MODIFIED GMS FOR URATE

UNDERSTANDING HISTOLOGY FOR BETTER ANALYSIS

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LEARNING OBJECTIVES

- Understand the **principle** of modified GMS staining for urates
- Recognise the **appearance and distribution** of urate deposits
- Identify **critical technical steps** required to preserve urates
- Anticipate **common pitfalls** and troubleshooting points

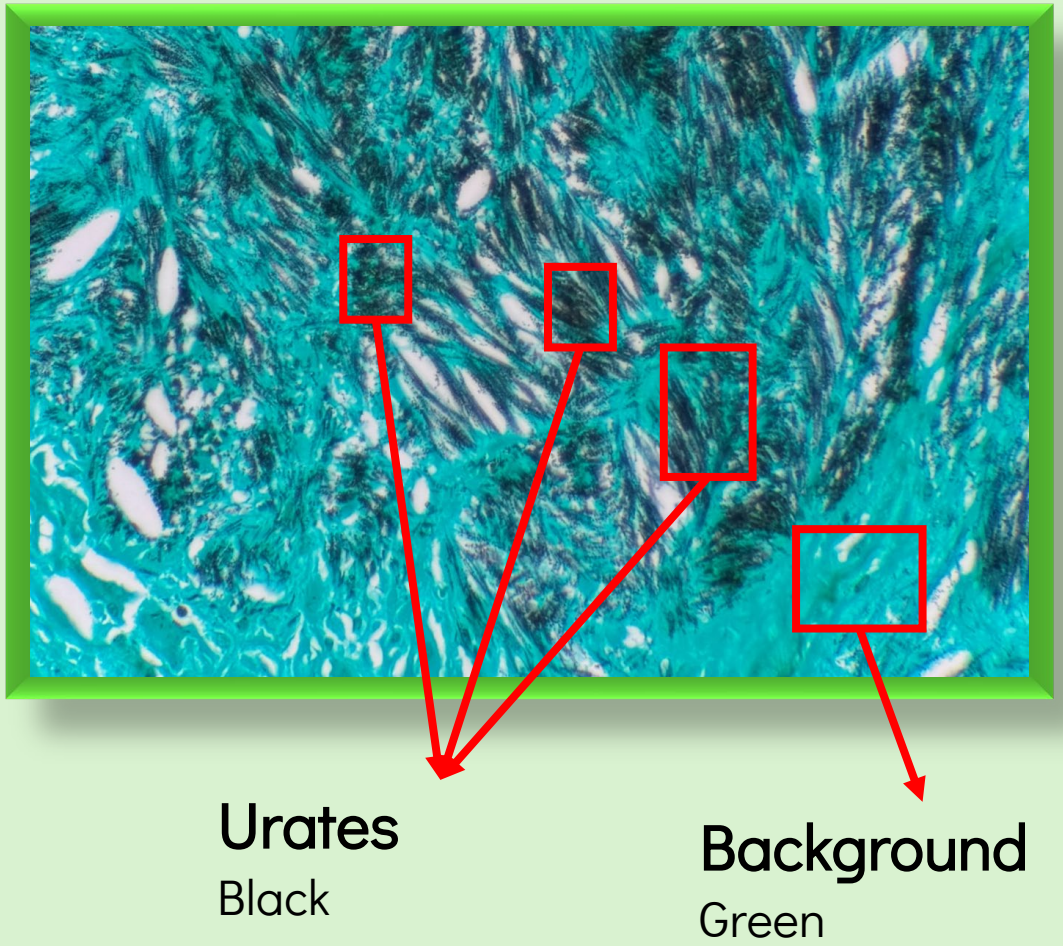
Modified GMS for Urate

To demonstrate urate crystals

- Especially in conditions like gout or tumoral calcinosis with urate components.

When it's used clinically ?

- Suspected **gouty tophi**
- Evaluation of kidney biopsies with **urate nephropathy (obstruction/ renal failure)**
- To differentiate urate from other crystal



Newcomer Supply. Urate Stain – Gomori Methenamine Silver Method (Technical Memo)
WebPath (University of Utah). Urate Crystals – Gomori's Methenamine Silver
Carson FL. Histotechnology: A Self-Instructional Text (referenced within WebPath manual)

How it works ?

Urate deposits in tissue can be difficult to see clearly with routine H&E stain

Ag^+ binds to urates

↓

reduce into visible metallic silver

↓

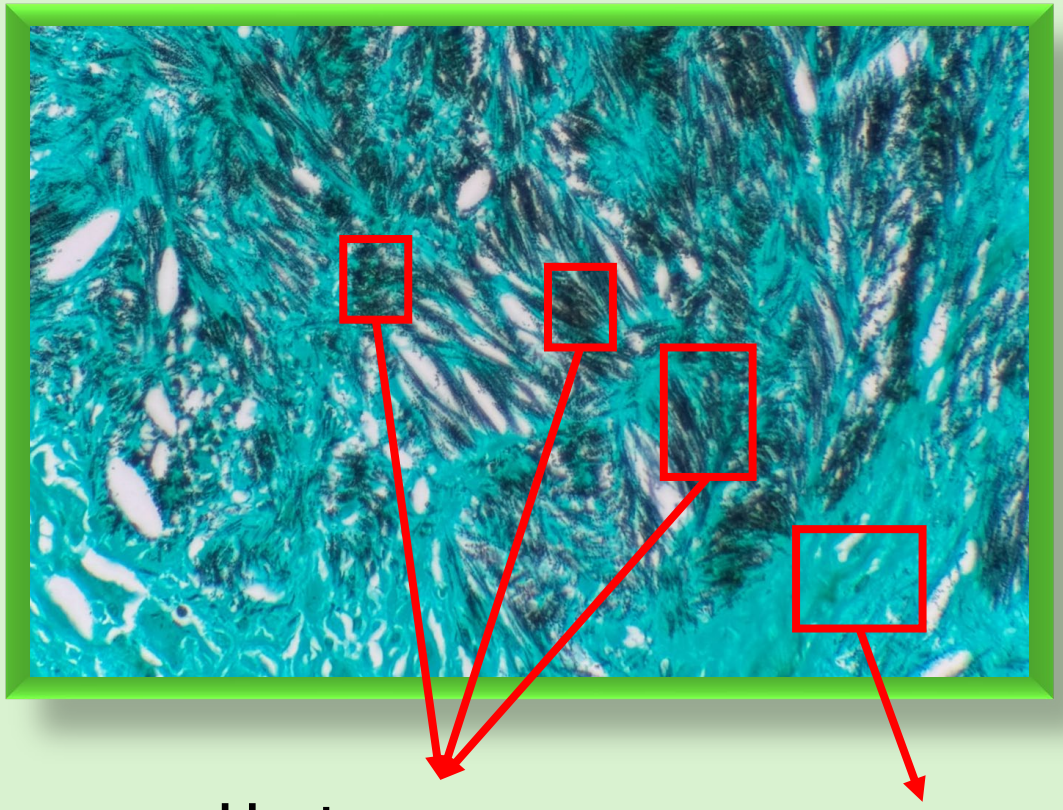
appear **dark brown/ black**

↓

light green counterstain the background

↓

This contrast helps pathologists confirm **the presence of urates**



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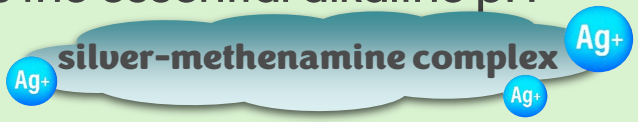
Preparation of Methenamine Silver (Stock) Solution

Ratio is very IMPORTANT !

8 ml	Methenamine Silver (Stock)	provide enough Ag+ binds to urates
+		
8 ml	Distilled Water	adjust dilution and reaction speed
+		
1 ml	5% Borax	creates the essential alkaline pH to form silver-methenamine complex

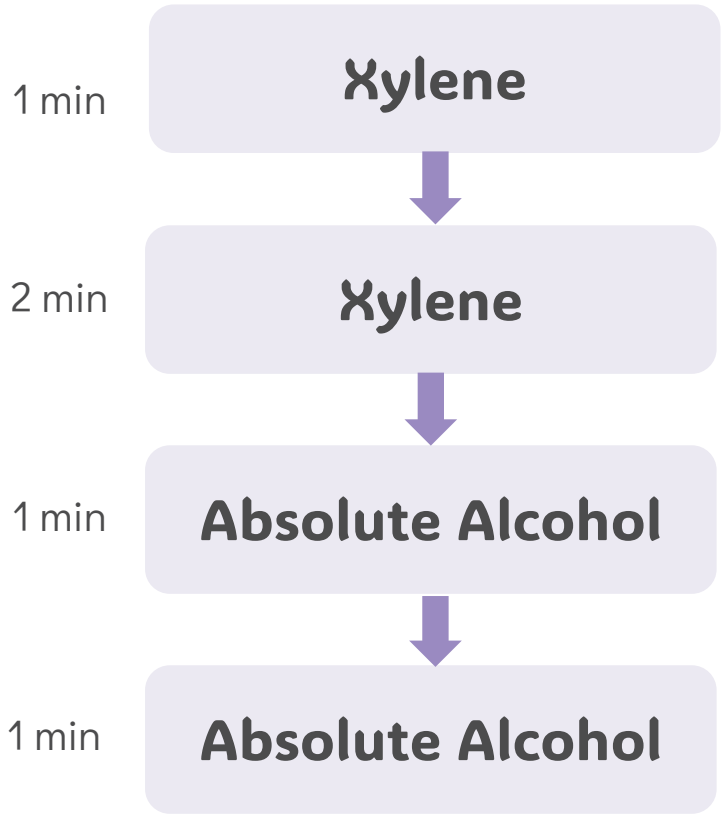


WebPath. Urate Crystals – Gomori's Methenamine Silver (Principle & Reagents)

Newcomer Supply. Urate Stain GMS Method (Technical Memo)

PROCEDURE

Formalin fixed tissue cut at 4 µm ; Control : Urates positive tissue



Deparaffinization

Deparaffinize with Absolute Alcohol

Do not hydrate sections with water

- Urates present in tissue as sodium urate, and it is water-soluble
- Deparaffinized with water will cause the urates to dissolve and wash out of the tissue

WebPath. Urate Crystals – Gomori's Methenamine Silver (Principle & Reagents)

Van Aken L, et al. *Preservation of tophi in the modified Gomori methenamine silver procedure for urates.* **Journal of Histotechnology**, 2025

Incubate

30 min

change hot water every 10 mins

Working Methenamine Silver (Stock) Solution

Rinse

DH2O

Pre-heated Working Methenamine Solution

contains

Reduction occur

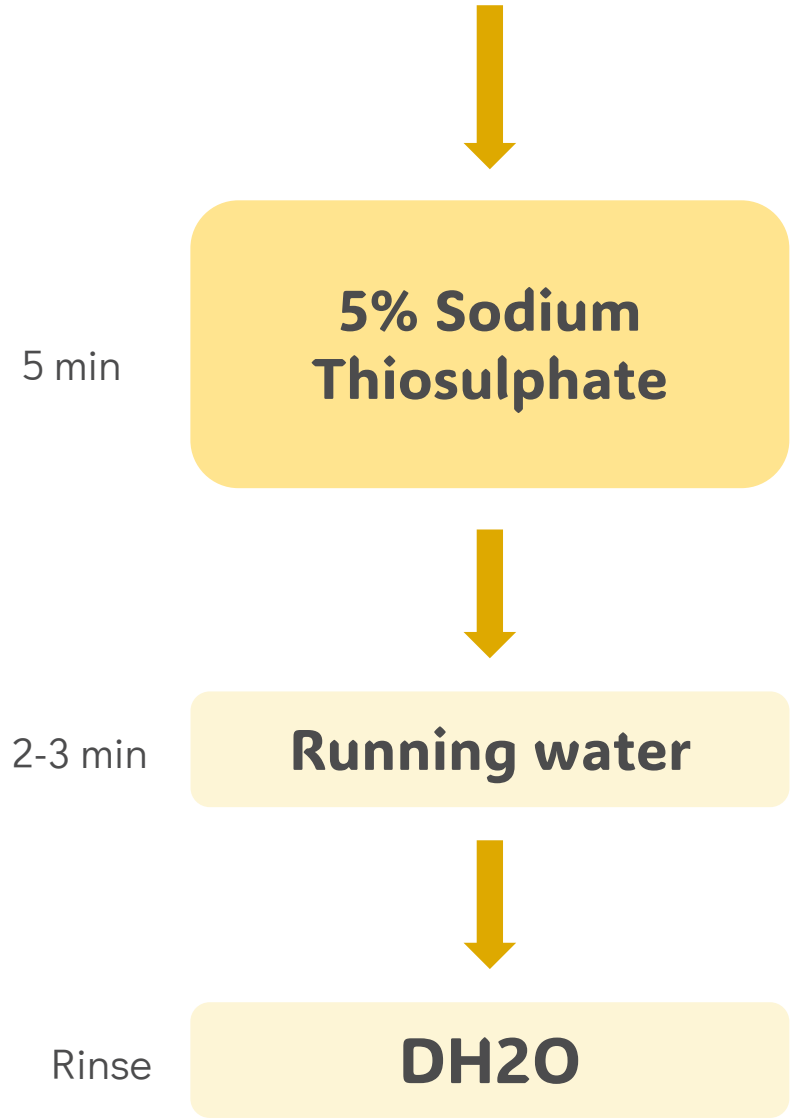
Ag+ deposits on urates,
reduce into visible metallic silver

become **dark brown to black**

Heating speeds up the reduction reaction

Newcomer Supply. Urate Stain – GMS Method

WebPath. Urate Crystals – GMS Procedure



“Fixes” the Silver

removing unreacted silver ions

prevents nonspecific darkening or the slide becoming black over time

WebPath. 5% Hypo – Sodium Thiosulfate
Biognost. Sodium Thiosulfate 5% – Instructions for Use

1-2 min

2% light green

DCM

Counterstain

Provides a background contrast **(green)**

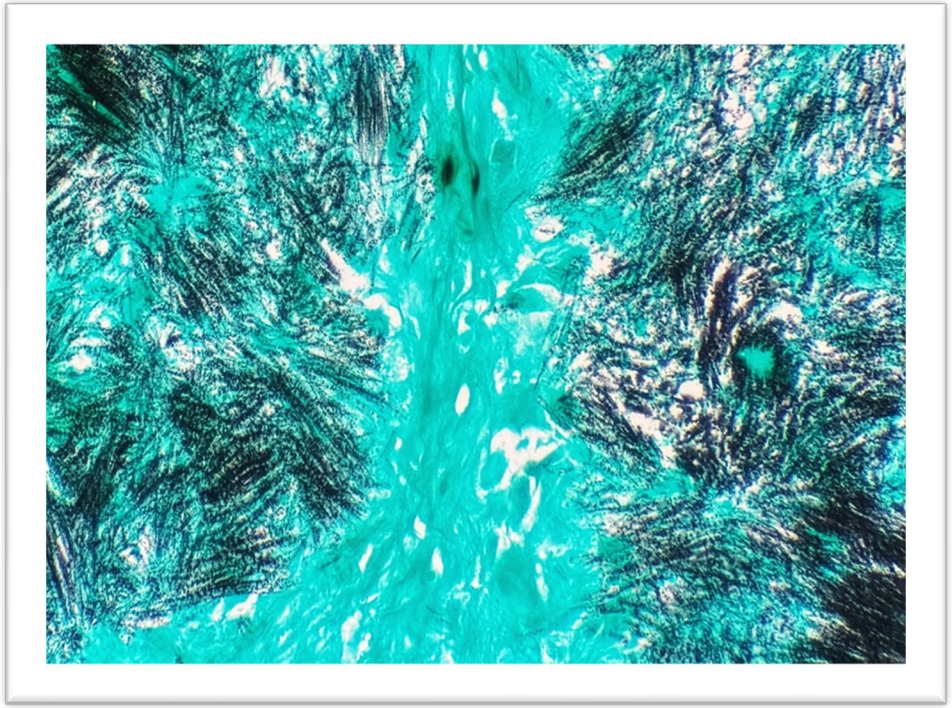
so the **dark brown/ black** silver-positive urates stand out clearly

WebPath. Urate Crystals – GMS Results

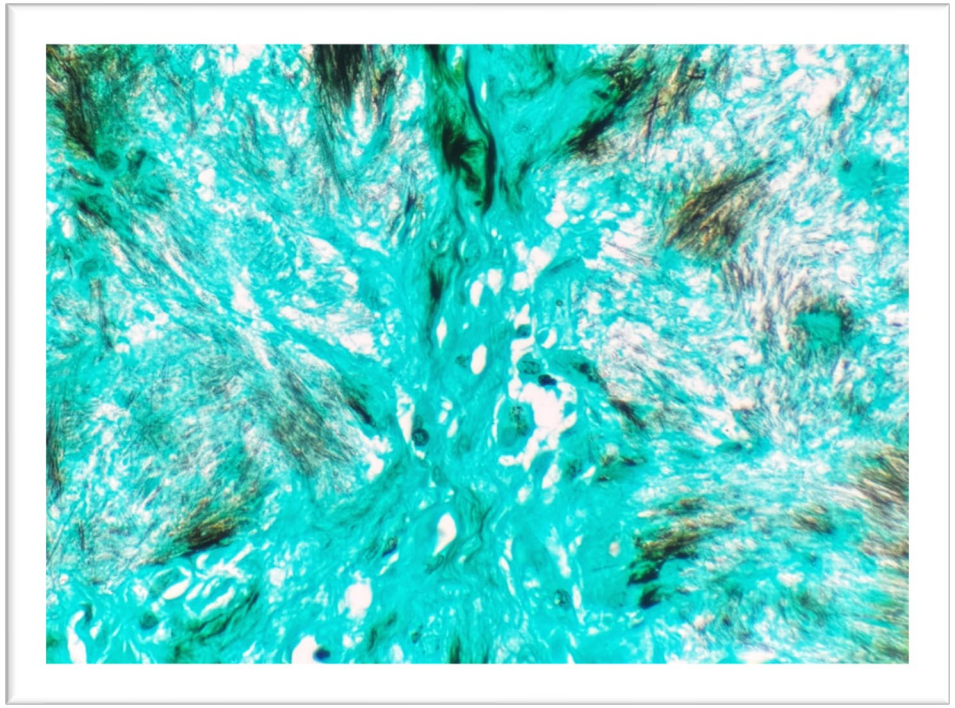
Troubleshooting

Deparaffinized with water

Control



Deparaffinized with water



Urate dissolve in water & washed off

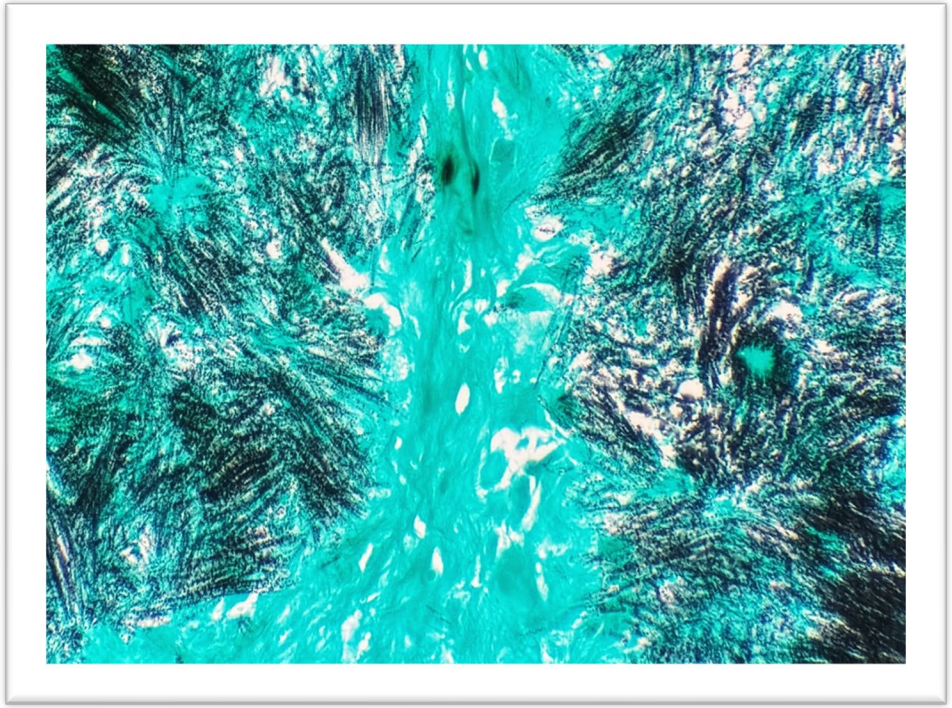
[may lead to false-negative]

WebPath. Urate Crystals – Notes, Controls & Pitfalls
Newcomer Supply. Urate Stain GMS Technical Memo

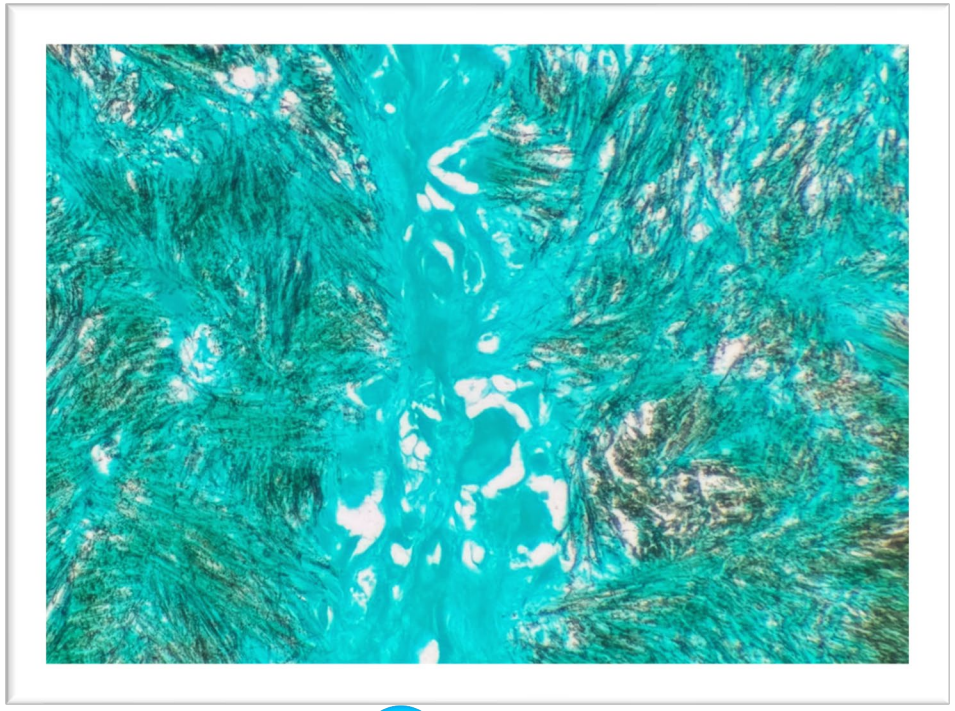
Troubleshooting

Incorrect Working Solution Ratio

Control



Less Methenamine silver



Too few Ag+ during staining

[pale staining, X contrast]

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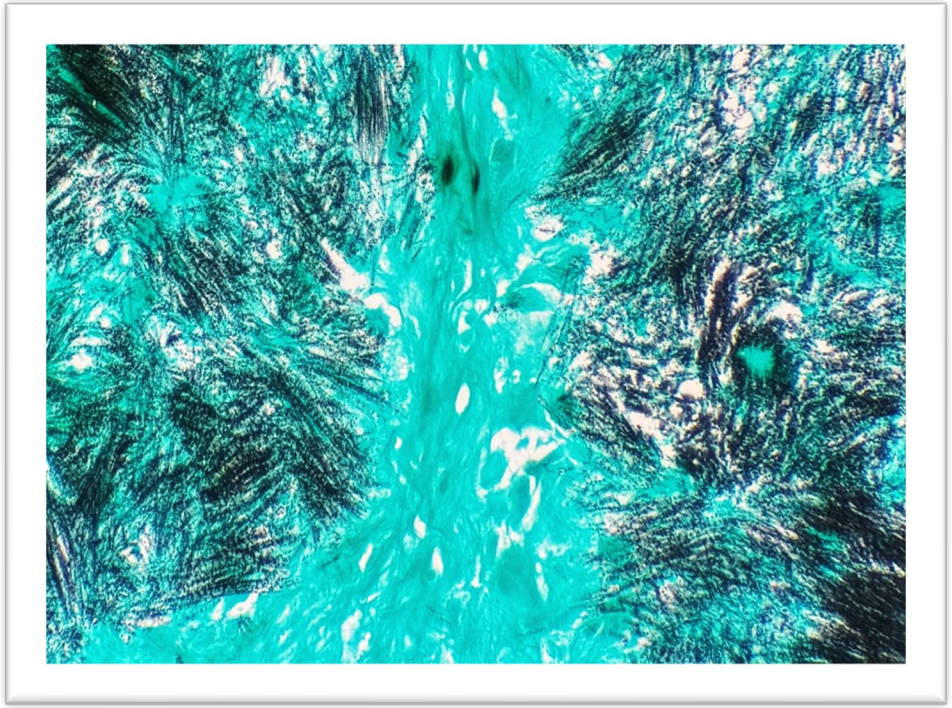
WebPath. Urate Crystals – Notes, Controls & Pitfalls

Newcomer Supply. Urate Stain GMS Technical Memo

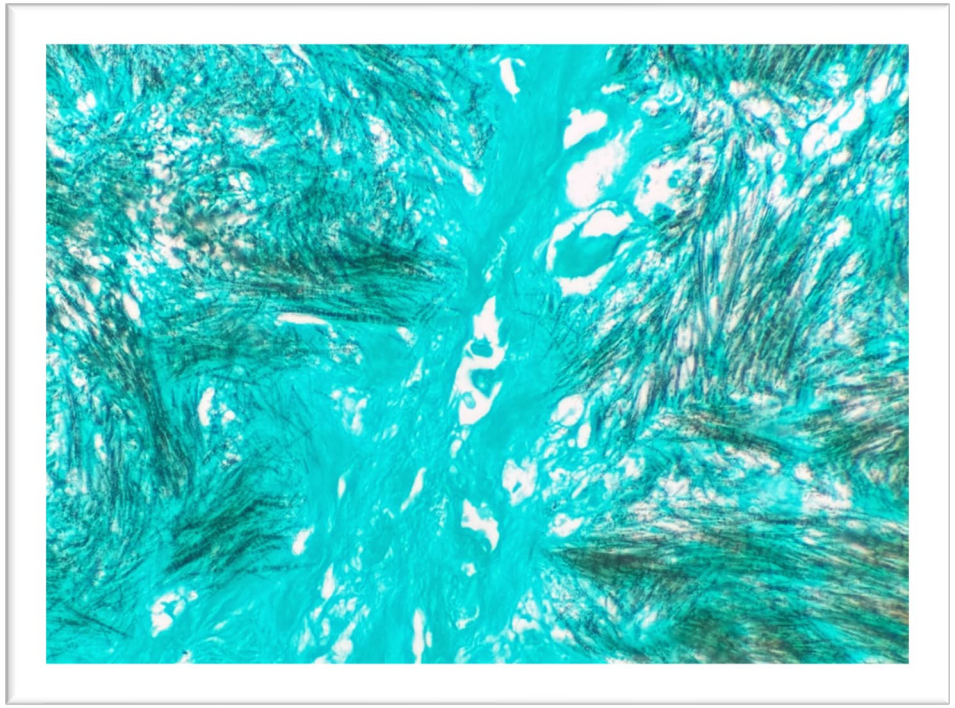
Troubleshooting

Absence of 5% Borax

Control



X 5% Borax



pH too low, reaction didn't occur properly

[pale staining, X contrast]

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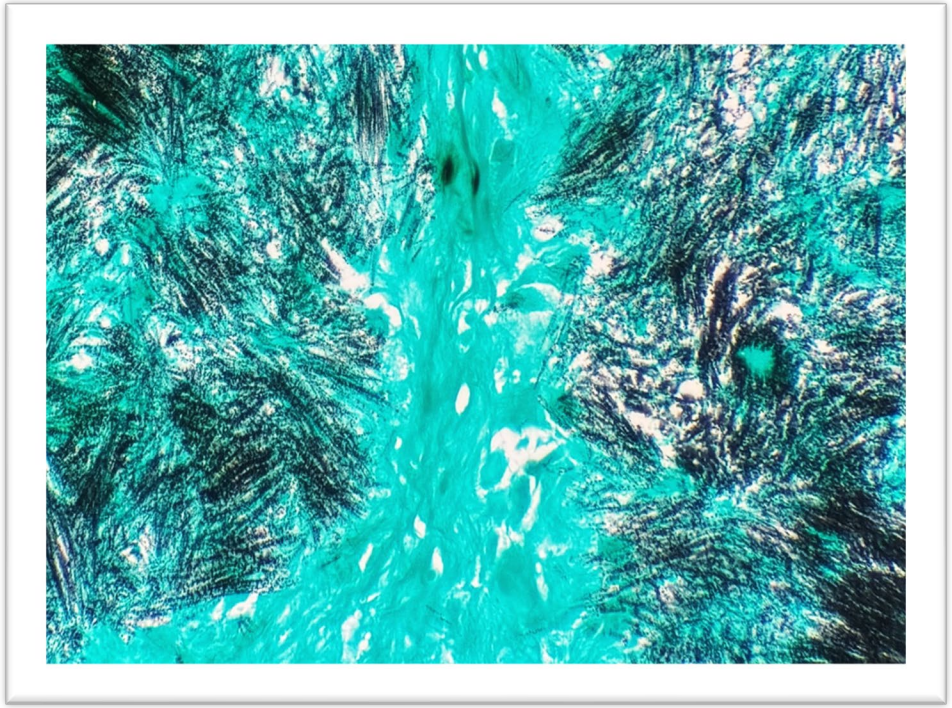
Newcomer Supply. Urate Stain GMS Technical Memo

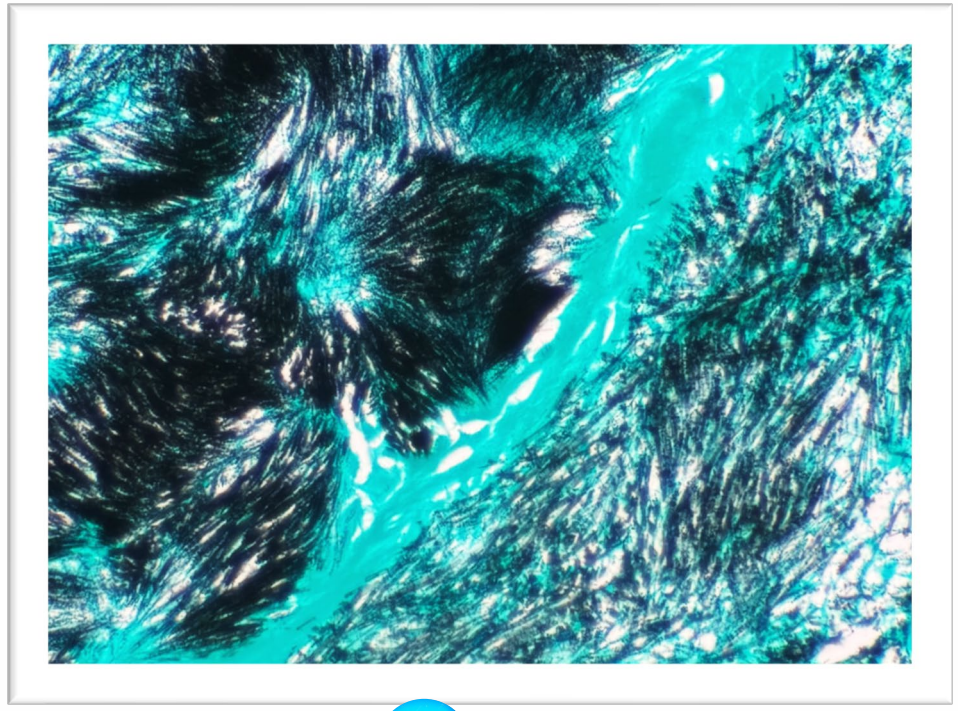
Troubleshooting

Absence of 5% Sodium Thiosulphate

Control



X 5% Sodium Thiosulphate



unreacted Ag^+ aren't removed

[background noise]

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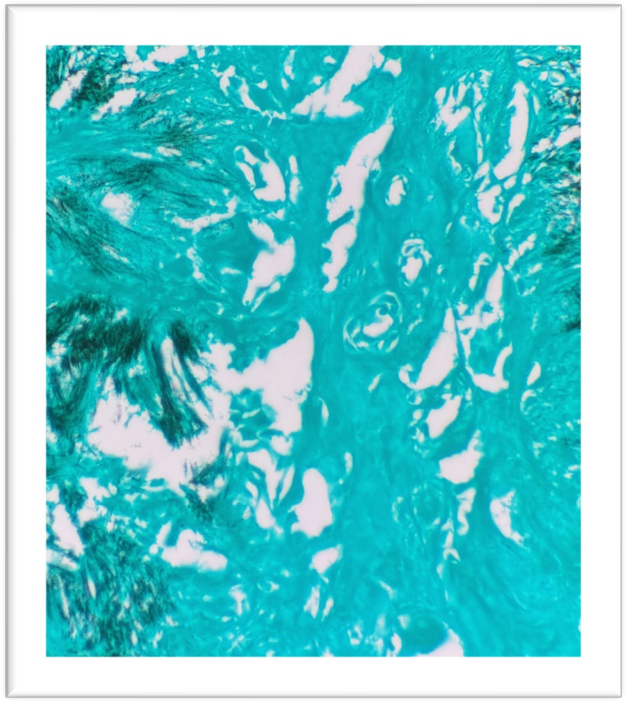
WebPath. Urate Crystals – Notes, Controls & Pitfalls

Newcomer Supply. Urate Stain GMS Technical Memo

Troubleshooting

Incubation Time

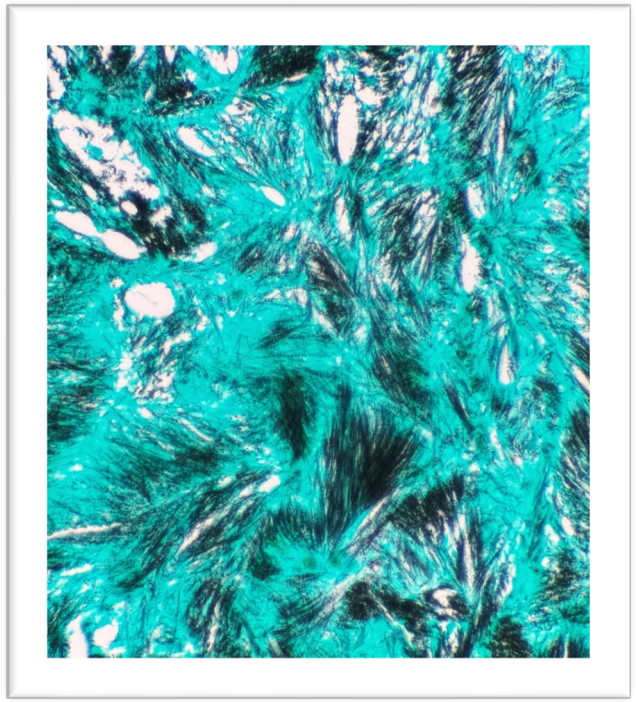
Under-staining



weak staining

[may lead to false-negative]

Control



Over-staining

Nonspecific staining,
dirty background
[X contrast]

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WebPath. Urate Crystals – Notes, Controls & Pitfalls
Newcomer Supply. Urate Stain GMS Technical Memo

TAKE-HOME MESSAGES

- Modified GMS is used to demonstrate urate deposits (e.g. gout, urate nephropathy)
- Urates stain black due to metallic silver deposition; background is green
- Water must be avoided during processing as urates are water-soluble
- Correct alkaline pH, reagent ratio, and sodium thiosulphate are essential for optimal results