

# Biology 12      **Biology for Dummies**

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## **1    A Day at the Theme Park**

It was a beautiful Sunday morning. We were all prepared to drive up to the “Kidney Aqua City” and spend the rest of the day there. We were hoping for an exciting day, more so because the weather was perfect. Our spirits rose. By the way, sorry for not introducing ourselves; my name’s Mr. Water Molecule, and these are my friends Glucosia, Ammonia, Proteinna, Sodium, Potassium, Chlorine and RuBiC.

As soon as we reached the park, I looked around, and was simply stunned by the countless tubes and water slides that seemed to come from every direction. The whole place was a maze! “Just where do we begin, Uric?” I asked my guide Mr. Uric Acid. “Right there,” replied Uric, who then pointed to a large hollow tube painted in a bright red. Beside the tube, there was a large sign-board that read: “Start: The Renal Artery.” We shuddered. We got prepared for the adventure of our lives, and jumped in one-by-one.

Once inside the renal artery, we began to feel an intense pressure. We felt as if someone was pushing us from behind. Uric said: “Welcome to the Afferent Arteriole.” We then reached a big blob of entangled tubes and red wires that looked truly frightening. In the midst of the darkness, I managed to squint my eyes and find a sign that read: “Pressure Filtration at the Glomerulus.” I couldn’t make any sense of it. I was just going to wink at my girlfriend Proteinna, when I realized I was being sucked into a huge structure. There were thunderous voices from invisible speakers that echoed throughout this structure, and they all said the same thing in the same mysterious voice: “The BowBow Man’s Capsule.” I was curious to know why Man was barking BowBow like a dog. I looked behind me, and saw my best friends Proteinna and RuBiC leave me behind to take a different path called the efferent arteriole. Tears filled my eyes.

“This is really scary,” I murmured to myself. Uric told me that this whole maze was called a nephron. I asked him how one would quickly know which one was the afferent arteriole and which the efferent. He told me that since ‘a’ came before ‘e’ in the alphabet, the afferent arteriole must come before the efferent in this fun ride. We then floated around in a fat tube. A bright sign told us that we were in the Proximal Convolute Tubule. Uric informed me that I could call it the PCT, and that the PCT had a twin sister called the DCT.

All of a sudden, tall carrier Protein Policemen in uniform swooped Glucosia, Amino, Sodium and Potassium and put them into separate, differentiated, shopping carts with wheels.

“What are these people doing, Uric?”

“Oh, they probably thought that these kids would be more useful elsewhere and do not belong here. Helpful molecules mustn’t remain here in this tract, you know.”

Someone then set fire to a pump at the back of the carts and this sent all of the shopping carts flying into the air. Uric revealed to me that this was a form of active transportation. They slowly faded from my sight, and eventually disappeared. Chlorine also went along with them because Sodium and Chlorine were a very close couple. I grew sad because everyone was beginning to desert me. But I contented myself by looking at Urea, Ammonia and my supervisor Uric who would always be present to guide me until the end.

We then reached a detour with a “Slow Down, Loop of Henle ahead” sign nearby. There seemed to be a steep turn in front of us. Almost immediately, some of my brothers blindly jumped out of the tube. I was totally confused. Uric explained: “Water, you are a special molecule. You like to be where there’s more solute. We are now in the interior of the kidney known as the Renal Medulla, and since there’s a lot of salt outside, your brothers are moving toward them.”

“Why don’t Sodium’s brothers also go outside then?”

“Good question. We are now in the ‘going down’ or descending limb, and in this limb, the guards will allow only your brothers to cross, barring exit to anyone else.”

But just then, my train of thought was interrupted by a bunch of Sodium’s brothers jumping in.

“These guys are here so that it doesn’t get too crowded out there, and so that more of Sodium’s brothers can leave this place later,” Uric explained sensing the puzzling look on my face.

We then proceeded to take a steep turn to the left, and we reached the so-called “ascending limb” of the Loop of Henle. Over here, some of Sodium’s and Chlorine’s brothers left the tube to meet their friends. Uric said this was so because the Renal Medulla wanted to maintain its concentration gradient so that it could remain hypertonic. I became wary of myself, and was wondering as to when this weird ride would come to an end.

We ascended the tube, and we found ourselves in a thick tube called the Distal Convoluted Tubule which was PCT’s twin sister. As we entered, a few of my brothers and salt friends left us. I had grown accustomed to friends leaving and re-joining me, so I didn’t really bother. Urea’s and Ammonia’s siblings greeted us. We then met with new friends who called themselves ‘histamine’ and ‘penicillin.’

“Who are you guys?” I demanded.

“Um, we’re roaming antibiotics and drugs. No one needs us anymore, so a kind carrier protein policemen escorted us here.”

“Did they set your tail on fire too?”

“Yes they did.”

Uric then continued with his monologue: “Today has been an ideal day. Usually, there are also some  $H^+$  ions that would join with us if the outside surroundings get too acidic.”

I nodded my head, pretending to understand.

“And if the blood is too basic, we’ll be greeted by  $Na^+$  and  $HCO_3^-$  ion friends. There are also some bizarre  $K^+$  folks who would join us if there’s too much of them out there.”

“Where are we headed to, Uric?” I asked, wanting to change topics.

“That I cannot tell you, my friend. It would spoil the excitement.”

The ride seemed to be coming to an end. We reached a fatter tube called the Collecting Duct. We instantly felt an uncomfortable sensation because this part of the ride was “hypertonic.” An invisible force was pulling me outward, but I managed to keep still.

Right then before my eyes, some of my brothers slipped and fell out.

“They want to be where there’s more solute, Water. You got to understand that.”

“So you’re telling me that there’s a lot of solute outside?”

“Yes, that’s right. And sometimes the solute concentration gets depleted, and so I’m forced to send my own kids out there.”

At that moment, Uric ordered his son Urea to jump out of the tube. Urea complied obediently.

The remainder of us who were left fell into a large, voluminous tank. A signboard said that this was the Renal Pelvis. The policemen here were rude, and I flew into a rage when they addressed us collectively as “urine.”

“How dare they!” I murmured.

“Sorry, Water, I hid this from you. Both of us are destined to die,” Uric said solemnly.

I heard a faint “nooo” somewhere in the depth of my body. Urine had been made, and I was part of it.

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I woke up in my bedroom that morning screaming “Nooo,” only to find that I had wet my pants.

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