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The Chemical Adventures of Sherlock Holmes

The Problem of Woolthshrap Prison

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The following story describes a chemical mystery with an emphasis on scientific observation and the criminal use of a classic reaction of chemistry. This is the seventh article in a series presenting a scientific problem in mystery form in the context of the popular and beloved characters Sherlock Holmes and Dr. Watson (1–6). Following the break in the story where the reader (students and teachers) can ponder and solve the mystery, Sherlock Holmes provides his solution.

The Story

From a distance, the cold fortress walls of Woolthshrap prison seemed to rise out of the gray, morning mist which clung to the fields and forests that surrounded our carriage. I pulled my woolen overcoat tighter about my shoulders and turned to Holmes who continued to gaze out the window, as in a trance, with his thoughts set upon the case that confronted us. The English countryside rushed past in the clatter of hoofbeats. The game was afoot, and I, as always, was at the side of the World's Greatest Consulting Detective.

"Holmes," I said, "Do you mind sharing your thoughts? I am interested, you know."

Sherlock Holmes turned sharply in my direction and responded. "Of course, Watson. But first, review the relevant facts of the case for our fresh consideration."

I began to feel as if I were again being put to one of Holmes' examinations of acumen. These frequent tests of mental keenness always created an anxiety, and I chose my words carefully.

"Well, Holmes," I offered, "after we were alerted by Scotland Yard about the trouble at Woolthshrap Prison on Thursday evening, we arranged for and caught the train from London to Worcester on Friday. Then, as you recall, we secured lodgings in that village on the outskirts of Hereford. Of course, this morning we took this carriage from the inn on our way to..."

"Great Scott!" cried Holmes, interrupting my train of thought. "Watson, I asked for the *facts* of the case. Facts! Not a travel itinerary." He was laughing merrily.

"Well," I stammered, "Perhaps the sequence of these events is relevant to this situation."

"Not so, Watson," he replied. "As I have said countless times, you must acquire an ability to focus your thoughts. With proper focus thoughts can be like drops of water all moving in the same direction, as a mighty river. Without focus, thoughts will be scattered like droplets of mist in this fog that surrounds us." He swept his hand around, making a wide circle in the air.

"Let me review the facts, Watson," the great detective continued without pause. "Thaddeus Stump was sent to Woolthshrap Prison because he was the leader of a criminal gang involved in fraud, arson, extortion, kidnapping, robbery, and various additional atrocities spanning the entire spectrum of derangement. Although he was caught by the Yard, the other members of the organization were not. However, he was the leader and his cohorts in crime would not make a move without his direction. Since he has been

in Woolthshrap, all was quiet in London until a fortnight ago when Scotland Yard detected renewed activity."

"Therefore," I interjected, "Mr. Thaddeus Stump must be in communication with his gang despite the fact that he is in isolation and solitary confinement and is allowed no visitors."

"Exactly," Holmes said. "So it is not a case of a man himself escaping from prison, but a case of a man's evil mind and criminal thoughts escaping the walls that confine his body. And in so doing, he again directs his organization as if he were not even in prison. It is an affront, Watson, to the English system of justice."

"And, Holmes," I replied, "his activities could be used to generate funds necessary to bribe certain crucial prison officials!"

"The corruption of government employees is a frightful thought," said Holmes. "We must clean this matter up quickly, Watson, or the corruption and decay of our British system may spread." His eyes gleamed with the familiar fervor and intensity.

Suddenly our carriage rattled to a stop and we stepped out to confront the imposing facade of Woolthshrap Prison. As I looked up to the top of the walls, I could not conceive of how anyone, in body or mind, could escape this forbidding fortress.

A thick, reinforced door opened in the wall near where our carriage had stopped and a tall man, sharp-faced with narrow cheeks, stepped across the threshold and approached us. He was accompanied by a thick-bodied guard, in uniform, whose large hands rested firmly on his hips.

I made the necessary introductions. "I am Dr. Watson and this is Mr. Sherlock Holmes. I believe that you are expecting us."

The tall man nodded slightly and said, "I am John Williams, the Warden of this facility. While I do appreciate your trouble in coming here, I am certain that we could sort this matter out in due course. I really do not think that Scotland Yard should have consulted you."

"Since we are here, Warden Williams," interrupted Sherlock Holmes, "perhaps you would be good enough to give us your perspective on this puzzling problem."

"Very well, gentlemen," said the Warden. "I was informed by Scotland Yard that they believe Thaddeus Stump is in communication with his cutthroats in London. To me this is not possible. He is kept in solitary confinement in a cell with no window and no connection to the outside. His meals are always brought by the same guard, this man Edmund, in fact." He indicated the stout guard who stood grimly behind him and continued. "In fact, I am the only one whoever talks to Stump and I can assure you that I am not a conspirator!"

The grim guard, not moving, stared straight ahead, his hands still on his hips, as the Warden presented this information. When Williams had finished his comments, Holmes walked behind the guard and suddenly clapped his hands together loudly behind the man's ears.

"What the devil," I exclaimed, thinking Holmes' startling actions to be rather rude. But the guard continued to stand silently and did not flinch.

"Deaf and dumb," said the Warden to Holmes. "But how did you know?"

"It is quite elementary," replied Holmes. "Any person will give some noticeable reaction when their own name is spoken. When you mentioned his name just now, he gave no reaction what-so-ever. Therefore, he must not have heard you speak."

"Quite so," said the Warden. "He is the perfect guard for Stump. Edmund cannot speak to Stump nor can he hear any words spoken by him."

Sherlock Holmes produced a paper and pen and wrote "what is your name and how long have you been employed here?" The guard took the pen and replied, "Edward Edmunds. Sixteen years come December."

At that moment a horseman rode up and handed the Warden a folded copy of what I could see was the *London Times*. Holmes seemed to be studying the hands of the new arrival who rode off immediately. He turned and cheerfully addressed the Warden. "You, sir, are left-handed and a smoker of cigarettes. The horseman who just rode off works at the Hereford Dye Factory upon the Wye River. And your guard here is involved with the medical supplies of the prison."

The Warden's eyes widened. "How in the devil did you know that, Mr. Holmes? You are correct on every count! The horseman is my nephew and he does, indeed, work at that factory. He brings me the *Times* each morning on his way to work. It's rather isolated out here as you may imagine and I try to keep up with the events of London. Edmund here is responsible for treating any cuts and bruises on the prisoners when the doctor is away and he is the doctor's assistant on all occasions. And I do smoke and I am left-handed, although my Mum tried to switch me often enough."

"How did you know all of that, Holmes?" I inquired. Holmes was always happy to reveal his deductions.

"I read it all in their hands, Watson. As you know I have some practical knowledge of chemistry and it is all very clear. Each of these men has yellow stains on his hands, of a significantly different origin I had noticed. The horseman had a bright yellow stain on all ten fingers as if from pushing cloth into or out of a vat. The Hereford Dye Factory is not five miles from where we stand."

"And the guard?" asked the Warden.

"Edward Edmund has a yellow-brown stain upon his right thumb and forefinger that I recognized from my chemical training as characteristic of the element iodine. Watson here will confirm that tincture of iodine is a common antiseptic found in most medical kits. It appears that he has been painting some wound recently."

"And I?" said the Warden.

"You, sir, have a faint yellow stain between the first two fingers of your left hand which can only be caused by consistently holding a strong cigarette in that position."

"Remarkable," I said.

"Nonsense, Watson. It is simply a matter of observation, focused thinking, and a bit of applied chemistry. Now, Warden, if you would be so good to show us Thaddeus Stump's cell, we might be able to shed some light on this little problem."

The Warden motioned for the deaf guard to follow and he led the way through the heavy door and into the yard of Woolthshrap Prison. We walked down endless corridors and through gates which were opened as we approached by attentive guards. The cells we saw were all occupied and the darkness and imposing silence intensified as we walked deeper into the labyrinthine prison. It was as if all

light, heat, and sound were absorbed by the cold walls. Nothing could escape. And yet, I reminded myself, somehow the tentacles of Stump's criminal mind reached from these depths to the distant London underground.

We proceeded down one last corridor and stopped at an iron door, Thaddeus Stump's cell. Holmes looked through a small slit in the door and after a moment motioned for me to examine the inner room. There was no window in the cell and it was a dim and dismal place. I saw a small bed and a straight chair in front of a rough wooden table. On the table was a lamp that provided the dim light and a half eaten plate of beans and potatoes. On the floor lay some discarded clothing and a folded newspaper. Thaddeus Stump himself was curled up on the bed sleeping soundly. Holmes turned to the Warden. "I see that Stump has obtained a copy of the *Times*."

"Stump is an evil man, Mr. Holmes," said the Warden, "but an extremely intelligent one. Reading material is allowed. We are not cruel here. I, in fact, give him my copy of the *Times* when I am finished with it. There is no harm in it. Before Edmund removes it with other rubbish, I look at every page to be sure that no message has been smuggled out."

"So he gets the London paper every day?" Holmes asked.

"Yes," replied the Warden in a tentative voice.

"And the potatoes?"

"Potatoes are served to him on each Friday," said the Warden. "Nearly raw ones. Stump actually prefers them that way. And in any case our cook does not waste much time preparing the prisoner's food properly. But what are you driving at, Mr. Holmes? These are surely trivial details."

I interjected, "Scotland Yard says that Stump communicates with his gang on Sundays. But where are you going with this, Holmes? Must we not examine the interior of the cell?"

"Really, Watson," said Sherlock Holmes. "You surprise me. I should think that the solution is quite obvious by now."

Stop Here and Solve the Mystery

1. Who is helping Thaddeus Stump communicate with his gang in London?
2. How are messages being conveyed out of the prison?
3. What chemistry experiments can Holmes use to demonstrate the scheme that Stump has used?

The following paragraphs contain Holmes' chemical solution to this mystery. Compare your solution to his.

The Solution

Holmes spoke quietly into the Warden's ear. Williams was startled and strode off rapidly down the corridor. When Holmes had drawn me into a private corner he whispered, "What are your thoughts on this case now, Watson?"

"I fear, Holmes, that the Warden and perhaps his nephew are the guilty ones. With the paper delivered daily, Stump conveniently receives all the news he needs about London society and crime. The Warden is the only one who can talk to Stump and it would be easy enough for messages to be passed on to the nephew whom the Warden sees every morning."

"So you would accuse Warden Williams," he said.

"It seems the ultimate conclusion of a chain of focused thinking." I was using Holmes' own methods to arrive at a solution to the problem.

"What about the stout guard Edward Edmunds?" he asked disinterestedly.

"Holmes, that is a cruel joke. The man can neither speak nor hear. Assuredly he cannot be involved in this affair."

"Watson, I fear that you make the mistake in discounting the abilities of people with some affliction or natural limitation. Intelligence does not depend on the ability to hear, speak, walk, or even to see for that matter. However, Mr. Edmund can read, write, and, based on my very simple queries, think. Edward Edmunds is the accomplice in this secret criminal communication. When the Warden returns we can conclude the case. Perhaps what you have missed, Watson, in all of this, is the observational powers of a scientist and the practical knowledge of a chemist!"

The Warden returned a few minutes later carrying my own medical bag and what looked to me like an ordinary potato. "What is the meaning of this?" I stammered, still suspicious of the prison director. "What are you doing with my medical bag?"

"Watson," Holmes said calmly. "I asked the Warden to have your bag retrieved from the carriage and brought to us here."

"But why, Holmes? And the potato, this has no relevance." Holmes took his pen-knife from his pocket and cut the potato in half. Then, reaching into my black medical bag, he removed a small bottle labeled "tincture of iodine" and placed a few drops on the fresh potato surface. He handed me the potato and before my eyes, where the iodine had touched it, the potato had turned a deep blue color.

"Watson, in 1814, Colin and de Claubry (7) reported that iodine and starch react chemically to give a blue or violet color. Let me think, the journal was *Annalen de Physik*, and, I am not sure of this, but on about page 297. That reaction has become something of a classic in quantitative analysis laboratories. It is remarkable to encounter it in Woolthshrap Prison."

"I am lost, Holmes. Please go on."

"Stump has been using a wire or a nail to carefully write messages with starch from his Friday potato on blank portions of the newspaper," he continued. "The starch solution is colorless and cannot be seen. When the Warden checks the paper for written messages he sees nothing unusual. The message is there but it is invisible. Now, when the guard Edmund obtains the paper from Williams he sprays the paper with a diluted tincture of iodine and, in turn, the

invisible starch message appears a visible blue! It is a classical reaction, Watson. The newspaper page itself turns yellow as a background. There is no starch in newspaper. So, Watson, having seen the iodine stains on the fingers of the guard I knew finally that he was the conspirator."

Addressing the Warden, Holmes said, "I would suggest that you retrieve the *Times* from Stump's cell and treat it with iodine. You will find the plans for his gang written in blue and Scotland Yard may be able to catch them if you can convince Edmund to cooperate and pass the information on to London as usual."

"That should be no problem, Mr. Holmes. Please allow me to apologize for my earlier lack of enthusiasm for your presence here. I am truly amazed."

The walk from the bowels of Woolthshrap Prison to the gate and our waiting carriage seemed less dark and cold, now that the solution to the mystery was revealed. As we climbed into our seats, I was delighted to see that the morning mist had been burned away by the autumn sun. The gray was gone and the sky was a beautiful deep azure. I looked down at the blue stain on the potato which, until then, I did not realize that I still carried. I thought of the hope that even a tincture of rationality could offer the world. I thought, also, that someday soon I would renew my study of chemistry. I wanted to share more intimately in the continuing Chemical Adventures of Sherlock Holmes.

At that moment, Holmes interrupted my day-dreaming.

"Come, Watson," he said. "I have a sudden craving for one of Mrs. Hudson's pot-roasts and some freshly boiled potatoes. It will be a cold night by the time we reach London and I relish the thought of our chairs by the fire at 221B Baker Street."

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