This book is not intended to replace or interfere with your doctor's recommendations or substitute for medical advice, and you should consult with your health care professional for matters relating to your health. This book is intended to share information and offer suggestions for improved and informed health care choices.

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- History of nasal wash devices, original drawings obtained from United States Patent and Trademark Office records.
- Photo of Mechanical Sinus Irrigator, from GOOGLE images.
- Photo of Sophie Murphy, from KOMU-TV.
- Photo of Rachel and Matthew Griffith, by Michael Griffith.
- Copy of Dr. Sage's Nasal Douche sketch, from "The People's Common Sense Medical Advisor" by R.V. Pierce, M.D.

Special heartfelt gratitude to Stacey M. Kerr, M.D.
Helped me roof the barn 42 years ago;
Canned salsa and picked green beans while listening to my complaints;
Gazed at the stars in the hot tub and edited my written thoughts.
~Thank you my dear friend.

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I have spent my life in children's noses and I was thrilled to read this book! Dr. Hana has grasped what all caretakers need to know to provide optimal care of both children and adults. The nose is a phenomenally central organ whose influence spreads dramatically to cause or extend diseases well beyond the nose itself. Understanding the nose is vital to understanding health. This book should be mandatory reading for primary care doctors and nurses. It is extremely beneficial to patients as well. Dr. Hana has grasped what so few have fully realized: the nose is a critical structure that greatly influences wellness and illness throughout the body. If you are a person with a suffering nose, you need to read this book!.

David S. Parsons, MD, FAAP, FACS
Clinical Professor, Universities of North & South Carolina, Pediatric Otolaryngology
Charlotte Eye, Ear, Nose & Throat Associates, Charlotte, NC
Co-author of The International Journal of Pediatric Otorhinolaryngology; Guest Editor of Pediatric Sinusitis; published over 130 medical articles; created three internationally distributed CD-ROMs describing comprehensive sinus care; helped develop the Minimally Invasive Surgical Technique; designed more than 45 surgical instruments; lectured internationally in more than 20 countries on 6 continents.

Dr. Hana Solomon is a brilliant doctor who has written an easy to understand intelligent book on clearing the acidic congestion of the nasal passages, which will help any person who follows her recommendations stay alkaline, healthy and strong.

Dr. Robert O. Young, Author of The pH Miraclent line treatment for nasal and sinus complaints as well as for prevention.

“Congratulations on a wonderful update with the 2nd edition of your book, Cleaning the Air, One Nose at a Time!

This is the book that I wish I had written myself! It encompasses all of the ailments that are related to the nose. As you clearly understand, the nose is central to all respiratory ailments, from otitis, to rhinitis, sinusitis, asthma, bronchitis, and even bad breath. And, the nose even plays an important role in lower respiratory infections like pneumonia, and the complications of Cystic fibrosis.

This is a wonderful collection of useful information, and should be the Owner’s Manual for anyone with a nose!”

Russell Faust, MD, PhD, FAAP, ABIHM (aka boogordoctor, at boogordoctor.com)
CEO, Sacred Herbals, LLC (sacredherbals.com)

“Being a family physician with chronic allergies, vasomotor rhinitis, and sinus issues, I know the nose inside and out. I know how great an effect the nose has on our overall health and sense of well being. I am so grateful for Dr. Hana’s book because it explains the anatomy, function, and care of the nose in easy to understand terms that I can share with my patients. In my practice I stress patient empowerment and preventive medicine, and I plan to enthusiastically recommend her well written and complete book to anyone with a nose!”

Stacey Kerr, M.D., Board Certified Family Physician
and author of Homebirth in the Hospital

“Nasal saline irrigation is a simple, scientifically proven method for preventing and treating so many respiratory health problems. It has been a breakthrough for my patients with recurrent sinus infections, nasal congestion, asthma and colds. Every day I teach people to incorporate this time-honored and effective technique into their daily health program. Clearing the Air One Nose at a Time is a must-read for every doctor who sees patients and every patient with a nose!”

Jane Murray, M.D., Board Certified in Family Medicine and Holistic Medicine
Medical Director, Sastun Center of Integrative Health Care, Overland Park, KS

“In an easy to understand fashion, Dr. Hana’s book clearly outlines many of the concepts involved with the care of the ears, nose and throat. This book places Dr. Hana as the expert in the science of nasal washing, and it should be required reading for anyone with nasal and sinus problems. It is time that nasal washing be used as a front line treatment for nasal and sinus complaints as well as for prevention.”

Kelvin Walls, M.D.
Board Certified Ears, Nose and Throat Specialist and American Academy of Otolaryngology-Head & Neck Surgery Member

“I have been using a nose washing system for two years and I swear by it, and after reading Dr. Solomon’s book I now know why it works.”

Bill Wax, Program Director and show host of
Sirius/XM Satellite Radio’s B.B. King’s Bluesville

Second Edition

Clearing The Air

One nose at a time

Caring for your personal filter

By Hana R. Solomon, M.D., Pediatrician

Dedication

This book is dedicated to those who will never be able read this book; these words and ideas belong to them.

To all those who taught me and to all who held my hand.

To my grandmother Sabta, who demonstrated how to really survive. She survived the Holocaust with all four children intact and taught me to be strong no matter the obstacles.

To my mother Elza Drapacz whose wisdom, compassion, and never-ending faith allowed me the freedom to find *me*. She taught me how to be appreciative of what I have. If I came home with a cut on my eye, she would say "Thank God it wasn't both eyes."

To my children Josh, Vera, Rachel, and Marcus who accept my still-youthful dreams and who are each living their own dreams.

To all the babies in my life - Sophia, Eliot, Ava, Jordan, and Benjamin - who remind us that sweet life goes on.

To my late sister Jeannie, who showed me how to taste all the spices that life offers, who danced to her own music, and who helped me grow up.

To Jeannie's children, whom I adore and hold as dear to my heart as my own: Solomon, David, Josh, and Michelle.

To my late father who showed me how to have fun and taught me the value of spirit, guts and artistic expression.

To my late grandfather Marcus Drapacz, my dear 'Sabba', a sweet and tender soul. He taught me tolerance and acceptance. Sabba traveled to Missouri in his 80's while speaking no English, barely able to get around, just so he could share my communal family experience on The Farm.

To my lifelong best friend and endless supporter, no matter how outlandish my current dream may be, my husband George.

This book is dedicated to all those who struggle with their noses and to those whom I hope will learn to appreciate that wonderful filter.

Finally, this book is dedicated to all those who have yet to find their voice.

Dr. Hana

Hana R. Solomon, M.D., Pediatrician
Columbia, Missouri

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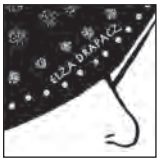
Introduction



Let's talk about your nose.

Let's talk about your kids' noses and your partner's nose and your grandparents' noses and your friends' noses.

In fact, let's talk about *everyone's* nose, because I know noses and what I know can help you.

Why do I care so much about the nose? Why should you care?

We have ignored the nose for far too long. The nose is more than just a bump in the middle of your face or a place for your sunglasses to rest. It is a part of your body that communicates with your outer world. It allows babies to continuously suckle on their mother's breast while easily breathing. The nose has the power to change your entire consciousness and mood in a single second - just expose your nose to a skunk. Or take a whiff of a rose.

The nose is our gatekeeper, our personal filter, and our great defender.

And when a nose fails in some fashion it affects the ears, sinuses, throat, appetite, and disposition. A dysfunctional nose can cause headaches, snoring, coughing and asthma, among other more serious conditions.

I know noses. Trust me, I'm a doctor. Shucks, as a pediatrician for over 20 years, I consulted with innumerable patients whose noses were snotty, congested, itchy, drippy, plugged, dry, sneezy, bloody, and overmedicated. My common-sense first response has always been, "Wash it first."

I guess you could say I was raised to have an "arms-length" relationship with the medical community.

It all began with my mother and my Sabta back in Brooklyn during the 1950s. My grandmother always insisted on chicken soup for any illness.

Despite her petite stature, she would declare, in her native tongue: "Eat. It's good for you!" On the other hand, I'm certain I never heard Sabta say, "Take this medicine. It'll make you better." As a child, I do not recall ever being given a pill for anything, *ever*. Only once did my doctor insist on a medication, a shot no less, when I was really ill.

During the 70s, in my early twenties, I joined a group whose lofty goal was to change the world by living off the Earth and leaving a tiny carbon footprint. There I found inner peace by growing organic food and preserving as much as possible for those long cold winters out on The Farm. I centered my life on beans, greens, meditation, and forgiveness. In this way, I was hoping to repair and change the world.

But the world was not changing fast enough and we were dirt poor. I could barely help myself, let alone anyone else. My teenage experience of volunteering as a candy striper in a Brooklyn hospital seeded my idea of being a doctor, but I lacked confidence. I had no role models to encourage me to pursue this outlandish notion. Me? A doctor? You must be joking! But somewhere, in the deepest part of me, I still wanted to be a doctor.

I dared not voice my dream. At least, not until my personal growth experience of living on the farm with beans, greens, and meditation fertilized my determination and strength.

When I was twenty-seven I left The Farm and began undergraduate studies with the goal of becoming a doctor. I completed four years of college in three years, and exactly three years after my exit off The Farm I started my first day of medical school as a single mom with two children.

The women in my family demonstrated for me, through their own lives, how to live as independent thinkers. My learning process was most certainly skewed by my life experiences, maturity and appreciation for the natural world. I was primarily interested in prevention and avoiding invasive medications and surgeries. I listened intently when professors taught me compassion and patient empowerment. The technical skills of surgical procedures, the nuances of x-ray procedures, and the minutiae of medical regulations were things I grasped quickly, and while I

understood their importance I found them tedious. I knew through my own life experiences that the body is a miraculous organism, often able to heal itself if supported in the right environment.

Throughout medical school and residency I was blessed to receive training from a spectacular teacher of healing. As I listened to his lectures, I did not know the extent of his rare gift, but I did appreciate that he was special. Dr. Gullio Barbero, a pediatric gastroenterologist, would often take four hours or more to hear a family's story. Really, *four hours*. He taught all of us, both the medical students and the residents, that you must start at the beginning: the childhood of the parents. Then you must follow that timeline all the way to the current tummy ache; four hours was actually the *abridged* version. He demonstrated how this was the first step to understanding the way to heal compassionately. You must listen. The rest is easy.

Another remarkable teacher was Dr. David Parsons, an ear, nose and throat surgeon. His general message was "First, do no harm." This is, of course, part of the Hippocratic Oath, which all doctors take upon graduating from medical school. Dr. Parsons' specialties were sinus surgery, ear tube placements, tonsillectomies and adenoidectomies. However, his message was, "Never perform surgery on a child if it can be avoided." He shared the notion that irrigation of the nose makes sense *before* a patient goes into the operating room. He taught that washing could even *prevent* a trip to the operating room.

I took this advice to heart.

During the decades since completing my medical training I have learned much about the nose. For years I shared a clinic with my husband who is a family physician, so I have seen my share of adult issues in the nose, sinus, ears and lungs. Let's face it: I developed into the "snotty nose" expert. I studied, reviewed, discussed and listened to my patients and found I often encouraged nose washing as a way to avoid or reduce the need for medications. I also reviewed published scientific literature regarding nasal irrigation, and I found enormous support for this simple idea. More importantly, I asked every one of my patients to tell me about their experiences with nasal washing. Then I compared this feedback with the formal studies published in the medical literature.

Unfortunately, for over fifteen years, the majority of my colleagues just didn't get it. They were not incorporating nasal washing into their practices.

My patients confirmed what I witnessed to be true: those who washed their nose daily came to see me less often. Those who washed daily used fewer medications. Those who washed saved lots of money. Those who washed slept better, snored less, and experienced fewer asthma episodes.

A long time ago, we learned that if we brush our teeth daily, we prevent cavities. So now we brush. We know that all sorts of filters, whether for the car, the clothes dryer, the home heating and cooling system … all work better if kept clean. Why not clean the body's filter?

This makes sense to me. It has made sense to Buddhist monks for millennia. Jala Neti is the ancient practice of nasal washing performed as a daily hygiene routine in the eastern world. Even our grandmothers knew that moisture in the nose makes sense. Have you ever sniffed salt water when you had a cold? Remember placing your head over a steamy pot or in the warm shower when you were ill? Ever used a humidifier? How about that clean feeling after an ocean swim? Washing the nose uses a similar principle, but *far more easily, efficiently, and effectively.*

The question for me was: why did so many patients *not* follow my simple suggestion? Every parent knows that when a child falls and scrapes a knee, the wound is first washed, and *then* an antibiotic ointment is applied, if necessary. What was preventing more of my patients from incorporating nasal cleansing as a daily hygiene practice?

There were many hurdles. Convenience was a big hurdle. Availability was another one. The "yuck" factor was a common obstacle. "You want me to do what? And where?!" was a familiar response from patients. Because of this, I began my journey of finding the ideal nose washing system for my patients.

I am a medical doctor who thinks like a mom. I have been teaching nasal washing since long before it was "cool." I was "green" before that was cool, too. I have witnessed as both a patient and a physician the

value and effectiveness of a preventive, holistic, patient-empowered approach. As a pediatrician, I have seen thousands of snotty noses, ear infections, sinus issues and asthma episodes. And my focus has been on avoidance of medications whenever possible. First, "Do No Harm."

This book is not intended to be a comprehensive compilation of all the issues related to the nose, nor a medical reference book. It is, however, full of good information and common-sense knowledge which I believe might be helpful in your journey to learn more about your body's air filter and how it relates to your overall health.

In life, as in medicine, nothing is absolute; everything is relative. The more you know, the better able you are to make choices that fit into your life. I share this with you so you can become empowered.

One more thing, and let's get this straight: we are talking about snot, goobers, boogers and mucus here, so please, do not be offended.

Stacey and Hana, young mothers studying pediatrics while cleaning house

Stacey Marie Kerr M.D., Hana R. Solomon, M.D.

How to Use This Book

This book is for you if:

You have a nose,

You are the parent of sick and snotty-nosed kids,

You are a health care provider,

You live or work in a polluted environment, or

You want to have fewer problems with your nose, you want to use less medication and visit the doctor less often.

Part I: Everybody Has a Nose, is an overview for everyone who has a nose. You will find detailed, scientific explanations of the anatomy, functions and dysfunctions of the nose and related organs in this section. I feel it's important that you become familiar with the basics. Remember, the more you know, the better equipped you are to make decisions. You may find the master diagrams helpful.

Part II: Keeping the Filter Clean, is about how to clean your nose and how to keep this important filter working well for you.

Part III: Every Nose is Special, covers specific conditions for various groups of people. Choose the sections that apply to you.

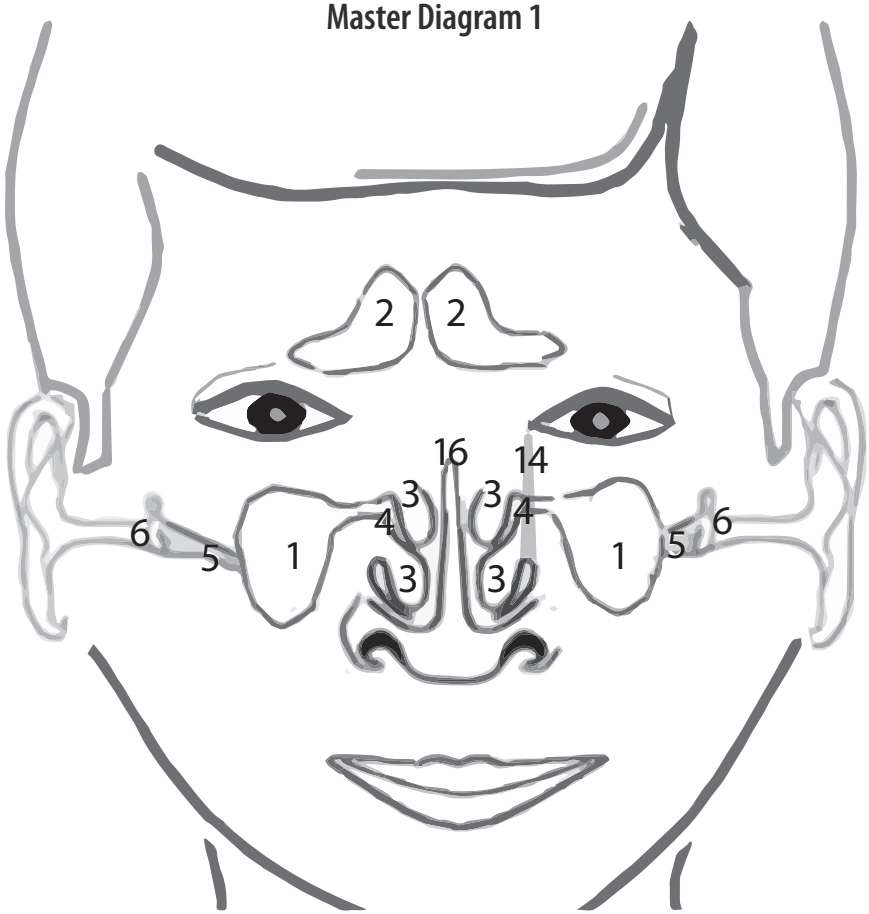
Full disclosure: This book is a plea, a pitch, an argument, an appeal, even a nag, in favor of daily nose washing. It is not an endorsement for Nasopure, a product that I have developed and patented. I do want to be clear: it is impossible for me to discuss and present the most up-to-date comprehensive information on nasal washing without mentioning Nasopure, because it is the system I know well through years of clinical experience. There are no paid endorsements in this book; every shared experience has been freely given by grateful nose washers. I hope that my full and complete disclosure here "clears the air" and explains any perceived product endorsement you might find in this book.

What is far more important is this: daily washing will keep your nasal passages and sinuses clean, clear, and healthy. Allergists, family doctors,

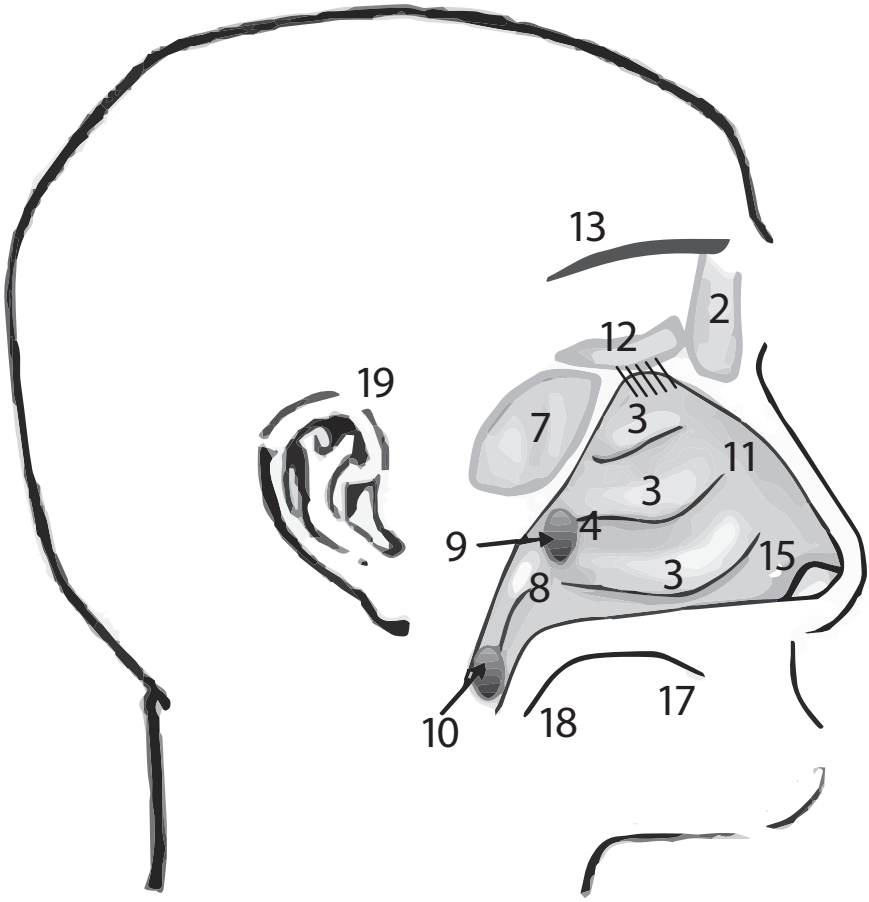
pediatricians, ear, nose and throat surgeons, naturopathic physicians and nurse practitioners all agree that nasal washing is safe and effective. You will hear from many of these experts as you read this book. What might be even more meaningful is that tens of thousands of people agree that nose washing, done correctly, feels good and refreshing and actually improves the quality of their lives. I truly don't care what you use to wash, as long as ***you use something every day to keep your nose clean and healthy.***

Welcome to our knowledge place.

Master Diagram 1

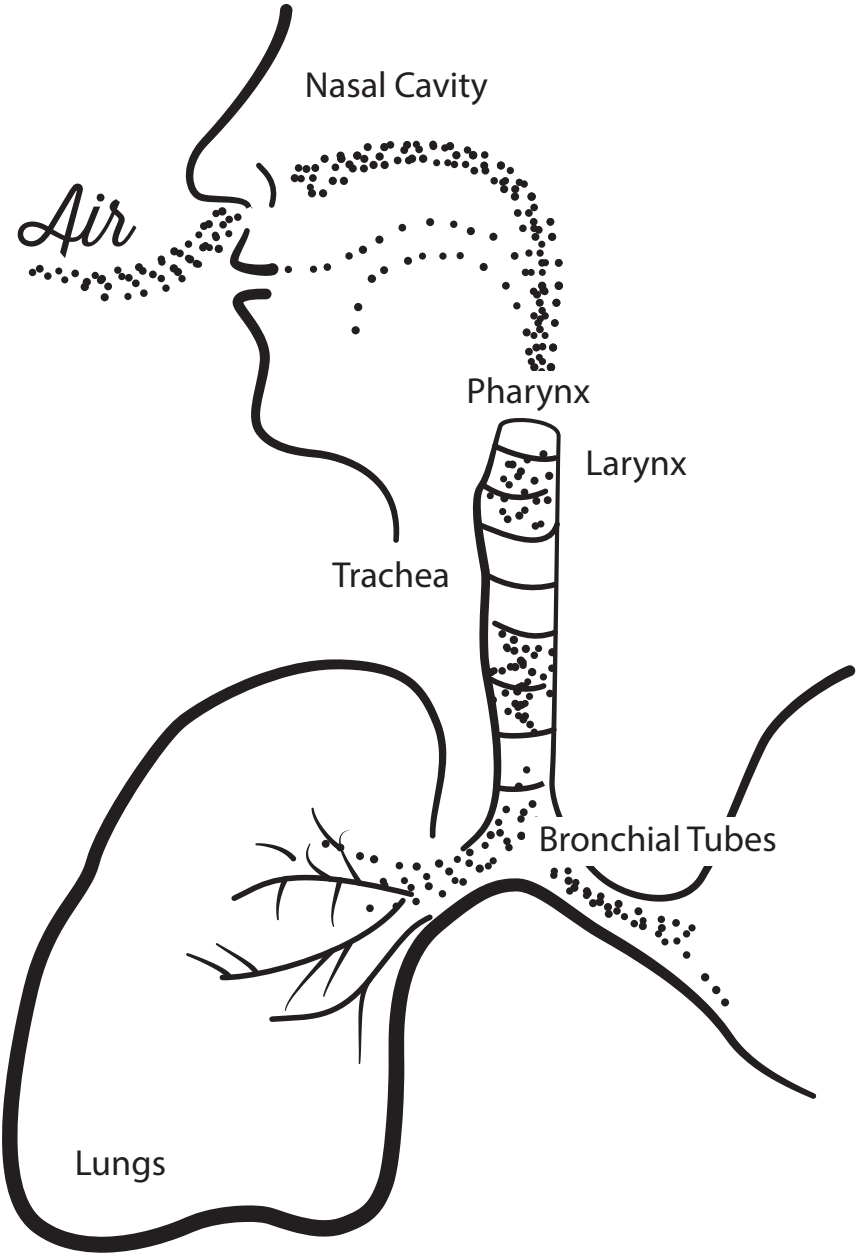


Master Diagram 2



1: Maxillary Sinus
2: Frontal Sinus
3: Turbinates
4: Sinus Drainage
5: Eustachian Tube
6: Ear Drum
7: Sphenoid Sinus
8: Eustachian Tube Opening
9: Adenoids
10: Tonsils
11: Blood Vessels
12: Olfactory Nerves
13: Eyebrow
14: Tear Duct
15: Tear Drainage
16: Septum
17: Hard Palate
18: Soft Palate
19: Ear

Master Diagram 3



Part I

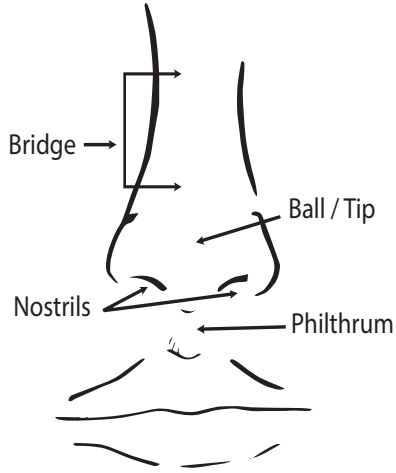
Everybody Has a Nose

Chapter 1

Lay of the Land— Overview of the Nose

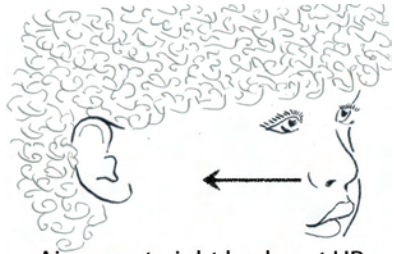
I have always practiced medicine with a basic premise: my patients and I are a team. I acknowledge their values, preferences, and experiences so that I can understand their needs. I then share what I know, both book and clinical knowledge. A patient will ultimately make his or her own best choice; being an informed consumer makes the most sense for ideal health. With this in mind, I'd like to share my knowledge of the nose and all related structures so you can choose what works for you. This book is not intended to be comprehensive, but will be thorough as it relates to nasal health. All the scientific minutiae one wishes to learn can be found in other publications and in references listed in this book.

The nose is an elegant structure, beautifully designed for essential and life-supporting functions. It is not simply an air-intake port. When the nose works well, it filters, warms and humidifies the air we breathe (10,000 liters each day) - no small task in today's environment. The nose is the first major defense the human body has to protect us from our polluted world. For example, a sneeze is the body's initial protection to expel something considered noxious or even dangerous.



Without this filtering mechanism, millions of impurities would be allowed into our fragile lung tissues, wreaking havoc and damaging the

gas-exchanging membranes deep within our chests. Without the oxygen-humidifying mechanism in our nose, our throat and airways would be dry and irritated all the time, and our moist lungs would dry out like a sponge left in the sun.


Air goes straight back, not UP

What we see of the nose is simply its outer covering and the two intake portals. The outer shape creates the illusion that the nose goes *up*. However, the nose really goes straight back into your head. The medical providers who specialize in the nose can safely insert a probe into your nose, directed straight back without any discomfort, yet a probe cannot be inserted upward more than a fraction of an inch. This common misconception has implications you will learn about as you read on. Remember, the nasal passages tunnel straight back!

Even when we are forced to breathe through our mouths, our bodies attempt to moisturize the incoming air by using the tongue as a makeshift humidifier. The healthy and clear nose is a much more efficient and effective air conditioner than the tongue. The nose needs to expose a maximum amount of its intake to the air conditioning apparatus, so it is divided into two wind tunnels *(nostrils)* separated by a thin layer of cartilage called the *septum*.

The septum divides only the front of the nose into two nostrils - the back of the nose is a single chamber. Each nostril is designed to increase surface area with three rolls of tissue *(turbinates)* on each side. The air we inhale passes over these turbinates, picking up moisture along the way.

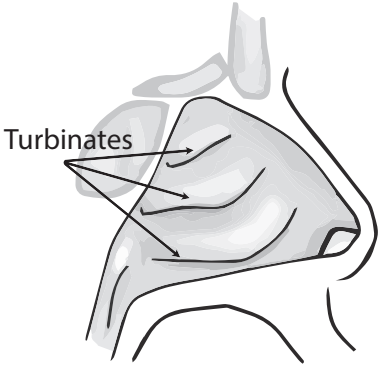
As the air swirls and spins, it passes across tiny hairs built into the lining of the nose. These hairs act as filters, capturing particles before they can reach the tender lungs and cause damage. Hairs just inside the nostril

are coarse, but the ones further back are small and almost microscopic. When these tiny hairs *(cilia)* are allowed to move freely, and are not gummed up by debris and mucus, they do an excellent job of cleaning the air we breathe and protecting our lungs.

Sometimes an irritant gets caught, either on those folds of tissues called turbinates, or in the cilia. When this happens, we might sneeze or our nose may itch. More mucus is produced and our nose lining swells, resulting in the familiar congested feeling. All of these reactions are really part of the body's design to protect itself from impurities. We can help the nose filter more effectively by washing this air conditioning system. Flushing the filter clean is an effective way to help our nose do its job in today's complex and sometimes unclean environment.

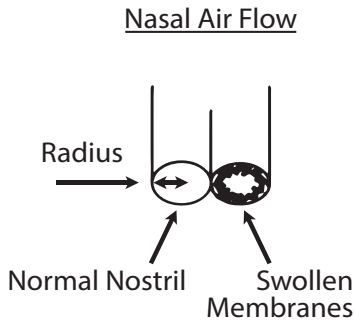
Primary Function of the Nose: Defend, Protect and Shield

There are many nasal irritants in our world: smoke (fires and cigarettes), allergens, pollution, infectious particles (virus, bacteria, fungus) and excessive mucus. Amazing things happen immediately after one is exposed to irritants.



First, those rolls of tissues *(turbinates)* swell. Increased mucus production occurs. The mucus gets thicker and stickier. The filtering hairs *(cilia)* become clogged. As a result, all the normal drainage systems fail to function. Excessive mucus drips down the throat. There is a decrease in our ability to smell, taste, or hear. We may notice increased sinus pressure, headaches, bad breath or decreased exercise tolerance. Symptoms of chronically obstructed drainage include fatigue, poor appetite, decreased ability to concentrate and even bloody noses.

Irritants are not the only cause of nasal congestion. Air that is cold or dry can also cause congestion of your nasal passages. The congestion slows the airflow to ensure that your lungs receive warm and moist air. And while this reaction may help protect your lungs, the resulting congestion is not pleasant.



The nasal opening, with its general rounded shape, follows basic laws of physics. Any decrease in the radius decreases the actual amount of airflow enormously. In practical terms, a tiny amount of swelling in the nasal passages can result in significant discomfort.

The turbinates' tissue folds increase surface area so more of the inhaled air can be conditioned. But what else is in the nose that allows it to act as such a great defender against irritants? Let's look at mucus and cilia.

The Magic of Mucus

Secreted by special cells, mucus is the substance that you know as "snot," "boogers," or "goobers" - terms that our children delight in saying. Nasal discharge, nasal drainage, rhinitis, sputum and phlegm are also terms used to describe this stuff.

But let's clear up the difference between *mucus* and *mucous*. Mucus is the stuff we know as nasal discharge. Mucous membranes are the actual lining of the nose and the sinuses. The mucous membranes secrete mucus.

Mucous membranes blanket the nose and other body parts. This membrane lining contains special *goblet cells* that produce mucus, a complex substance that keeps the nose and sinuses moist. We produce between one pint and one quart of mucus per day, thanks to goblet cells. That's two to four cups, or eight to sixteen ounces per day!

Certain proteins in the goblet cells determine the thickness, stickiness (viscosity), and stretchiness (elasticity) of the mucus. Mucus is usually very watery but it gets thicker and stickier when exposed to irritants such as allergens, infections and pollution. In addition, hydration, age, hormones and medications affect the consistency of mucus. Older people experience thicker and stickier mucus because of hormonal changes, as do pregnant women.

During cold weather, the nose hairs do not work as well to sweep the mucus towards the back of the throat and this explains why we often develop a runny nose when exposed to very cold temperatures. Mucus also thickens in cold weather. When an individual comes in from the cold, the mucus thins and begins to run before the cilia begin to work again.

Mucus traps irritants and protects our entire airway before being expelled. There are two layers in the mucous membrane lining of your nose. The outer layer is thick and rich with immune cells, antibodies and antibacterial proteins. This layer traps bacterial, viral, and particulate matter. The thinner, underlying layer enables the cilia to beat, their tips essentially grabbing the superficial layer and pushing it in the direction in which the cilia are beating, usually towards the back of the throat. Most normal mucus is swallowed and the trapped irritants are inactivated in the intestines *(gastrointestinal tract)* before leaving the body.

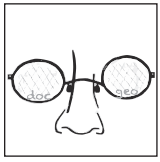
A problem occurs when mucus blocks the sinus or ear drainage openings. If the sinus opening *(osteomeatal complex)* becomes plugged we are at risk for infection or at the very least a sinus pressure headache. Similarly, if the ear drainage tube *(Eustachian tube)* gets clogged, ear pain, decreased hearing, infection, and other maladies can occur. When the normal flow of mucus is inhibited for any reason *(mucostasis)*, dangerous bacterial, viral, or allergen particles can remain on cell surfaces long enough to penetrate the body's defense system.

Excess draining down the throat is called *post-nasal drip*. This can cause a cough, a change in voice quality or a sore throat. Mucus is naturally acidic and can burn the throat if allowed to stagnate there. Hence the complaint, "I woke up with a sore throat" is often a result of mucus drainage during sleep. Enough mucus and swelling can also cause a decreased sense of smell and taste.

The Wonders of Mucus

- Goblet cells in the mucous membrane produce mucus.
- Humans produce one pint to one quart of mucus each day.
- Mucus is swept along by cilia.
- Mucus protects cells and traps irritants.
- Mucus is cleared by sneezing, coughing, swallowing and blowing.
- Mucous membranes cover the entire respiratory and digestive tract lining.
- Amount of mucus is increased when exposed to allergens, infections and pollutants.
- Consistency of mucus thickness when exposed to allergens, infections and pollutants.

Mucus and Its Many Colors: Help, My Mucus Is Green!



In general, mucus is clear, thin, watery and even slimy. If infected with viral, bacterial or fungal particles, mucus normally changes to colors that can include white, yellow, green, brown, grey, or even blood-tinged. Discolored mucus can often have an offensive odor.

Many people assume that if their mucus is clear or white they are not infected, but if the mucus is yellow or green they require an antibiotic. This is not true. In fact, when one has a common cold the mucus progresses from clear to white to yellow to green and sometimes grey or brown and then clears again, all within seven to ten days. If one has persistent (more than three to five days) yellow or green discharge, then a bacterial infection ***may*** be present. We now know that even if a bacterial infection is suspected, a good flushing three to four times a day may prevent the need for medications. Only about 20% of bacterial sinusitis cases actually require antibiotics. Yes! Eighty percent of the time antibiotics are not needed!

This is also true for inner ear infections. NOTE: The antibiotic may treat the infection but will not address the original cause of the unhealthy environment.

People with asthma experience excess mucus production as part of the asthma inflammatory reaction, particularly in the bronchial tubes but also in the nasal cavity. This mucus is usually white and frothy and blocks or clogs the airways which in turn causes chest tightness, coughing, and wheezing.

Mucus Serves As a Frontline Defense

- Filters and moisturizes our air.
- Traps inhaled irritants (molds, pollen, dust mites, animal dander, smoke, ash, pollution).
- Protects against bacterial or viral invasion.
- Contains bacteria-fighting substances, including natural antibodies.
- Moistens food, making it easier to swallow and pass through the intestine.
- Smoothes the airway's linings and traps foreign substances before they invade the lower respiratory system.

The Cilia Sweep

Remember the little hairs *(cilia)* that blanket the inside of the nose and the sinuses? These are tiny projections which move in a wave-like pattern to transport mucus and all filtered material from the nose. Most mucus and debris is swallowed, spit out, or physically removed by blowing the nose.

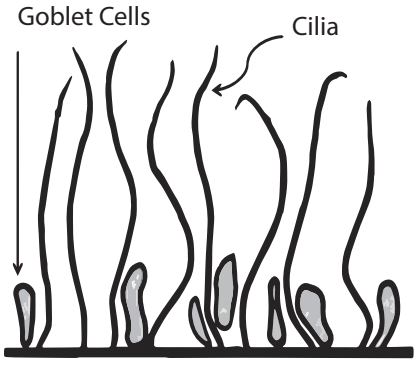
I like to think of cilia as a broom because they function to sweep the mucus outward. The sinuses in their healthy state are relatively empty, thanks to the constant sweeping of the mucus against gravity. The cilia work in unison to move the mucus through the drainage openings *(ostia)*. The mucus is drained into the nasal cavity where it then exits out of the nose or onto the back of the throat. When cilia do not function properly due to infection, smoking, or a congenital problem (rare),

mucus is not properly cleared. Infection then becomes a self-perpetuating process during which the infected mucus interferes with the normal sweeping process of the cilia, and this in turn prevents proper clearance of the mucus.

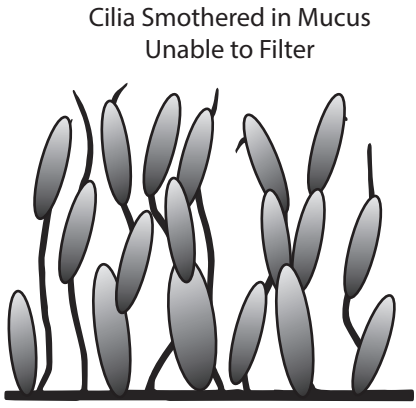
Cilia filter and mobilize...
debris, mucus, irritants, pollen, dust particles, virus, bacteria.

Mucus traps...
particles and moistens membranes.

Sinus and Ear Openings (ostia)...
allow normal mucus to drain from sinuses and ear cavities.



Normal Cilia



Abnormal Cilia

Left Maxillary Sinus
Arrows show direction of mucus being swept out of sinus cavity by cilia.

LET'S HEAR FROM THE **Experts**

One of the nose's major tasks is to filter the air before it enters the lungs. Dust, smoke, dander, microorganisms and pollen contaminate the air at times and the small particles are caught by the mucus of the nose. Many of these are quite irritating to the nose. The nose normally protects itself with a mucus blanket that is moved by microscopic hair-tipped cells to the back of the nose where it is swallowed and the stomach juices are fairly effective in destroying these agents. When the nose is inflamed, it is not able to remove the noxious agents. Inflammation worsens the longer these agents remain in the nose.

Nasal irrigation with saline is effective in removing these noxious agents. Nasal saline solutions are available to spray as a mist which moisturizes the nose, but I believe that large volume irrigation is required to remove the harmful agents from the nose.

Jerry Templer, MD
Professor of Otolaryngology
University Of Missouri-Columbia School of Medicine

Smell and Taste

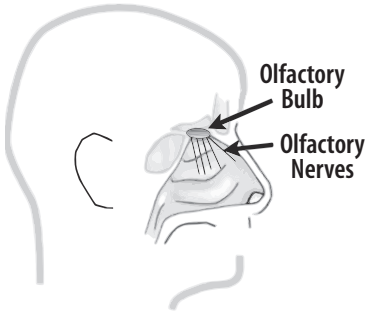
Both of these senses are directly related to the health of the nose.

Smell (*Olfactory system*)

What would life be like without the ability to smell? The term *anosmia* means lack of or decreased sense of smell. The olfactory nerve cells with their special ends, called *olfactory receptors*, are located at the upper area of each nasal cavity. This is why we sniff to increase the ability to smell subtleties. The average nasal

cavity contains more than 100 million olfactory neurons. In newborns, the nerve endings are a compacted sheet, but in children and adults, these tissues become less dense and interwoven. As humans age, the number of olfactory neurons steadily decreases.

The sense of smell is initiated by airborne chemicals that enter the nasal cavity in circular currents of air movement. These chemicals stimulate our olfactory nerves. The response to an odor is directly related to the sniff's duration, volume and velocity. The ability to smell can be compromised if the olfactory receptors are covered in mucoid debris.



Taste (*Gustatory system*)

Considered the fifth sense, taste is mostly the smell of food in the mouth. *Ageusia* refers to a lack of or reduced ability to taste sweet, sour, bitter or salty substances.

Taste buds are tiny projections embedded in the tongue; a single taste bud can respond to multiple types of tastes. Taste buds cover the tongue, but are also located on the soft palate, epiglottis, larynx, and pharynx. There are eight to ten thousand taste buds in the human mouth.

Certain tastes are appreciated by anatomical locations. For example, sweetness is most readily detected at the tip of the tongue, whereas salty taste is detected at the front and sides of the tongue. Sour tastes are along the sides and bitter sensations are appreciated at the back of the tongue.

In humans and many other vertebrates, the sense of taste works with the sense of smell in the brain's perception of flavor. The gustatory system is intertwined with the olfactory system - that is to say, smell and taste are very closely related. Anyone who cannot smell appreciates the fact that his or her food tastes differently or does not have any flavor at all. See *Loss of Smell and Taste* on page 221.

Moods

Smells and the ability of the nose to fully function can affect our mood. Remember the last time you were exposed to a foul odor? You immediately felt a disgust or distaste for the source. Remember the last time you smelled something romantically appealing? It can aid in creating a sensual experience, which leads to many normal and delightful life activities. Candles, perfumes and aromatherapy are all booming businesses, a clear indication of how odors affect our moods. I am certain you can relate to a past experience when you were exposed to a scent which evoked childhood memories.

Sexuality

The nose contains tissue that is identical to our sexual organs' erectile tissue. The turbinates inside the nose contain large collapsible pockets of blood called *venous sinusoids*. These sinusoids become engorged and swell in response to irritants, resulting in decreased airflow. When you are exposed to any irritant, the instantaneous reaction causes the typical congested nose. Have you ever walked into an environment that contains strong irritants? Your nose instantly swells and feels dried, stuffy, and blocked. *Immediately*. Like an erection.

In evolution, survival is based on the ability to smell. The concept of human pheromones, or sexual scents of attraction, has been debated and researched for years. Pheromones' existence in humans may be in dispute but if you think about it, how often have you been turned off just by someone's smell, or the reverse, turned on by a subtle perfume?

If you're looking for the mate of your dreams, pheromones may contribute to this attraction. Our body odors, perceived as pleasant and sexy to another person, are part of a highly selective process. Pay attention to those signals when looking for a mate!

There is still much to learn about these substances but we do know that the nose and sexual behavior are related.

Other Uses for Your Nose

On a lighter note, rubbing noses with someone you really like just wouldn't be the same without a nose, would it? What non-Eskimos call "Eskimo kissing" is loosely based on a traditional greeting and form of expressing affection, usually between family members and loved ones.

Think how hard it would be to keep your glasses in front of your eyes, not to mention how sore your ears would get, if you didn't have a nose.

Functions of the Nose

- Filter the air we breathe
- Moisten the air we breathe
- Warm the air we breathe

Dr. Hana's
CLINICAL PEARLS

Ear pain? Look in the nose.

Loss of taste? Look in the nose.

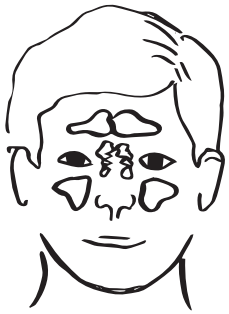
Headache? Look in the nose.

Sore throat? Look in the nose.

Asthma poorly controlled? Look in the nose.

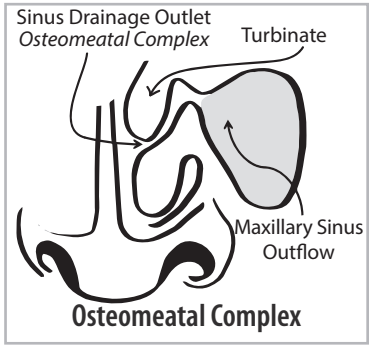
Snoring? Look in the nose.

Sinuses—
What Are They and Why Do We Have Them?

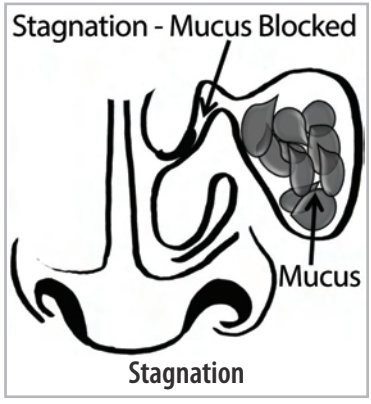


The sinuses are air-filled pockets within the skull, one pair on each side of the nose (the maxillary sinuses), one pair just between and above the eyebrows (the frontal sinuses), and two sets behind the nasal cavity (the ethmoids and sphenoids).

The function of the sinuses has been the subject of extensive research and we still have much to learn. What we do know is that the sinuses contribute to conditioning the air we breathe, give resonance to the voice, assist in absorbing shock, reduce the weight of the skull, and contribute to facial growth. If we did not have sinuses, our skulls would be too heavy to carry around; they lighten our load and influence our facial form.



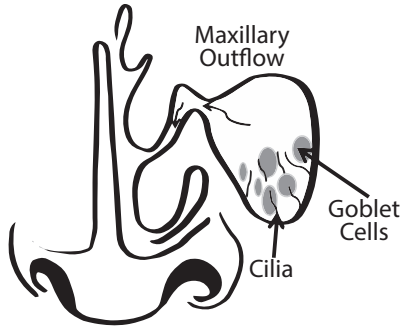
The *osteomeatal complex* is the sinus drainage area, tucked between the lower two turbinates and emptying into the back of the throat. This important system of sinus openings collects mucus discharge from the various sinus cavities.



There is a phenomenon called *stagnation* that can occur at the osteomeatal complex - the main intersection of the drainage system. Stagnation occurs when the nose lining swells, blocking the osteomeatal complex and disrupting normal mucus clearance. This results in an unhealthy sinus environment. Clearance of the

nose is accomplished when free-flowing secretions, open draining ports, and freely moving cilia have been restored.

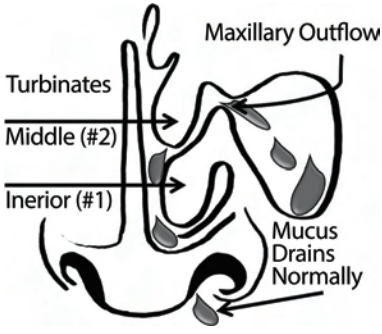
The sinuses, like the nose, secrete mucus and contain cilia. Interestingly, the nose contains many more mucus-producing goblet cells than the sinuses, and thus produces more snot. Of the various sinus cavities, the maxillary sinus has the most goblet cells.



Maxillary Outflow

The cilia present in the sinuses work to move mucus in wave-like sweeps outward, toward the opening. Sinus cilia beat at a rate of 700-800 beats per minute and move mucus at a rate of 9 mm per minute. The movement of mucus is known as *mucociliary clearance*, or transit time. This clearance is vital since some sinuses drain via an opening at the top rather than the bottom, and the cilia must move mucus against gravity. It is interesting to note that hypertonic saline nasal irrigation has been shown to improve this transit time by 17% .

The sinuses drain into the osteomeatal complex and if clear, will drain normally. If obstructed by disease or normal body variations, the sinuses are unable to move mucus out and congestion begins. This crucial location requires cleansing without disrupting the natural balance.

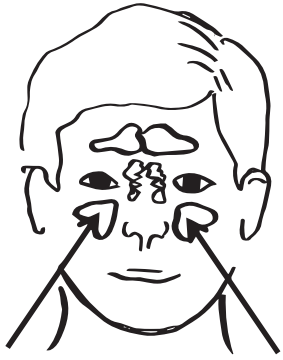


Normal Mucus Drainage

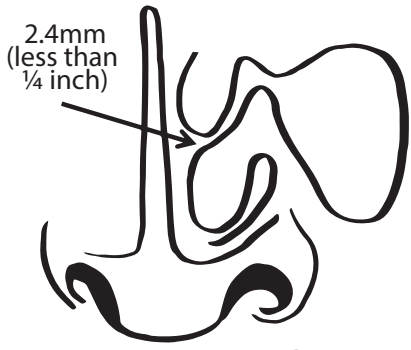
When all is working well, the sinuses are clear and empty of stagnant mucus.

Note: the exit *(maxillary outflow)* is small, located higher than the maxillary body and tucked between the turbinate folds. One can easily imagine how this becomes blocked due to colds, allergies, dried mucus and, as we will learn later, pregnancy.

As mentioned above, there are four pairs of sinuses in adults: *maxillary, frontal, ethmoid and sphenoid*. Babies are born with two of these sinus sets, the maxillary and the ethmoid. The remaining two sets develop during childhood, starting in the first year and expanding progressively until the child is in the early teens.



Maxillary Sinuses

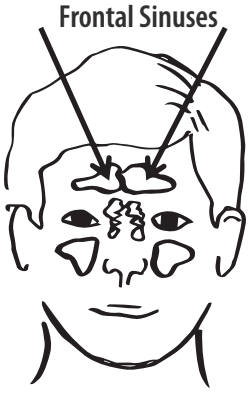


Sinus Drainage Outlet

Maxillary Sinuses

The largest of the sinuses are the maxillary, one located in each cheek. Imagine a cave-like room with the only window at the very top of a wall, near the ceiling. This drainage port is higher than the body of the sinus. That means the cleansing sweep of the cilia must move *against* gravity.

The bony opening *(ostium)* size is very small, averaging 2.4 mm (a hair less than ¼ inch). The actual sinus opening is even narrower than the opening in the bone because the mucosa lining takes up space. Additionally, it is difficult for a doctor to see this tiny opening because it is hidden behind a bony protuberance. All of these factors contribute to a final sinus drainage port that is tiny and well hidden.



Frontal Sinuses

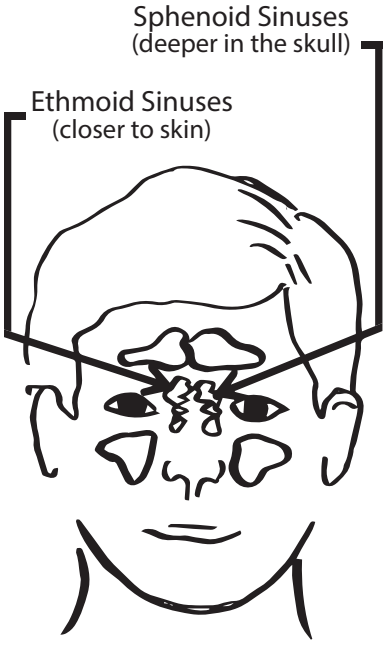
The frontal sinuses are located in the middle of the forehead. Unlike the maxillary cavities, they have their ostia at the bottom portion of the cavity, so they have gravity working for them. Accordingly, these sinuses are less likely to become infected.

Ethmoid Sinuses

The ethmoid sinuses are like sponges with tiny openings; this sponge is actually bone with many air cells. They are located at the roof of the nose, between the eyeballs. The bone is lightweight with approximately six to twelve small sinuses per side. The nerves, which allow us to smell the world around us, are located just below these sinuses. These sinuses drain indirectly into the osteomeatal complex.

Sphenoid Sinuses

Located directly behind the ethmoid sinuses, the sphenoid sinuses are near the middle of the skull. These can vary in both shape and size. Often, the nasal septum can influence their contour. In fact, those with a deviated septum (a septum that is deviated a bit to one side) are more at risk of developing an infection in this particular cavity.



In general, a good washing of the nasal cavity is all that is needed to maintain a healthy environment for the tissues. Encouraging adequate drainage of the maxillary sinuses allows the natural process to proceed.

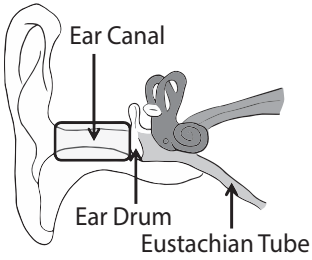
Three key elements necessary to maintain normal function of the nose and sinuses:

- Keep the cilia clean enough to keep on sweeping.
- Keep the sinus drainage port open and free to drain.
- Keep the mucus thin and free-flowing.

As The Nose Goes, the Ears Follow

Structure of the Ear

We can't look inside our own ears but we can sure feel what goes on in there! As you will soon learn, what goes on in the ears is intimately connected to the nose. Three distinct areas make up the human ear: the outer, the middle and the inner ear.

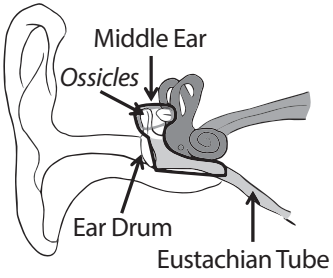


Outer Ear

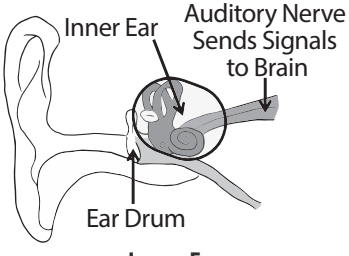
The "ear canal" is part of the outer ear. This is the part we can see, the part that can get blocked with ear wax, and the part that captures sound from outside the body. The ear canal carries sound to a thin translucent membrane called the eardrum, or the *tympanic membrane*. It is the only portion a medical provider can easily observe in a clinic setting when evaluating a possible ear infection.

On the other side of the tympanic membrane is the middle ear, an air-filled chamber that contains the *ossicles* (three tiny bones all linked together). When the eardrum vibrates with sound coming from the ear canal, the ossicles pick up the vibrations and amplify them, carrying them to the inner ear. The inner ear translates those vibrations into electrical signals and sends them to the auditory nerve, which is connected to the brain. When these nerve impulses reach the brain, they're interpreted as sound.

How does this involve the nose? Well, there is a direct connection between the middle ear and the nose.



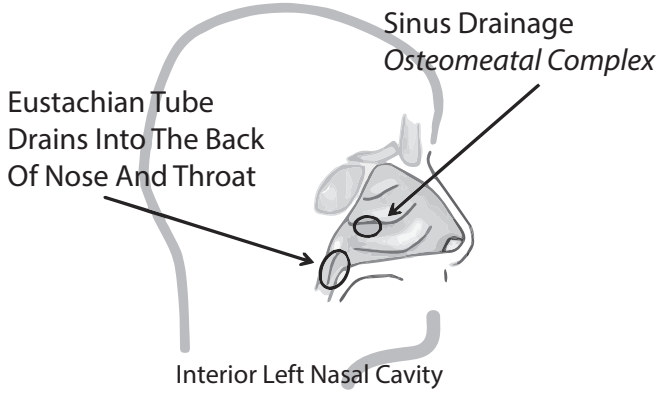
Middle Ear

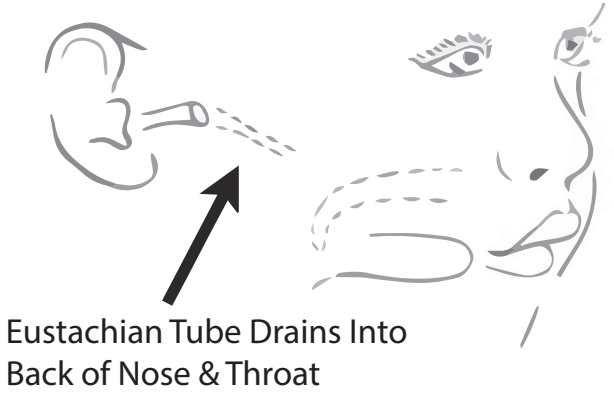


Inner Ear

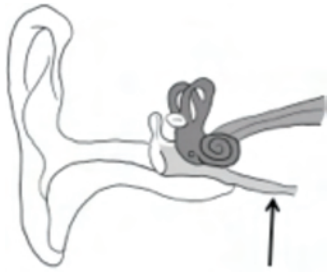
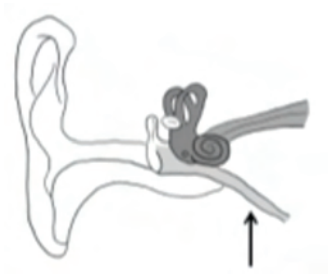
For sound vibrations to send the signals to the inner ear, the middle part of the ear must be ventilated, allowing the air pressure on either side of the tympanic membrane to equalize. The *Eustachian tube* is responsible for this ventilation. This tube begins in the middle ear and extends into the back of the upper throat, approximately at the same level as your nostrils. The portion of this tube nearest the eardrum is always open, protecting the middle ear. The end that drains into the back of the throat is normally closed. We open and close this part of the Eustachian tube when we chew and suck.

In adults, the Eustachian tube is approximately 35 mm long (1.38 inches). In children, it is significantly smaller and more difficult to drain for many reasons.

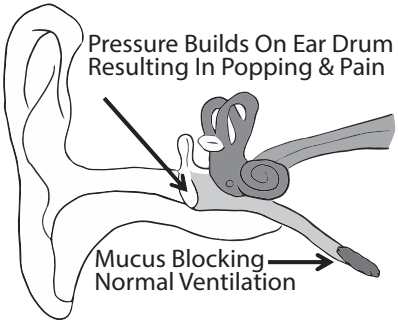




Eustachian Tubes Differ Between Kids and Adults

Kids	Adults
	
Smaller Tube	Larger Tube
Horizontal Drainage	Drainage Assisted by gravity
Tube Softer, Collapsible	Tube Stiffer
Length of Tube (9mm, 0.35 inches)	Length of Tube (18mm, 0.71 inches)
Rounder Opening	Oblong Opening

Who Cares When Your Eustachian Tube Does Not Work? You Do!



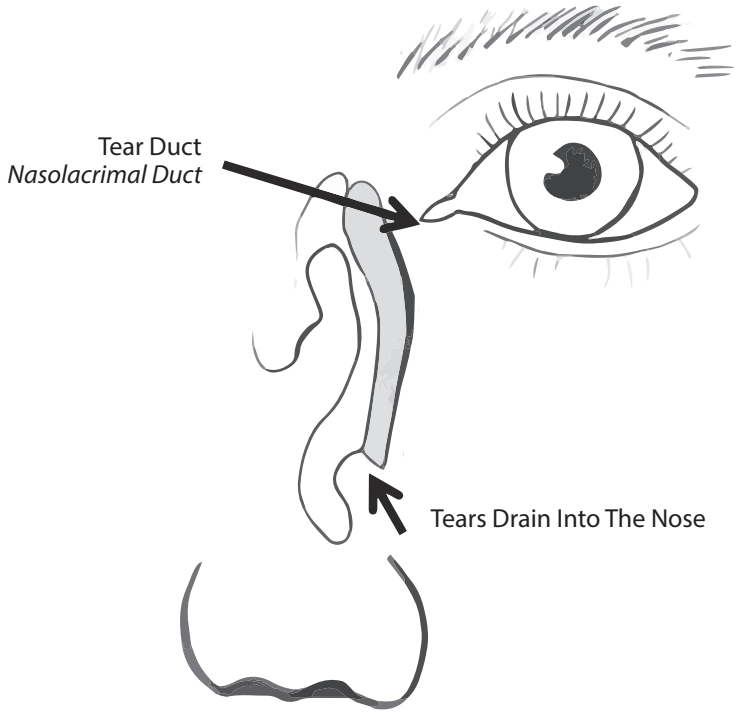
Eustachian Tube Dysfunction

The Eustachian tube drains mucus from the middle ear into the back of the throat. Upper airway infections or allergies can cause this tiny tube to become swollen, trapping bacteria and causing middle ear infections.

If air is bubbling up and mucus is flowing down and out into the throat, all is well. But for this to happen it is vital that the Eustachian tube remain open and free to drain. None of this can be accomplished if there is a mucus plug or if there is swelling, as both plugging and swelling prevent natural drainage.

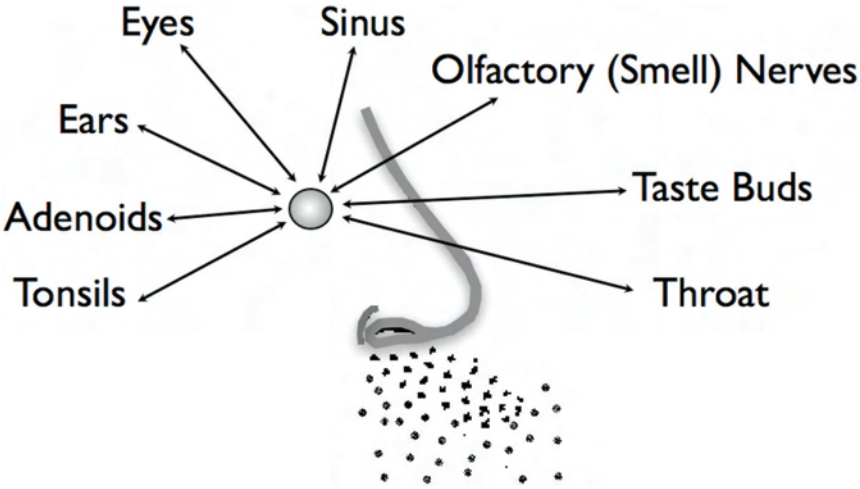
Again, as the nose goes, the ears follow. Nasal health is critical for healthy ears.

The Eyes Have It—
An Intimate Connection with the Nose



The tear duct *(nasolacrimal duct)* drains tears from the eyes and empties those tears under the lowest turbinate. This is why crying often results in nasal discharge. This also explains why nasal washing done incorrectly can push the solution up and out through the tear ducts.

This pathway may contribute to allergens entering the eyes, draining into the nose and causing allergic symptoms in the nose. There is also evidence that there may be backward *(retrograde)* flow from the nose back up into the eyes as well. For example, if you're wearing goggles but are exposed to outdoor pollen, you might develop itchy eyes. The pollen has entered the nose but because of the retrograde movement of the pollen, the eyes may itch. This is another example of how the individual parts of our facial anatomy are all connected.



Facts: It's All Connected

- We breathe 10,000 liters of air per day through the nose.
- We produce one pint to one quart of mucus per day.
- We have 8-10,000 taste buds in the tongue.
- We have 100 million olfactory neurons.
- Cilia beat 700-800 beats per minute.
- Cilia beat 17% more effectively after washing with hypertonic saline.
- Normal pH of nasal mucus in adults is 5.5-6.5.
- Normal pH of nasal mucus in infants and children is 5.0-6.7.
- Best pH to foster excess mucus clearance is 6.9-9.5.
- Buffering with sodium bicarbonate improves the flow of mucus.
- Buffering is beneficial for both hypertonic and isotonic solutions.
- 60 million Americans suffer from allergies.
- 80% of infections of the ear and sinus will resolve with nasal washing alone.
- Sinus opening allowing mucus to drain is less than 1/4 inch.