dentate; and the distal end of the segment preceding with a few teeth at the sides.

Last thoracic segment minutely dentate on posterior margin.

This species is allied to coronatus, from which it is distinguished (among other characters) by the absence of the dentations of the antennal segments, which gave the latter its name, by the absence of cilia on the inner surfaces of the rami of the furca, and by the much smaller size.

Described from several specimens (females) taken in shore at the head of Keweenaw Bay on the south shore of Lake Superior.

Collected in great numbers from the well south-west of the University. Both male and female were found, also many young.

Cyclops-?

A species with eleven-jointed antennae. Found sparingly in the Howe well. Not carefully examined.
Cyclops Thomasi. Forbes.

"Body slender. Sides of the fourth segment postero-laterally produced into recurved angles, a slight approach to which angulation is seen in the second and third segments. Lateral angles of the fifth, pinched into a slight fold or notch just back of the apex. (In the male, none of the segments are produced into angles at the sides.) In the first abdominal segment, a lateral indentation marks off the much dilated-anterior from the tapering posterior portion. The last three abdominal segments do not taper individually, nor scarcely as series. Posterior border of the last abdominal segment set with a fine pectinate fringe. Caudal rami slender; six to seven times as long as broad; fully equal in length to the two and a half segments immediately preceding. Each ramus bearing six finely-plumose setae, and on the outer side, at about one-fourth its length from the base, a short transverse row of six to eight point-like spines, similar to those which constitute the pectinate fringe of the last abdominal segment. Of the four apical setae, the first is much shorter than the furca, the fourth still shorter, the second fully three times as long as the furca, and the third about half as long as the second. The webs of the second and third extend well toward the rami. First antennae, seventeen-jointed, scarcely reaching the third body-segment. (Nearly reaching the fourth segment in the male.) Labrum usually with eleven teeth. The armature of the swimming feet is as
(18)

follows:

First Foot.

(a) Outer branch

: (b) Inner branch.

: ex., one spine :

Basal joint—interiorly, " seta : basal joint—interiorly, one seta.

: exteriorly, one spine :

Middle joint—interiorly " seta : Middle joint—interiorly, two setae.

: exteriorly, two spines :


: interiorly, " setae :

: one seta.

: in., three setae.

Second foot.

Outer branch.

: Inner branch.

: ex., one spine .


: ex., one spine.

Middle joint— : in., " seta.

: ex., two spines.

Apical joint : ap., one spine.

: one seta.

: in., three setae.

Third Foot.—Like second foot.

Fourth foot.
### Outer branch
- **:ex., one spine.**
- **Basal joint- :in., one seta.**
- **:ex., one spine.**
- **Middle joint :in., one seta.**
- **:ex., two spines.**
- **Apical joint :ap., one spine.**
- **: one seta.**
- **:in., three setae.**

### Inner branch
- **:ex., unarm ed.**
- **Basal joint- :in., one seta.**
- **:ex., unarm ed.**
- **Middle joint :in., two setae.**
- **:ex., one seta.**
- **Apical joint :ap., two spines.**
- **:in., two setae.**

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Inner of the two apical spines of the inner branch of the fourth foot half the length of the outer. Fifth foot composed of two joints, of which the apical is well developed and about half as wide as the basal; the basal bearing at its outer angle a rather short seta, the apical bearing one rather short and one long seta. Ovisacs small, broadly elliptical, with major axes parallel to the sides of the abdomen, which they partly cover. Each ovisac contains from thirteen to twenty-two (usually sixteen to twenty) large eggs. Animal yellowish white, or sometimes particolored in yellow and white.

(In the male, the yellow first abdominal segment contrasts with a lighter-colored segment preceding and following.) Ovaries often colorless, but becoming darker as the eggs approach maturity. Ovisacs varying from dark blue-gray in the earlier to almost colorless
in the later stages of the development of the contained eggs.

Length of animal, exclusive of caudal setae, 1.11 mm. (Male .92 mm.)" (Cragin's description.)

Six specimens taken from the Hart well.

Cyclops —n.s.

No description that I have at hand answers for this Cyclops.

It is a small species, with seventeen-jointed antennae reaching nearly to the posterior edge of the second segment of the cephalothorax; long first segment, short furca, and well developed caudal setae.

The length without caudal setae is 1mm, the greatest width .31mm. Length of cephalothorax .7mm; of abdomen and furca .28mm, more than half the length of the longest caudal seta.

The first segment of the antenna is long, being a little more than equal to the second, third and fourth segments together. The second segment short, the third a little more than half the length of the second; fourth longer than second; fifth shorter than fourth equaling second; sixth half the length of fifth; seventh equal to fifth and sixth together; eighth to eleventh sub-equal, about half as long as seventh; twelfth longer than eleventh; thirteenth and fourteenth nearly equal; fifteenth longer, equal to twelfth; sixteenth equal to two of ninth, seventeenth still longer. Antennules four jointed. Labrum with 12 well defined teeth. The second and third from either end are larger than the others, and point outwards. In
the adults all the rami of the swimming legs have three segments. In some of the young the dividing line between the second and third segments is not present. The outer ramus of the first leg has the basal segment armed with one spine without and one seta within. The armature of the middle segment is similar to that of the basal. The apical segment has two spines without, two setae at tip, and two setae within.

The basal and middle segments of the inner ramus are not armed exteriorly, but the outer distal angle of each is produced into a short spine. This feature is very noticeable. Both have one seta within. The apical segment has the same modification of the angle and one seta without; one spine and one seta at tip, and three setae within.

Second pair of legs: Basal segment of the outer ramus has one spine without, one seta within; middle segment one spine without, one seta within; the apical segment has two spines without, one spine and one seta at tip, and three setae within. The inner ramus has a fringe of fine hairs on the outer margins of all the segments, and the same production of the distal angles as seen in the first pair. The last segment has one spine without, one spine and one seta at tip, and setae within.

Third pair of legs: Outer rami, basal segments, one spine without and one seta within; middle segment, one spine without, one seta within; apical segment, two spines without, one spine
and one seta at tip, and three setae within. The first two segments of the inner ramus are unarmed without, and each have one seta within. The apical segment has one seta without, two spines at tip, and two setae within.

The fourth pair of legs are armed the same as the third.

The fifth pair of legs have two segments. The first is broad and has a seta on the outer angle. The second segment is nearly cylindrical and has one seta and one spine at the tip.

Abdomen of the female stouter than that of the male. The last segment in both finely toothed on the distal margin. Rami of furca more than twice as long as broad. Inner caudal setae twice the length of outer.

Found in many different collections made from well at Experiment Station. Not so abundant as *G. gyronus*, but occurring in quite large numbers.

Order Ostracoda,

Family Cyprididae.

*Cypris sp.*

Many adult and young specimens taken from wells I and III.

Also found in well II.
VERMES.

Nemathelminths.

Order Nematoda.

Family Anguillulidae.

One young undeveloped specimen was taken from well I.

Annelida.

Order Oligochaeta.

Family Phreoryctidae.

Phreoryctes emissarius, Forbes.

"A very long and slender worm, six to eight inches, or more, in length (in alcohol), by .6 to .7 mm. in diameter,— the segmentation very distinct, the color pale red, the cuticle highly iridescent. The cephalic lobe is separated from the first segment by a rather deep lateral constriction. It is broadly rounded in front, and about two-thirds as wide as long. Segments nearly quadrate, four hundred or more in number. (An imperfect specimen contained three hundred and seventy-five.) Setae single, acute, the first segment with two very small ventral and no dorsal ones. Four rows on the following segments to the eightieth or ninetieth; on the remainder of the body only two rows, the dorsal setae disappearing. The last of this series become very minute and variable, and are frequently wanting on here and there a segment preceding the last that bears them. The ventral setae are very large and long, and
strongly hooked, but diminish in size at the two ends of the body. They project into the coelom, when retracted, a distance equal to two-thirds the whole diameter of the worm.

Two longitudinal blood vessels, both closely applied to the alimentary canal, one dorsal and one ventral, the dorsal one contractile. A pair of long contorted vascular arches in each segment, extending loop-like into the ventral coelum, below the sub-intestinal vessel. Nephridia, a pair to each segment opening upon the surface a short distance in front of the ventral setae."

One live specimen pumped up from well in Rev. Mr. Wilder's cellar. Nearly six inches long, having about 310 segments.

**Family Lumbriculidae.**

*Limbricus* sp.,

Several specimens were brought in from well I. (In box I mounted in glycerine jelly.)

**Rotatoria.**

**Order Philodinida.**

**Family Philodinidae.**

*Rotifer* sp-

Four or five specimens taken from well II.

**Order Ichthydina.**

**Family Ichthydinae.**

*Chaetonotus.*
Three specimens, Well I.

PROTOZOA.

Class Sarkodina.

Sub Class Rhizopoda.

Order Amoebae.

Amoeba sp.;

A few specimens. Probably Amoeba proteus.

Class Mastigophora.

Order Flagellata.

Many specimens of a number of small forms. Wells III and V.

Class Infusoria.

Sub-Class Ciliata.

Order Peritricha.

Vorticella sp.

Order Holotricha.

A few. Also many small Infusoria which were not studied.

Summing up we find three sub-kings, twelve orders, and more than twenty species here represented. The list is incomplete and further collections from these and other wells in this locality will probably add many species.

It is not safe to make general statements based on such limited research, but so far as the investigation has been carried the
crustacean fauna has been found to be more varied and abundant than any other group. Seven species were noted in all. The Isopod, *Asellus stygius*, was found in four wells, occurring in great numbers in two of them. Six specimens were counted in a single gallon of water, drawn from the Drill Hall well, and the water-pail habitually filled from that well seldom fails to contain one or more of them. This is the blind *Asellus* of Mammoth Cave, Kentucky, first described by Prof. Packard under the name *Caecidotea Stygia*, later re-described by Prof. Forbes and placed under the genus *Asellus*. It is very common in springs and tile drains in this section.

The amphipod, *Crangonyx mucronatus* is not so often met with. Around Champaign, it occurs but sparingly in drains, and is still less frequently found in wells. Under the order Copepoda, four species were determined. Each species had a special well for its home and was never found in any neighboring well. This fact would seem to argue different sources of water and life for each of the four wells, though their localities are closely associated.

Of the four species of *Cyclops*, *C. gyroinus* was taken in the greatest numbers. This species, though so lately named, is probably widely distributed. The first specimens were taken from Lake Superior, later it was found in the lakes of Yellowstone Park.

Ostracoda, another order of our predaceous entomostraca, is represented by *Cypris* sp. a well known form in the lakes and ponds of Illinois. Every collection from three of the wells contained a
number of specimens of Cypris.

The sub-kingdom Vermes is generously represented. The three wells from which the greatest number of collections were taken yielded many specimens. Four orders and seven species were present. Of these Phreoryctes emissarius is the most worthy of note. Previously found in a well in McLean county, Illinois, (March 1880); and afterwards in a mass of roots of the elm taken from a tile in a farm drain (1890).

But little work was put upon the Protozoa. They were found attached to or swimming among bits of vegetation, pieces from the pumps etc. The crustaceans were the most interesting and further study of them may add materially to the list of Illinois Crustacea.
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