

3.9 BACTERIA - FUNGI - PARASITES - SPERMATOOZOA

The presence of bacteria in the sediment very often results from improper collection of the specimen, or from delays in carrying out the examination. Otherwise the finding of bacteria in freshly voided urine specimens is an unequivocal sign of a significant bacteriuria. The presence of three to five bacteria per high power field (i.e. 400x) is usually associated with a bacterial count $> 10^5$ bacteria per ml. Such considerations apply even more to the finding of fungi.

Trichomonas is a parasite found fairly often in urinary sediment. The urine should be examined for it immediately after voiding, as it can be recognized with certainty then on the basis of its mobility.

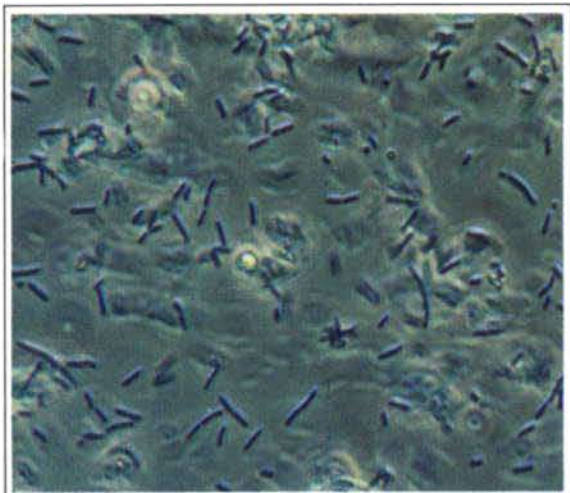
There is generally no difficulty in recognizing spermatozoa.

249-250 Masses of bacteria; phase contrast (400x), (400x).

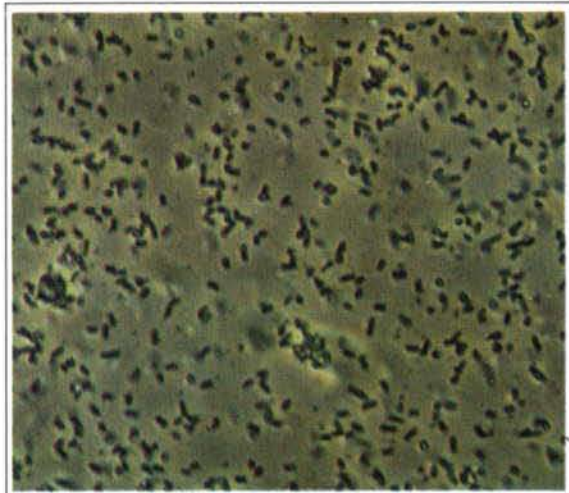
251-252 Isolated and budding fungi (400x), (400x).

253 a-b *Trichomonas* (400x).

254 Spermatozoa (400x).



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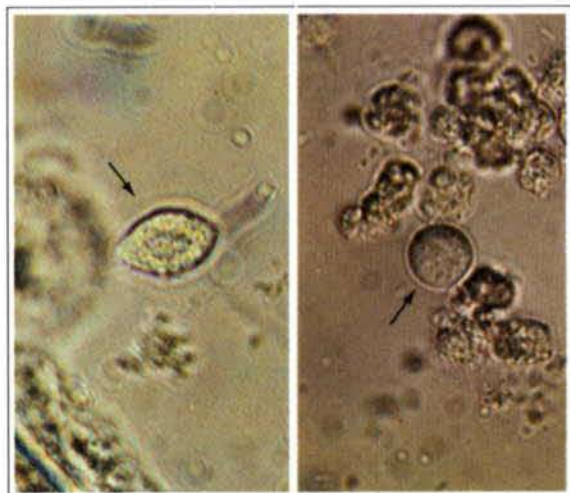
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3.10

CRYSTALLURIA

For centuries the excretion of «gravel» in the urine has been connected with a tendency to develop urinary calculi; hence, ever since microscopic examination was first used, attempts have been made to interpret crystalluria as a guide to conditions under which patients are liable to develop urolithiasis. This interpretation, however, has been found to be valid only to a limited extent and under certain conditions.

Most of the crystals found in urinary sediment are not in fact present when the urine is voided but only form later, when temperature and/or modifications in pH favour the precipitation of urinary solutes.

For this reason no significance is generally attached to the presence of crystals in urine that has been allowed to stand; only those already formed in freshly voided urine are now considered significant, especially if the finding appears repeatedly, or if the crystals are of large dimensions or clumped, or are of special composition, such as magnesium ammonium phosphate.

There are very few exceptions to this rule, one of them being cystine crystals, which are always of significance even when found in samples that are not fresh.

Within these limits, the study of crystalluria may be of considerable practical interest in patients with urolithiasis [11,12,49].

3.10.1 URIC ACIDS AND URATES

Uric acid crystals were the first formed elements in urinary sediment to be described accurately. More than 12 forms had already been identified by the beginning of the 20th century. In doubtful cases, where there are masses of crystals, a positive reaction to the murxide test helps in their identification (p. 206).

Uric acid crystals are characteristic of acidic urine; for this reason, even when they are found only in urine that has stood for some time, their repeated appearance demonstrates the existence of a habitually low urinary pH, which may create a predisposition to precipitation in vivo.

These crystals have been variously described according to their shape (olive-leaf, barrel-shaped, needle-like, etc.), but their common characteristic is, in general, their yellow or reddish brown colour, due at least in part to a pigment known as uricine, more rarely to drugs, for example, salicylates, which may stain the crystals brown.

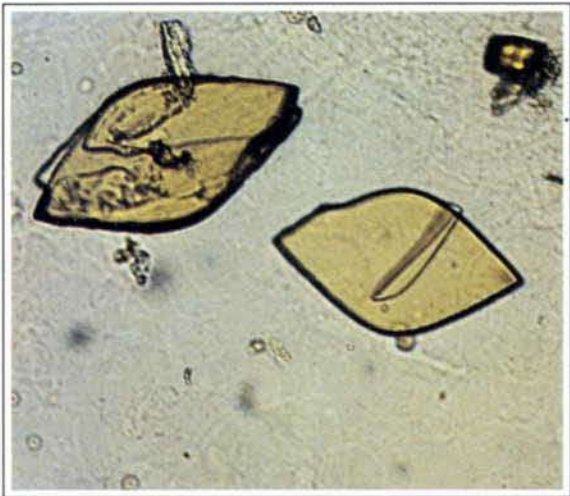
255 Uric acid: lozenge-shaped crystals of characteristic colour. Similar crystals but smaller and tapering, have been called «olive leaf» (160x).

256 Uric acid: brightly coloured prisms (100x).

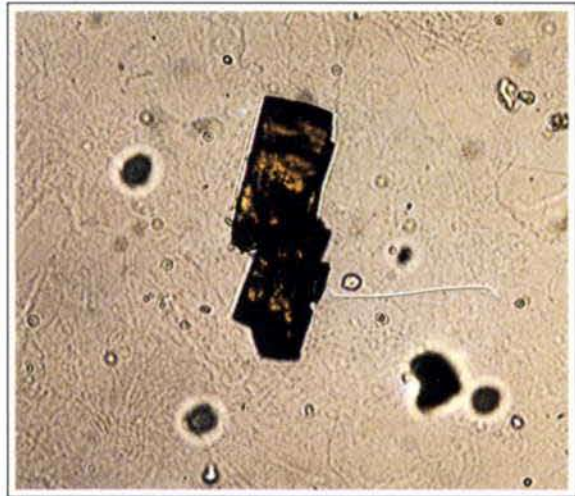
257 Uric acid: hypopigmented rhomboid crystals (100x).

258 Uric acid: polygonal forms (400x).

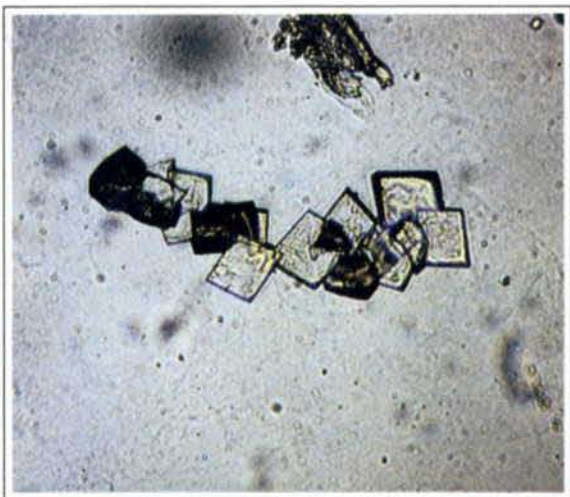
259-260 Uric acid: more or less clearly delineated hexagonal forms (100x), (100x).



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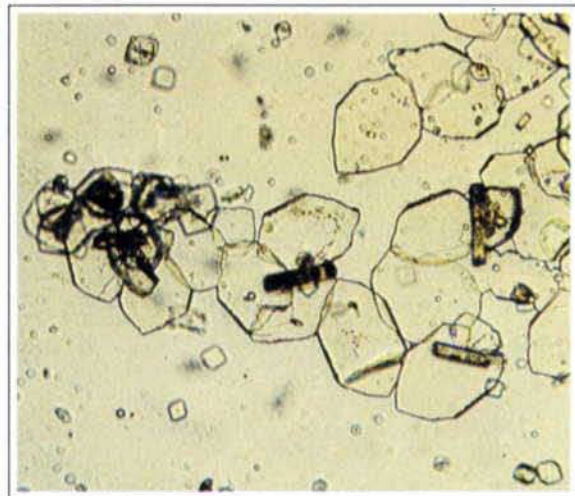
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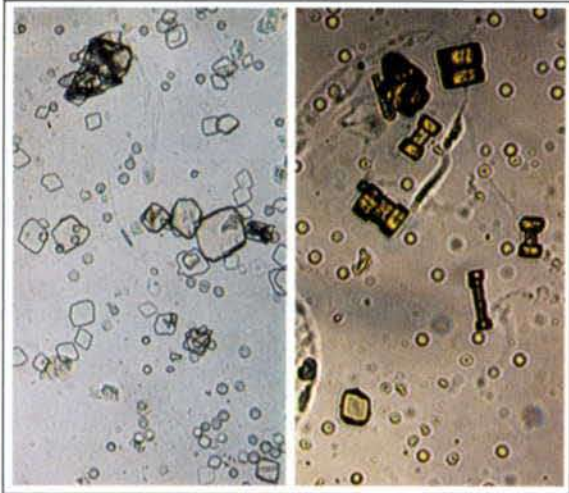


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- 261** a) Uric acid crystals; polygonal, unpigmented fragments (100x).
b) Uric acid crystals, unusual clusters (100x).
- 262** Cluster of uric acid crystals (100x).
- 263-266** Uric acid: large crystal formations (100x), (100x), (100x), (100x).



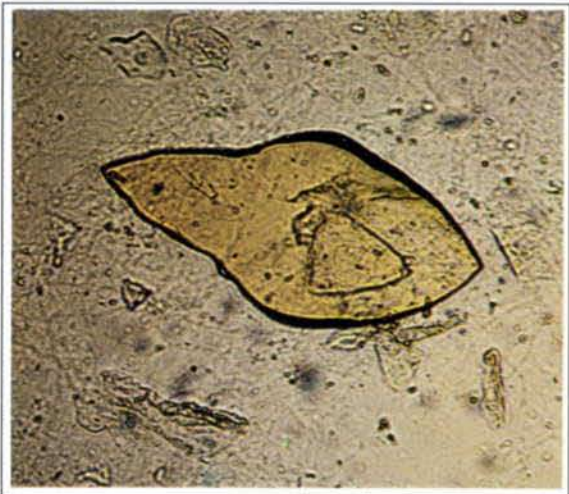
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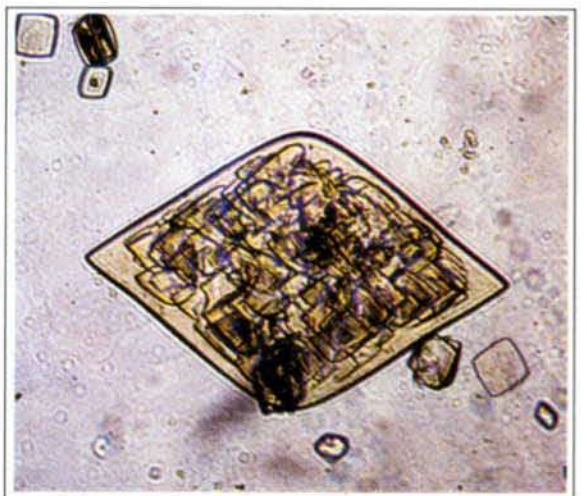
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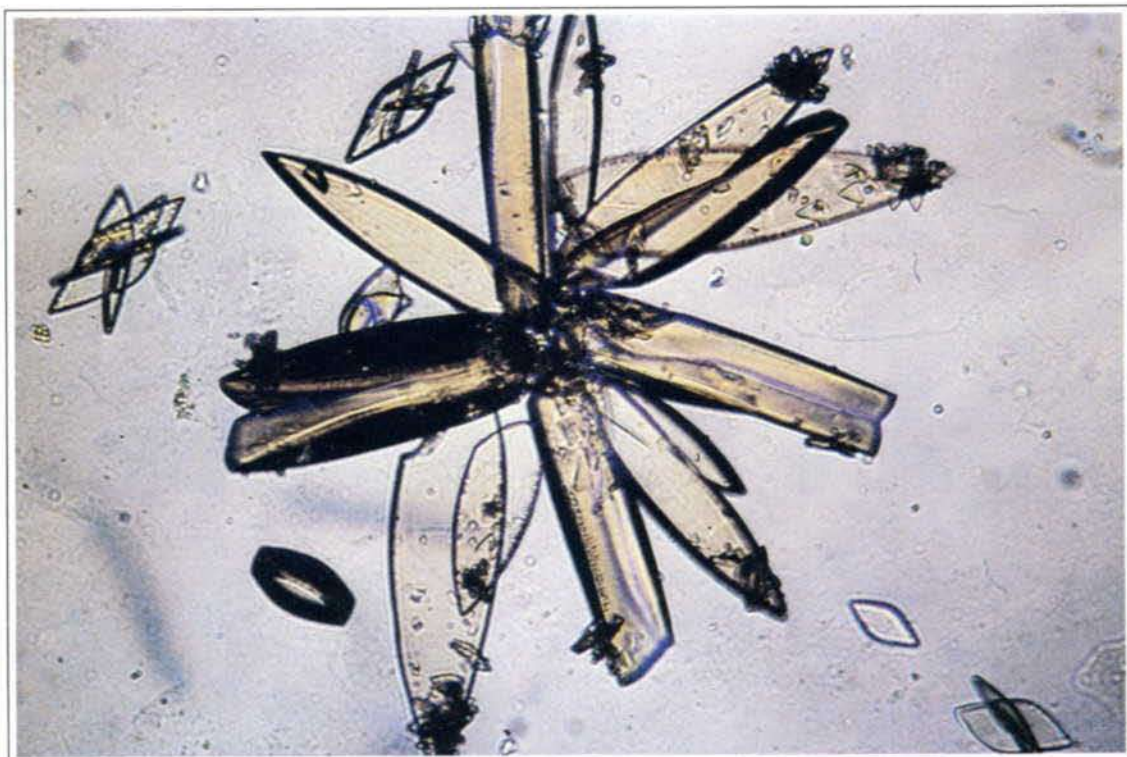


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A large, faint, circular microscopic image showing a 'star' cluster of uric acid crystals. The cluster is composed of numerous small, needle-shaped crystals radiating from a central point, forming a star-like pattern. The background is light and grainy.

267 Uric acid: «star» cluster (250x).

268 Uric acid: clusters of crystals (100x).



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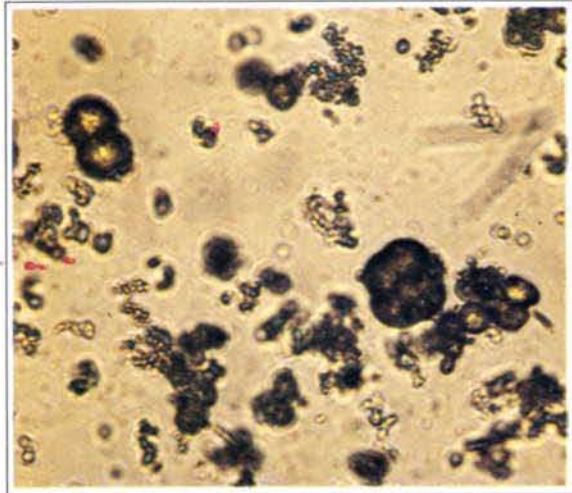


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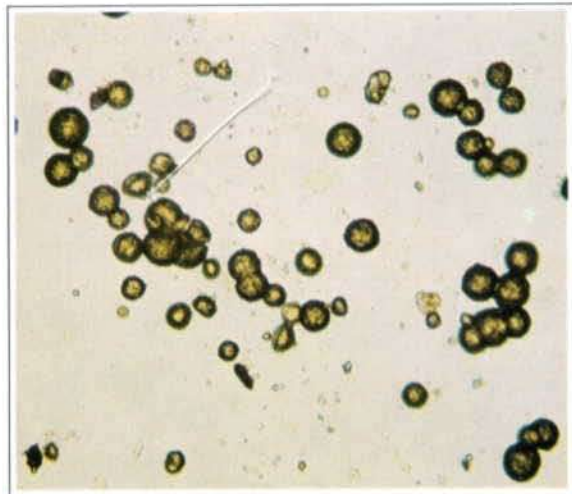
- 269** Ammonium acid urate: note the typical morula form with spicules (400x).
- 270-272** Acid urate, globular formations (160x), (160x), (160x).
- 273** Uric acid and acid urate (100x).
- 274 a-b** Amorphous urates at different magnifications (100x), (400x).



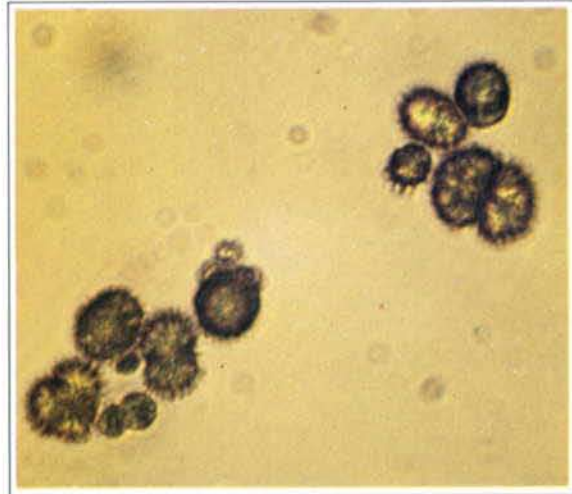
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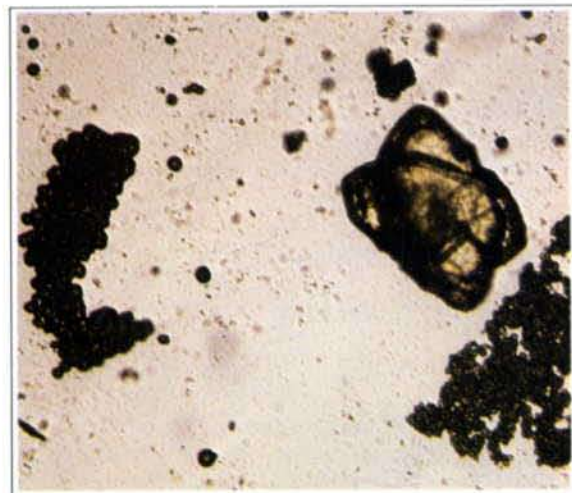
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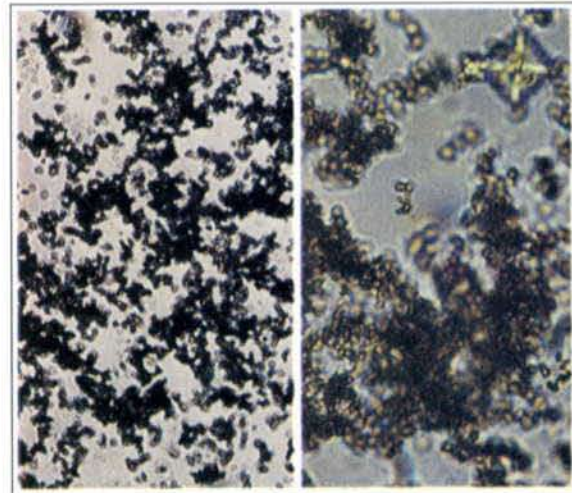
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3.10.2 CALCIUM OXALATE

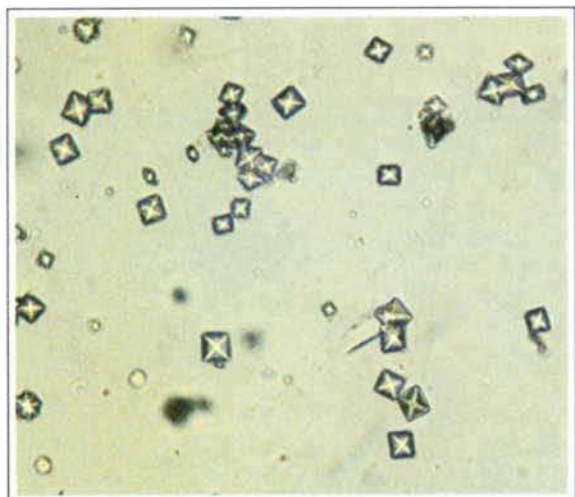
Calcium oxalate may be found in the urine as a dihydrate (weddellite) or a monohydrate (whewellite), the former occurring more frequently than the latter. The commonest form of dihydrate calcium oxalate crystals is octahedral and is generally defined as being bipyramidal and like an envelope in shape; the most typical forms of monohydrate calcium oxalate are the biconcave disk or «dumb-bell» shape.

The presence of calcium oxalate crystals are a characteristic of acid urine, but not of this alone; when the urine contains a great many such crystals it takes on a whitish colour. They can be dissolved in hydrochloric acid.

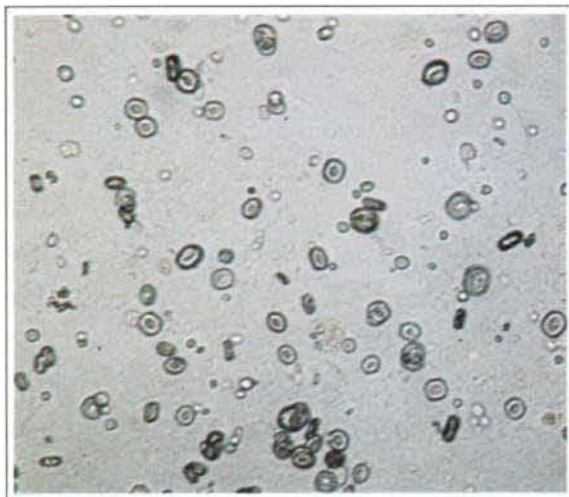
The presence of these crystals in the sediment is generally due to the fact that the urine has been kept for some time at room temperature, or at low temperature, before examination; they can, however, be observed quite often in the freshly voided urine of healthy people, especially after they have eaten food rich in oxalic acid, such as spinach or cocoa.

Generally there is no connection between this crystalluria and urinary calculi, but if the crystals are large or clustered, or if they appear very frequently in the freshly voided urine examined immediately at body temperature, they should be considered an abnormal finding.

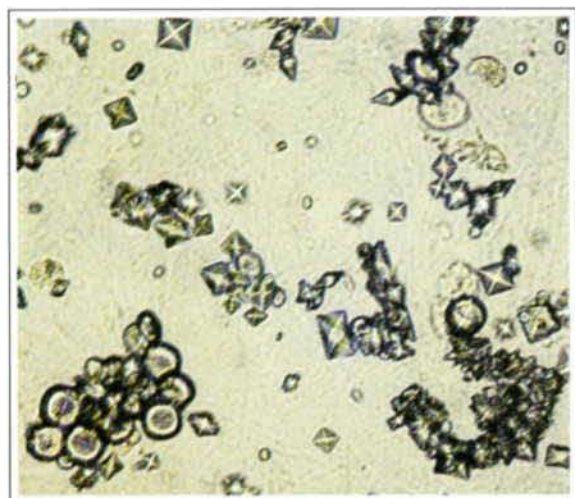
- 275 Dihydrate calcium oxalate (weddellite) with typical «envelope» forms. The crystals are of varying dimensions, generally from 1 to 30 μ , but occasionally they may be as large as a millimeter. Weddellite may also assume a bipyramidal appearance or the shape of a polyhedral prism (160x).
- 276 Monohydrate calcium oxalate (whewellite): typical biconcave disks (160x).
- 277-278 Mono- and dihydrate calcium oxalate; fig. 277 shows many clusters (160x), (100x).
- 279 Monohydrate calcium oxalate: biconcave oval disks (100x).
- 280 Various calcium oxalate formations (envelope, oval, dumb-bell shaped). This field illustrates the great morphological variety of crystals found in urine; such a wealth of forms is generally only found in urine kept at low temperature (100x).



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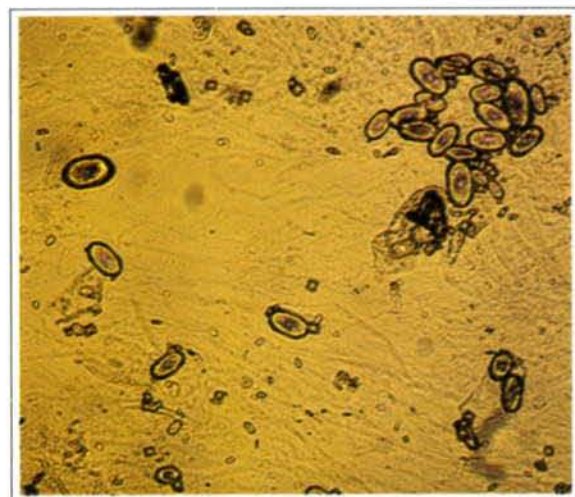
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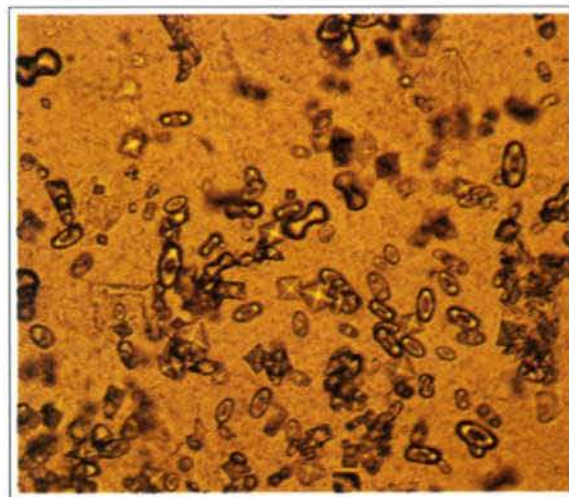
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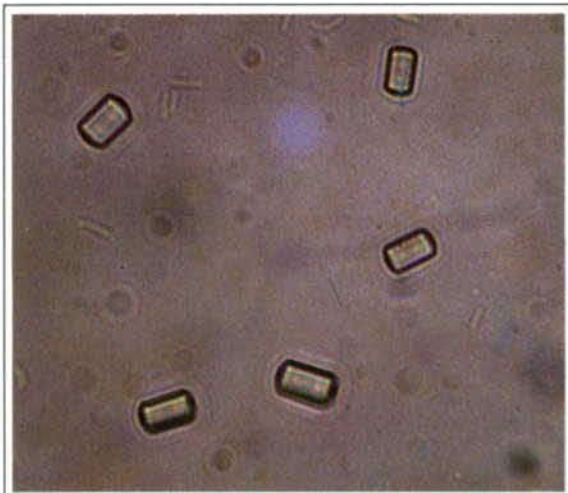


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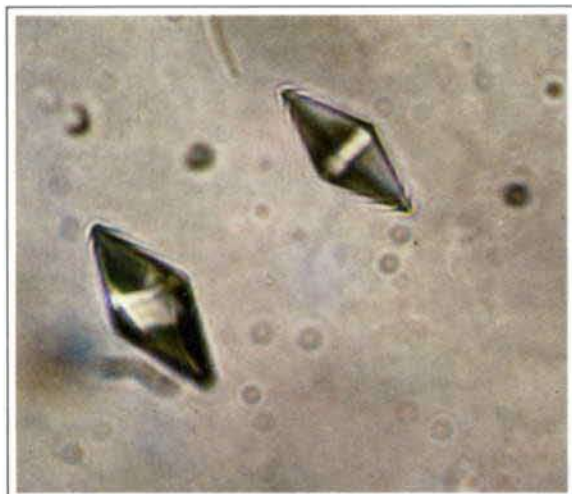
- 281** Dihydrate calcium oxalate: rare star-shaped crystal (250x).
- 282** Calcium oxalate: unusual forms, probably of a dihydrate (400x).
- 283** Dihydrate calcium oxalate: prism shapes (250x).
- 284-285** Clusters of calcium oxalate. Forms of this kind can be interpreted as true microcalculi (100x), (100x)
- 286** Clusters of calcium oxalate and uric acid (100x).



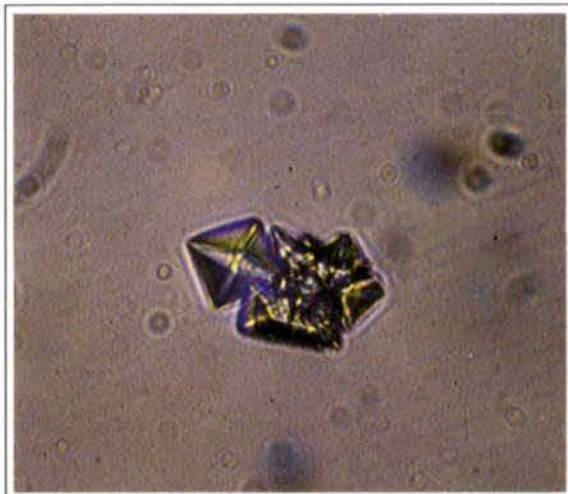
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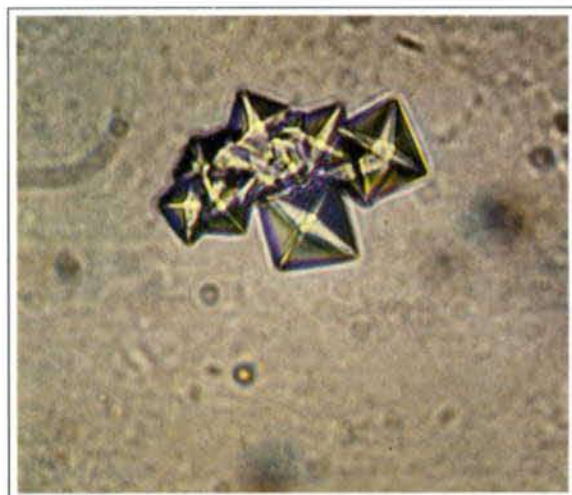
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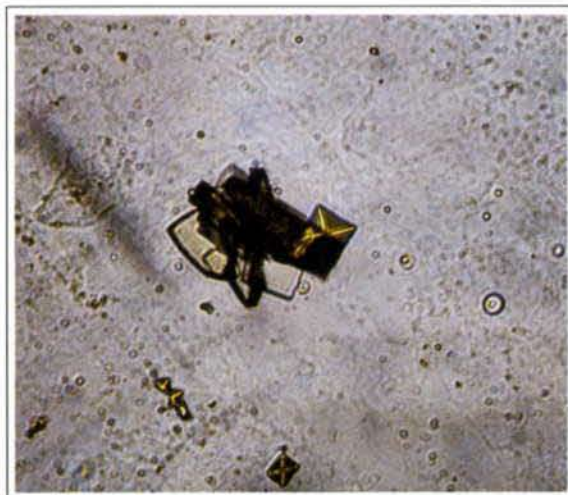
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3.10.3 PHOSPHATES

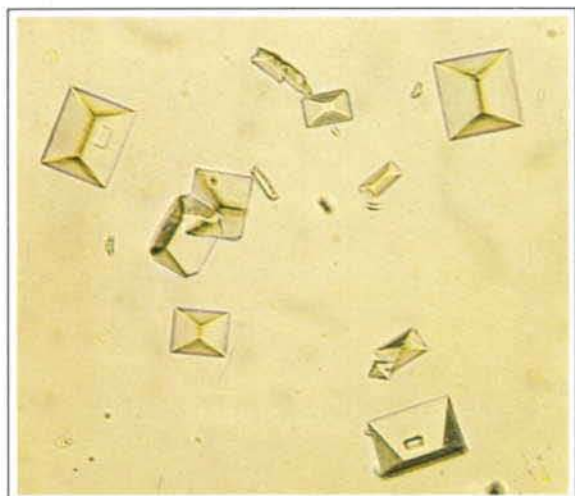
There has been considerable debate about the significance of urinary phosphates in various diseases. A great many of the claims that were made are no longer acceptable. In practice only the presence of magnesium ammonium phosphate in freshly voided urine is now regarded as significant. This finding suggests infection with urease-producing bacteria (very often *Proteus*).

The phosphates found in urinary sediment either have no definite shape and are dust-like (amorphous phosphates) or are crystalline (calcium phosphate and magnesium ammonium phosphate).

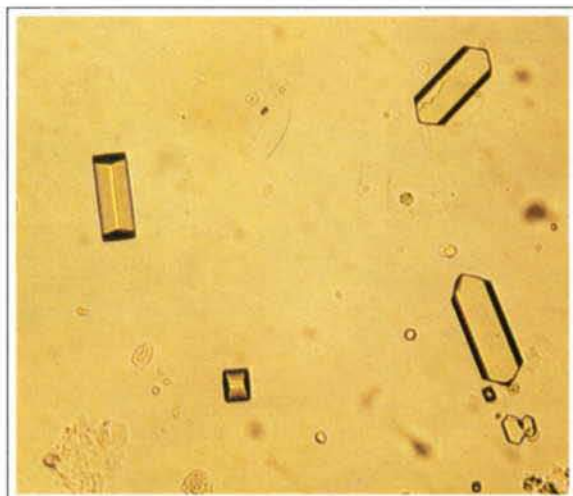
Calcium phosphates may be found in alkaline, neutral or acid urine; amorphous and magnesium ammonium phosphates are characteristic of alkaline urine.

287 Magnesium ammonium phosphate: typical prism-like «coffin-lid» crystals (100x).

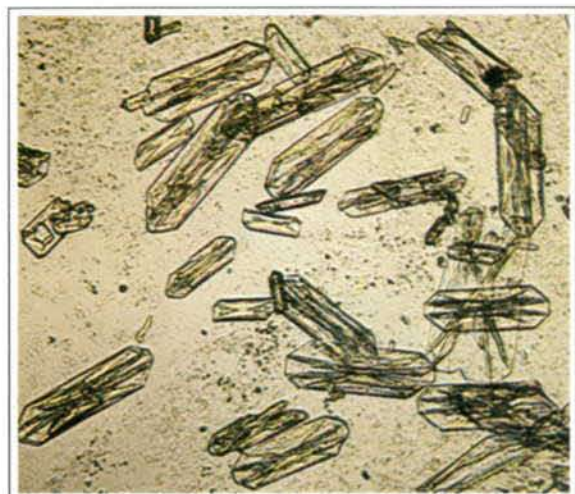
288-292 Magnesium ammonium phosphate: various forms of crystallization (100x), (100x), (100x), (100x), (100x).



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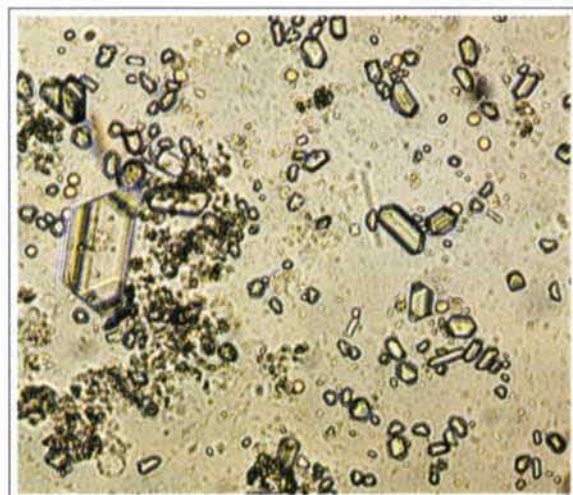
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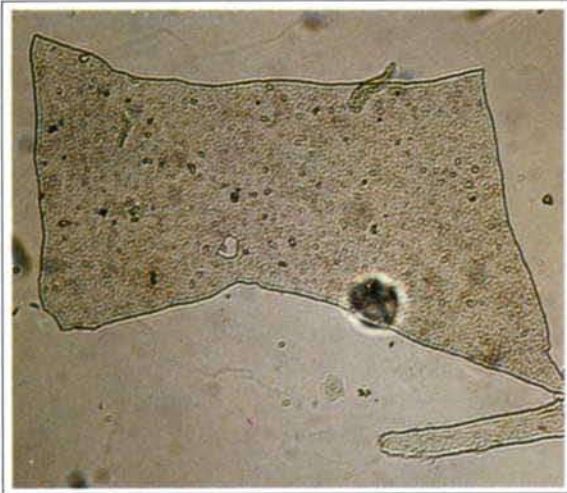


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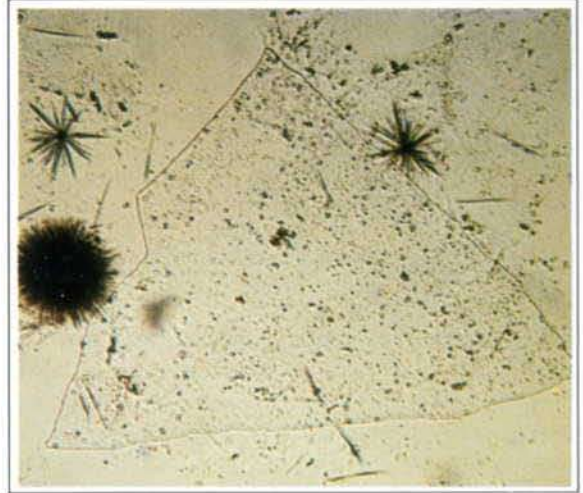


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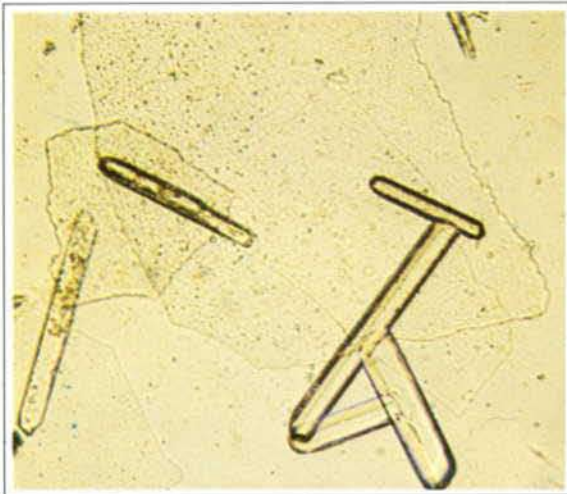
- 293** Typical calcium phosphate plaque (100 x).
- 294** Plaques and needle-like crystals of calcium phosphate, mostly in clusters (100 x).
- 295** Plaques and prisms of calcium phosphate (100x).
- 296-297** Clusters of calcium phosphate (250x), (250x).
- 298 a-b** Amorphous phosphates at different magnifications (100 x), (400 x).



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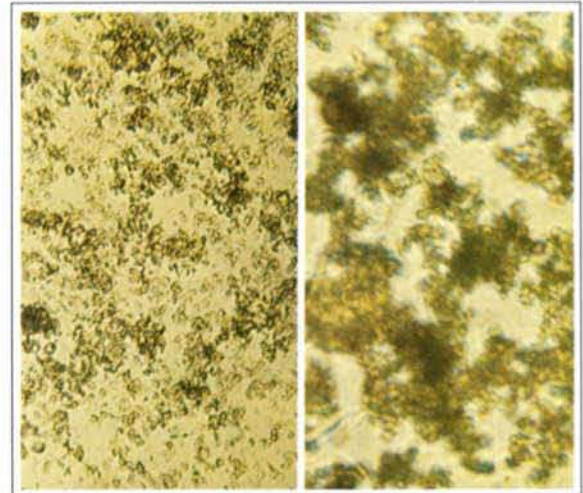
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3.10.4 CALCIUM CARBONATE

Calcium carbonate is soluble in acetic acid, forming small bubbles of CO₂; it can take the form of spheres, which are sometimes dumb-bell-shaped, or appear as amorphous granules or needle-like clusters.

It is typical of alkaline and fermented urine.

3.10.5 AMINO ACIDS AND OTHER SUBSTANCES

The presence of cystine crystals in the sediment is always a very important diagnostic feature, as they are a definite sign of urolithiasis or a predisposition to it.

Cystine crystals appear only in acid urine; they are very regular hexagons that are transparent, colourless, and soluble in hydrochloric acid but not in acetic acid. Their presence is always of pathological significance.

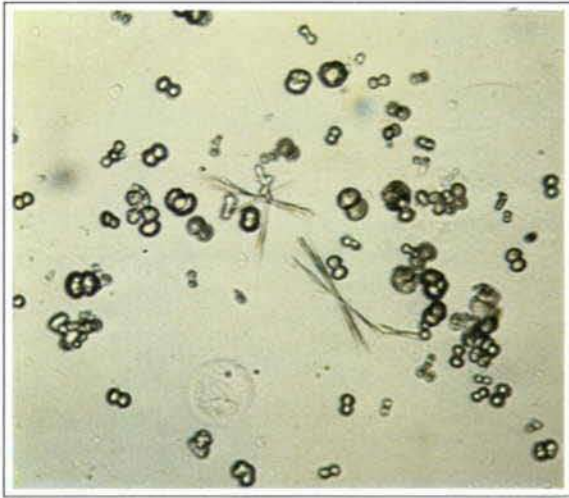
Besides cystine crystals, other amino acid crystals can be found, although very rarely, in urinary sediment.

299 Calcium carbonate crystals may be found isolated or joined together to form dumb-bells. In the latter case they look like oxalate crystals (160x).

300 Carbonates, detail under high power (400x).

301-302 Hexagonal cystine crystals (400x), (400x).

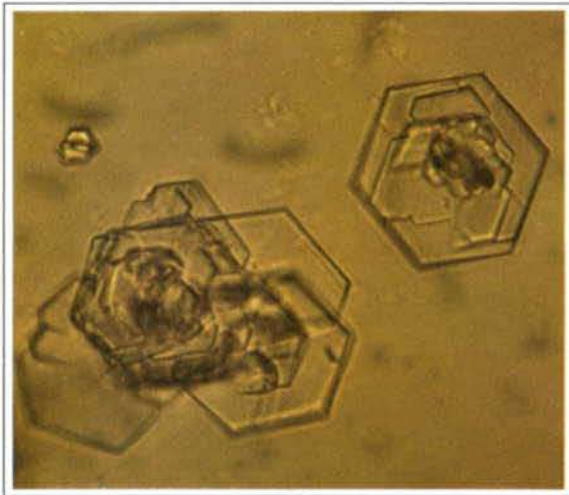
303-304 Needle-like tyrosine crystals (400x), (400x).



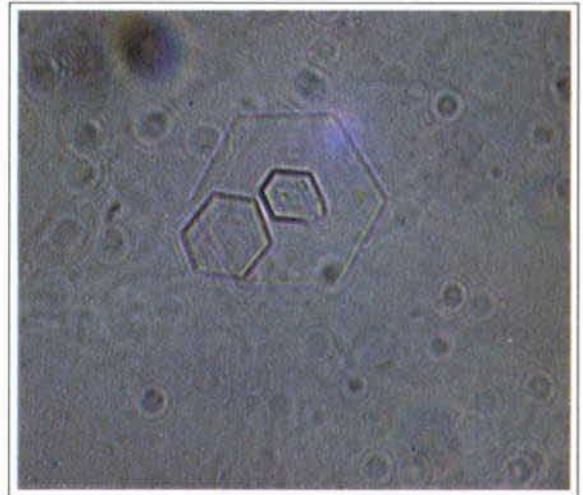
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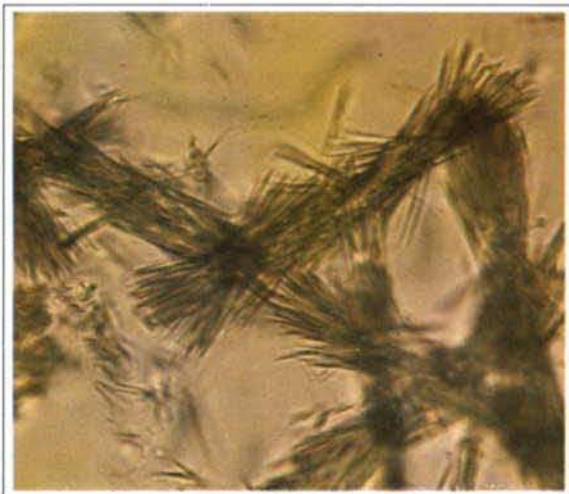
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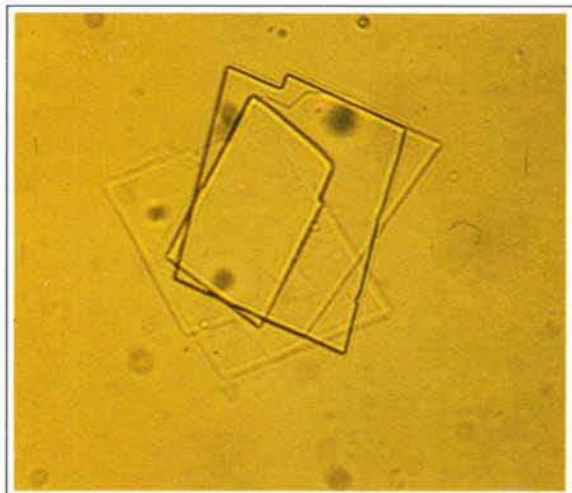
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It is not uncommon to find plaques of bilirubin in cases of severe jaundice. Hippuric acid and cholesterol crystals may also be found in urine.

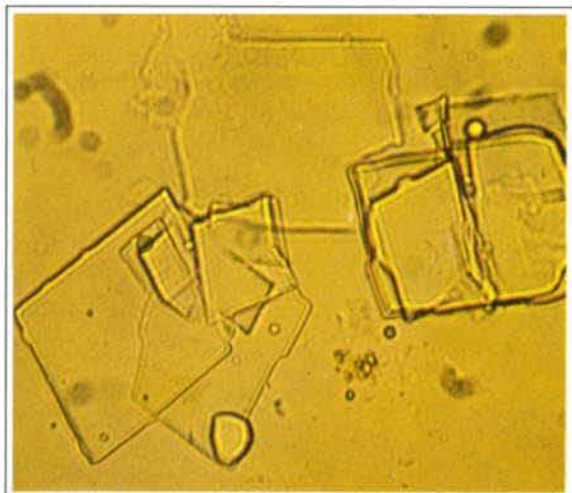
305-306 Cholesterol crystals (160x), (160x).

307-308 Bilirubin pigmented plaques and cells (250x), (400x).

309-310 Hippuric acid (100x), (100x).



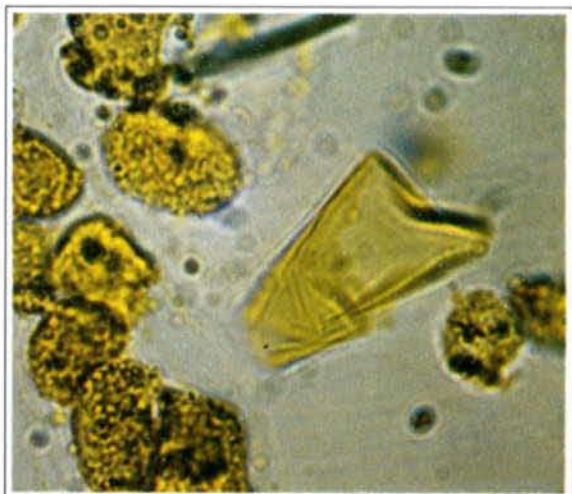
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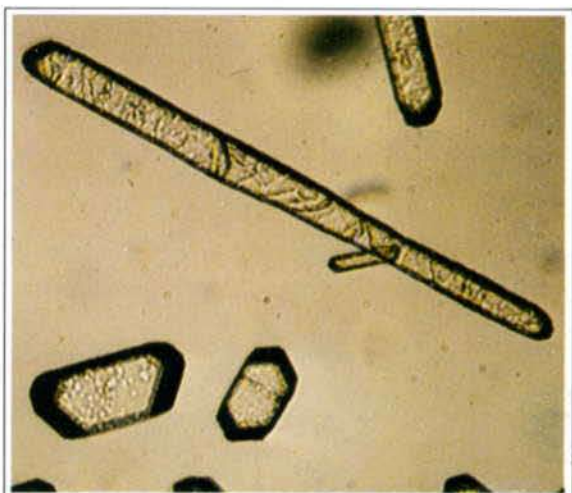
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3.10.6 DRUGS

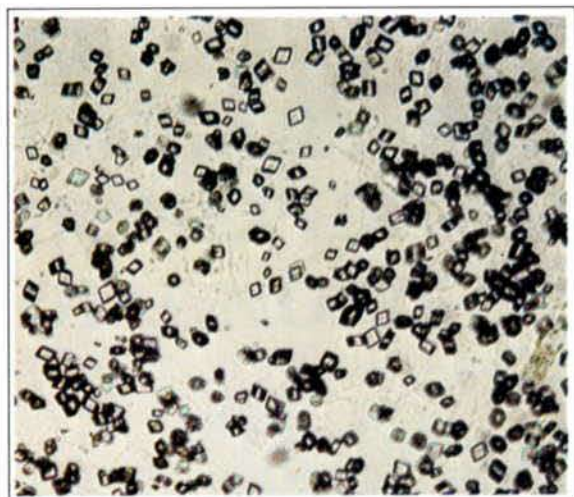
Many drugs can give rise to the presence of crystals in the urine; the causes of their formation are often difficult to identify. It is quite common to find them after taking cotrimoxazole. Crystals from pharmaceutical products inserted in the vagina may also be found.

311 Crystal formation with rhomboid elements, after cotrimoxazole therapy (100x).

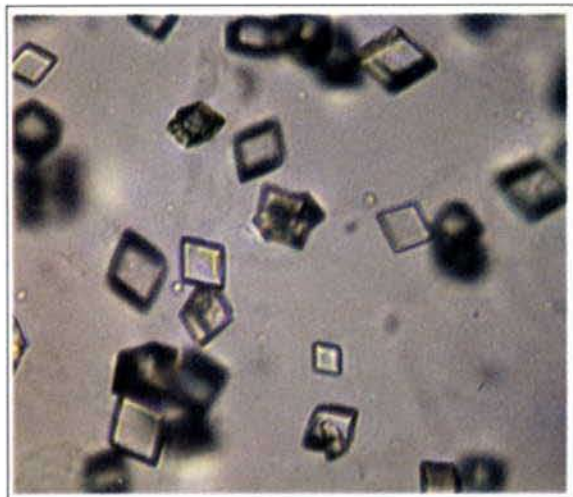
312 Same field under higher power (400x).

313-314 Crystals from a pharmaceutical product given intravaginally (Canesten) (160x), (400x).

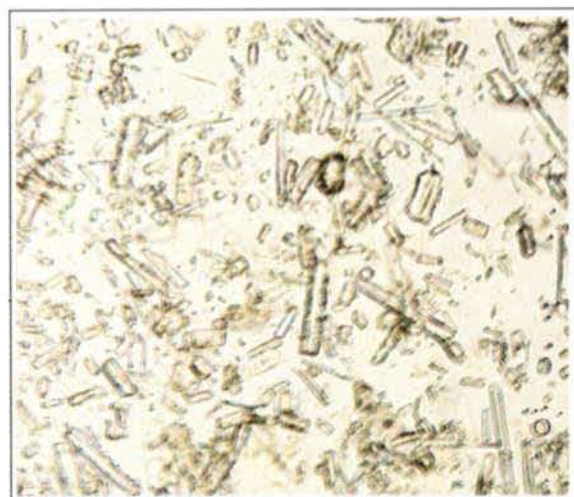
315-316 Contamination of sediment by metronidazole vaginal tablets (160x), (400x).



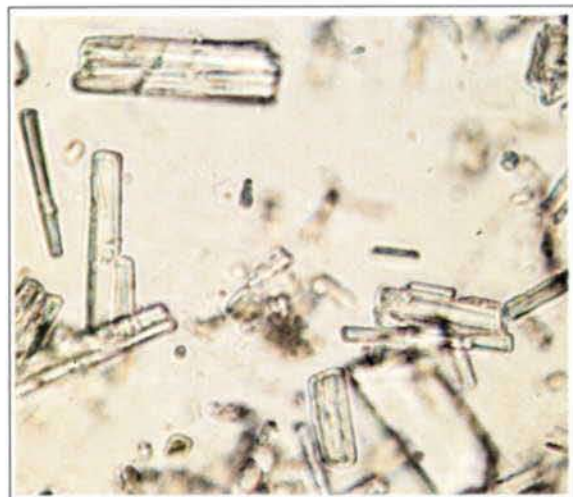
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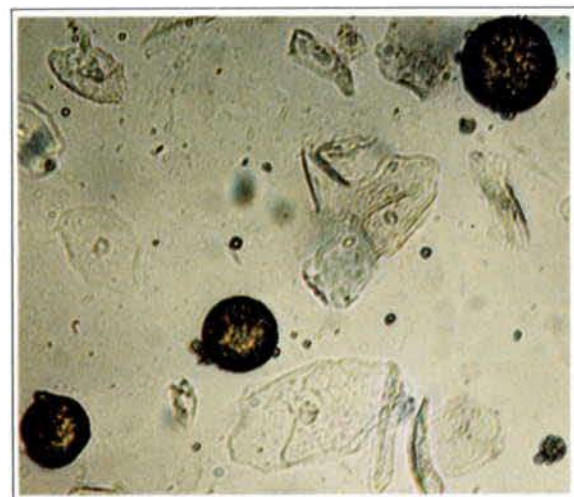
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