e-Perspectives

on the Medical Transcription Profession

April 2005
Issue 50

Contents

Published by Health Professions Institute
The Leader in Medical Transcription
Education and Reference Products

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Published by
Health Professions Institute
Modesto, CA

April 2005
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e-PERSPECTIVES on the Medical Transcription Profession (ISSN 1066-3533) is published periodically by Health Professions Institute, P.O. Box 801, Modesto, CA 95353-0801. Phone 209-551-2112, fax 209-551-0404. Send e-mail to **hpi@hpisum.com.** Web site: **http://www.hpisum.com.**

Address changes and updates may be made on-line at **http://www.hpisum.com/register.ihtml**, or by mail or fax to Health Professions Institute, P.O. Box 801, Modesto, CA 95353-0801, fax 209-551-0404.

This electronic magazine is available to the public on-line at the Health Professions Institute Web site: **http://www.hpisum.com**. Correspondence should be sent to **hpi@hpisum.com**, and manuscripts to Editor, ***e-Perspectives***, **spitman@hpisum.com**.

Life Lessons

Adrienne Yazijian, an author well known to readers of *Perspectives* magazine over the past 15 years, died in December 2004 after surgery and a brief illness. We all expected that, with her indomitable spirit, she would triumph and be back with us after the New Year. She didn't make it but her spirit will always be with us, and we will always remember her zest for life and the many positive ways she touched our lives. "She applied life lessons to her business, and business lessons to her life."

This is the 50th issue of *Perspectives* magazine, which has evolved over 15 years of publication to its present electronic format. As an e-zine, ***e-Perspectives*** will be available to a wider and wider audience of healthcare professionals who value the substantive original articles we publish. ***e-Perspectives*** will now be available worldwide to anyone with an Internet connection. The PDF articles may be downloaded and printed by those who want a print copy for reference.

Advances in stem cell research are much in the news these days, and medical transcriptionists will increasingly encounter new terms on these and related topics in medical dictation. Featured in this issue of *e-Perspectives* is Dr. John Dirckx's "Bioethics in the Laboratory: Perspectives on Embryonic Stem Cell Research." He presents a thorough and thoughtful analysis of the nature of stem cells and their role in biomedical research, and describes the ethical dilemmas faced by those involved in such research. In addition, he provides an extensive 4-page glossary of terms used in stem cell research. (These terms and other additional terms are included in the new 10th edition of *Vera Pyle's Current Medical Terminology*, available from Health Professions Institute.)

Sidney Moormeister, who mentors new medical transcriptionists and those thinking of medical transcription as a career, offers much-needed advice about educational pathways and choosing qualified schools. We hope "Foiling P.T. Barnum . . ." will help to dispel myths about training and prevent a potential student from being "a sucker born every minute."

Ellen Drake presents articles for both teachers and students in this issue. In Teaching Tips she offers help on teaching a course in disease processes or human diseases, including class activities, textbook activities, testing, and a complete course description. Student Scope presents a brief review of comma usage, with 12 comma rules, an exercise in applying the rules, and answers and explanations.

Rich Lederer recounts what he calls the most important linguistic anniversary of our lifetimes. In Looking at Language, he tells the story of the development of the first modern dictionary by Samuel Johnson, published in 1755. At HPI we've had experience publishing dictionaries as well. This month we just released the 10th edition of *Vera Pyle's Current Medical Terminology*. Vera Pyle long ago followed Dr. Johnson's practice of defining terms and providing supporting quotations from medical dictation. Now, if only we could "dominate the field for a century," as Johnson's *Dictionary of the English Language* did, . . .

Renee Priest, with her unique brand of self-deprecating humor, tries to cope with the inevitable hazards of being a sedentary medical transcriptionist of a certain age. Various coping mechanisms for presbyopia, and exercises for arms, fingers, lower back, repetitive stress syndrome, and arthritis—all to achieve pain-free productivity and job longevity—are described with good-natured humor in "The heating pad is behind the pickled eggs!"

Sally C. Pitman

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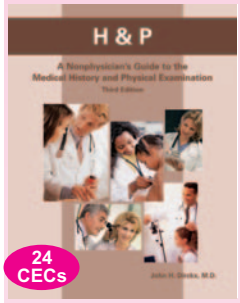

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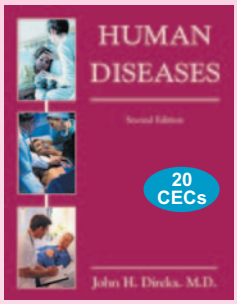

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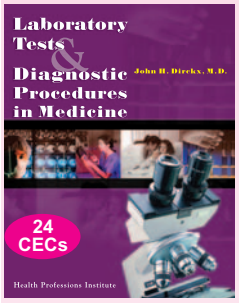

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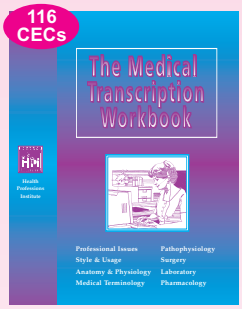

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Here's a sample of brand-new terms you can find in the 10th edition of *Vera Pyle's Current Medical Terminology*:

absent breath sounds—jargon term substituted for "absence of" in awkward expressions such as "auscultation revealed absent breath sounds."

Enfant pediatric vision testing system—a noninvasive, child-friendly medical device that tests for visual deficits using visual evoked potential technology. It records the brain's response to light, and can detect vision problems such as amblyopia in children as young as 6 months old.

percutaneous myocardial channeling (PMC)—a minimally invasive procedure that stimulates blood flow in the heart to relieve pain from angina by creating channels in the inner wall of the heart. It is thought that these channels promote the growth of new blood vessels to improve blood supply to heart tissues in need of nourishment.

pericardial well (*not* wall)—the space around the heart where iced saline slush is placed in coronary artery bypass graft surgery.

double dip • hostile neck
DASH • milk scan • at U
moyel • NERD • "snick" BilDil
• sweet oil • SPIDER
"secreting the infant"
keel and wing • green lizard
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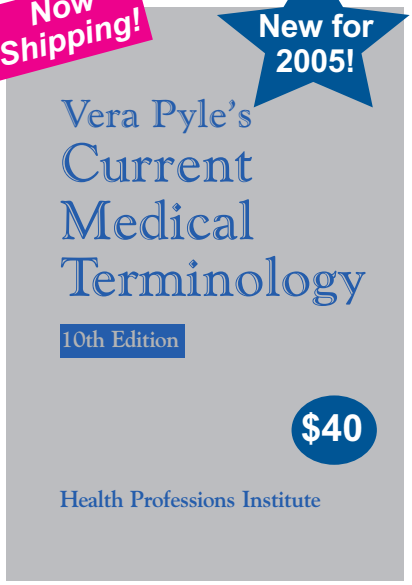

The new 10th edition of ***Vera Pyle's Current Medical Terminology*** is now shipping! Within its pages you will find the new, difficult, and "oddball" terms that are so hard to verify, with more phonetic entries than ever. Need to know the latest surgical terms, procedures, tests, and diseases that aren't yet in dictionaries? What about those "stumper" terms that befuddle every new generation of MTs as well as the seasoned professionals? The 10th edition of "the silver bullet" has them, and it's just $40.

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Celebrating the Life of a Friend and Colleague

Adrienne Yazijian introduced thousands of people to medical transcription as a career and to the American Association for Medical Transcription as a professional organization. As the first *real* AAMT President in 1979-1980 (two others having held the office briefly before her in 1978), she was the dynamic leader who applied executive leadership skills to the fledgling association and put it on the national map. She believed that medical transcriptionists were professionals and deserved recognition as important members of the healthcare team.

Adrienne Yazijian
1940-2004

A medical transcription service owner for over 25 years in Fresno and San Diego, California, Adrienne Yazijian brought her enthusiasm and love for medical transcription to her position as President. She was a founding member of AAMT and a director for four years, during which she hosted the first annual business meeting of AAMT in Fresno in September 1979. At that time AAMT had 1400 members and 6 local chapters. With Jackie Hagedorn of Chicago, Adrienne worked tirelessly to establish chapters all over the country. By the fall of 1980 AAMT had 56 local chapters in 29 states. Jackie remembers "how vital we all were in those days 25 years ago, so full of hope, and spirit, and fun! We were true crusaders in the name of AAMT and the profession of medical transcription." She remembers Adrienne as "always charming, interesting, and full of humor and wit."

In the early 1990s Adrienne was also a founding member and director of the Medical Transcription Industry Alliance (MTIA). An entrepreneur, she recognized kindred spirits at the 1994 MTIA conference in New Orleans: "I saw again and again that spirit, that drive, that enthusiasm, that determination, that courage that clothes the entrepreneur."

Adrienne Yazijian was a dynamic motivational speaker who touched the lives of many medical transcriptionists, students, and teachers over the years. In all her professional activities, she demonstrated an inherent self-confidence, an optimism for the possibilities and opportunities open to all of us, a zest for living, and a vision for personal greatness as individuals and as a dedicated group of professional medical transcriptionists. She made us feel we all had potential as leaders. Joanne Yanni of Philadelphia remembers meeting Adrienne, who greeted her with open arms as "new blood" as a new AAMT director.

Adrienne was a Renaissance woman who faced every challenge with energy and enthusiasm. Hazel Tank of San Diego says, "Adrienne never simply walked into a room. She 'burst' into any area, making her presence felt without a single word. Such was her commanding personality." She brought those qualities to all her professional activities, and after selling her transcription company in 1995, she had several other successful careers—first as a sales executive for a corporate giant; a consultant to physicians, HIM directors, and medical transcription companies; advisor to more than one college medical transcription program; CEO of a company providing speech recognition software; and a real estate broker in Palm Springs and San Diego. She was excited about living and life and expected to have many more years of interesting work ahead of her, before a brief illness resulted in her death on December 1, 2004.

When I met Adrienne in 1976, I remember being impressed that she was a *businesswoman*. We both owned medical transcription services—hers in Fresno much larger than mine in Modesto—but running a small medical transcription company was, for me, just something I did in response to a need in the community. For Adrienne, running a business was a *business*. She was very good at it and the results showed in her professionalism, her businesslike approach to managing employees, negotiating with clients, and delivering top-quality medical transcription day in and day out for many hospitals and clinics. She had a good sense of who she was and what she wanted to do, and she pursued her goals relentlessly and with style and flourish. In the days when most of us just tried to stay ahead of payroll demands and slow-paying clients, she had a business plan and a vision of her company in a growth industry.

Along the way, she was a prolific writer and authored many articles in periodical publications on a wide range of topics, including professional development, leadership, time management, listening skills, team playing, corporate culture, entrepreneurs, organizational skills, customer relations, project management, developing best practices, creativity, self-help activities, the joys of meaningful work, work as more than a necessary evil, goal setting as adult magic, passion and satisfaction in work, strategic planning, "tangentitis" ("running off on a tangent, which stalls productivity"), new techniques in business management, and the clean-your-office retreat as a means of sorting through clutter ("the key to realizing what you now want and who you now are"). I could go on and on, or I could provide an extensive bibliography of her published works. The point is that, of all the many things Adrienne did well in her professional life, writing was one of them and one that gave immense pleasure to her and to many of us. She touched many lives and has left a powerful legacy in print as well as in our hearts.

She applied life lessons to her business, and business lessons to her life. Take skiing, for example. She wrote a wonderful column on "balance."

> I rarely fall, even though I ski the steep and the deep. Not that I view falling as failing . . . it's just that I have pretty good balance and an insatiable need for a little danger, adrenaline rush, or endorphin push once in a while. . . . If you fall frequently [in life], figure out why. If you haven't fallen in a long time, figure out why. . . . What is certain is that life is full of obstacles and unforeseen hazards, and if any of the major areas of your life fail, it is good to know the others are strong enough to keep you upright. Balance. It's a good thing to contemplate.
>
> (*Perspectives*, Winter 1996-97)

"We will not see profits grow if we do not learn how to grow people," she wrote in "The Corporate Culture." In her "wrong jungle" analogy, she draws distinctions between effective leadership and management:

> Management is efficiency in climbing the ladder of success; leadership determines whether the ladder is leaning against the right wall. You can quickly grasp the important difference between the two if you envision a group of productive transcriptionists cutting their way through the jungle of transcription with machetes. They're the producers, the problem solvers. They're cutting through the undergrowth, clearing it out. The managers are right behind them, sharpening their machetes, writing policy and procedure manuals, holding "How Not to Get Carpal Tunnel Syndrome" seminars, bringing in improved technologies, and setting up work schedules, compensation and benefit packages, and incentive programs. The leader is the one who climbs the tallest coconut tree, surveys the entire situation, and yells, "Wrong jungle!"
>
> As individuals and business owners, we're often so busy cutting through the undergrowth, we don't even realize we're in the wrong jungle, this being especially true of one who owns a mid-sized business (grossing between one and two million a year) and is still involved in the day-to-day operations of the company. In the rapidly changing environment of technology (equipment), effective leadership is more critical than it has ever been before. Adopting the new technology is like exchanging the machete for an automatic jungle cutter that can mow down acres in minutes. Part of the challenge of change is for former machete cutters to learn the new technology.
>
> *Perspectives*, Spring/Summer 1991

Whether Adrienne was telling a roomful of medical transcriptionists in Santa Barbara in 1981, "You are all professionals," as Clare Terrill remembers, or laughing and gasping for breath in a wild helicopter ride over the Capitol, as Marcia Gaffney recalls, everyone remembers her as gutsy and a lot of fun. After all, she sued Lanier and WON!

Her distinctive laugh always rang out with delight and warmth, and the mischievous gleam in her eye evidenced her unfailing good humor. Her upbeat jazzy style is even reflected in her signature, which graces hundreds of membership and Certified Medical Transcriptionist certificates dated December 31, 1979, and thereafter.

In 1998 Kathy Rockel asked Adrienne what created the "passion" she sensed in the early newsletters and journals of AAMT. Adrienne said, "It's simple. We had a purpose. Find the purpose and you will find the passion." Powerful words. Adrienne always felt that helping to found AAMT and nurturing it through its first decade was one of her greatest passions and finest achievements. She wrote in 1996, "Never let your fire of urgency go out." She never did.

Sally C. Pitman
Modesto, California
December 2004

"The heating pad is behind the pickled eggs!"

by Renee M. Priest, CMT

"GEEZZZZ, MOM. Don't look, you guys, don't look. MOM! What are you doing this time!"

And what could I say. There I was, artfully draped over a red rubber chair ball, creatively attempting my best imitation of the "chair corpse pose" (since I no longer have a hard-backed chair upstairs). According to the description, it is an exercise for aching lower backs.

I suppose I should be grateful they did not walk in on my "walking sessions" on the Gazelle. Somehow the mental picture I have of a short, round woman, puffing away, moving those feet back and forth, wearing brightly colored Mouse Mitts, seems like it would cause as much indignation as the lying-over-the-ball exercise!

Certainly I was not given much chance to explain to my daughter's friends that this came from the pages of my treasured copy of "Yoga for Wimps." The exercise book of choice because … well … if truth be told, that Pilates CD I bought last year, and the "Fat-burning Yoga" CD that my daughter talked me into buying at the same time, just scared the heck out of me.

Nope, there was no time for explanations because it took that child a big five seconds to look at me, screech, and bolt for her bedroom and the video camera!

Low backache has to be the worst enemy any MT can have. No one can see it. There is no swelling to point to, no big wad of bandages, and inevitably, saying my back hurts is met with "but you sit all day! How can that make your back hurt?" Over the years I have tried acupuncture, massages, more brands of ergonomic "back-friendly" chairs than I ever knew existed, yet on any given day the sheer act of keeping the "tushie" in the chair demonstrates a degree of will power I never knew I was capable of.

Sadly, over the last couple of years, I have had no choice but to learn how to live with the indignant shrieks of mortified teenagers when they make the mistake of walking into my office area unannounced. As my body ages, the slow attrition of sitting for prolonged periods, the cumulative effect of repetitive stress syndrome (carpal tunnel, the grim reaper of the MT world), and a family history of arthritis that has lodged itself in my finger joints are all making themselves felt in some uncomfortably painful ways.

Given the odd assortment of gadgets and gizmos I increasingly find myself accumulating in the search for pain-free productivity and job longevity, I can't really blame my kids for feeling like I have mutated into the MT version of Kevin Costner in the movie *Tin Cup*. Only, instead of wandering around in my boxer shorts with a golf ball dangling in front of my eyes from the latest "$9.99" contraption sold on late night TV that is guaranteed to improve my performance, these days I can be found sitting in and on an ever-changing assortment of chairs, lumbar cushions, vibrating massage chair covers, and big red rubber balls that are supposed to be good for your spine but in reality changed the simple act of sitting and using a foot pedal into the equivalent of climbing MT Everest for a decidedly coordination-challenged MT.

There used to be a time when I tried to hide things like the fuchsia Mouse Mitts, or the flannel, fingerless gloves that stretch to my elbows, by whipping them off and tossing them blindly behind the books lining my walls at the first hint of footsteps nearing the doorway. That lasted until the time it took me two days to find my favorite microwavable heating pad after I panicked when a car I did not recognize pulled in my driveway. Two days without a heating pad is sort of like what I imagine two days of sitting on rocks might feel like, and I decided that I just no longer cared how silly I might look if that is what it took to keep at least one part of me comfortable.

My family has a long-standing joke that if you want to know where Mom has been, you only need to follow the trail of reading glasses left behind … by the clothesline, the garden, in the car. I suppose I should be ashamed to admit this, but I have to have multiple pairs. It is that darned "take them off, set them down, walk away without them" syndrome that I inherited from my mother.

I keep telling my daughter that she needs to stop snickering while we are looking for yet another lost pair because this is most certainly hereditary, but so far she hasn't any signs or symptoms of this familial disease, and she is still smirking each time she overhears "where have my glasses gone now" coming from my office. The day I discovered I could buy reading glasses by the dozen at Sam's was a huge relief! No more working while squinting through a headache and an evening of aching eyes. Just pop open the bottom desk drawer and take out a new pair!

The worst thing about that hereditary loss syndrome, though, is the fact that it migrates. It moved right from the fingers to the wrists and the feet! Feet are pretty darn important to an MT, and misplacing my lamb's wool-lined slippers three times in one winter just about sent me over the edge. Oh, I know, some people swear by slipper socks for keeping the tootsies warm and toasty, but to me, the darn things are just too darn slippery and get caught under the edges of the foot pedal.

Worse than suffering the cold feet, though, is attempting a plausible explanation for exactly why one of my stiff wrist braces ended up on the floor in, as one of my British friends would say, the "loo." Some things were simply not meant to be done wearing those braces, no matter how badly your wrists ache!

Over the years the ever-present arthritic ache has become a companion that just won't go away. Despite the cortisone and the special exercises I do to keep the fingers limber, there are still days when the most wonderful feeling in the world is to plunge those hands into a warm paraffin bath. It is such a feeling of relief that it is tempting to try to prolong it as long as possible. Which explains why I once found myself standing in the grocery store staring at the bewildered look of a cashier as I handed her a $10 bill from a hand still covered with wax. My children ate many hamburgers paid for by their friends on the strength of the story for several months!

When that heating pad eventually turned up, by the way, it was found to be neatly wedged behind a gallon jar of pickled eggs—garish pink-colored rubbery-looking things that my husband adores. He counts them in the jar to make sure no one else is eating them behind his back, not that I or the kids would touch those things on purpose. I still have not figured out how I could have possibly tossed it that far because the door between the office and pantry area is usually closed.

I would suspect my family of pulling my leg, but they all look so darn innocent.

Renee Priest, CMT, is the moderator for the Hot Zone at MT Desk, **www.mtchat.com**. As on off-site acute care MT for more that 10 years, she believes that humor is her most effective tool in dealing with the stress inherent in this profession. E-mail: **pithy@millenicom.com**.

FOILING P.T. BARNUM (SOME THOUGHTS ON CHOOSING AN EDUCATIONAL PATH IN MEDICAL TRANSCRIPTION)

by Sidney K. Moormeister, Ph.D.

It happens more and more frequently these days: I open my e-mail to find inquiries so plaintive that I wish I could cry. So many voices, so many questions, so many people imagine (and I use that word intentionally and emphatically) that medical transcription is the new career nirvana. After all, you can work at home (in your jammies, no less—no corporate pinstripes necessary), making plenty of money to satisfy your (and your family's) every need.

There is some pretty hefty mythmaking going on in the world of transcription education (and what passes for it). Perhaps some words offered from this "old salt" with 37 years of experience can help those people seriously considering medical transcription to separate the come-ons from the truth and make an informed decision about their education. If this small offering can save even a few people the grief of losing their money, of having their hopes dashed against the realities of today's transcription marketplace, and instead assist in making a rational, sane, and informed decision about education, it will be worth the time it has taken to set these words to paper.

First, the myths. There are three myths that must be dispelled.

1. **Medical transcription is a source of "easy money."** Shockingly, some people believe this. Much like carnival barkers, various "schools" hold public meetings that are reminiscent of a scene from Elmer Gantry. The "bait" is offered ("You can make forty thousand dollars a year while working at home in your jammies."). People investigating our profession are taken in by the promise of easy money. The sad news is that there is no golden goose; golden eggs are in perilously short supply these days. Stop and think about it. Use rational thought and reasoning. If medical transcription were so easy that anyone could do it, wouldn't more people be doing it? Wouldn't the critical shortage of truly excellent, qualified transcriptionists cease to exist? Medical transcription is mighty hard work. It is challenging intellectually and it is hard on the body (just ask my chiropractor). So the first step in making an informed choice is to leave your illusions of easy money behind.

2. **It doesn't matter where you go to school; you can get a good medical transcription education anywhere**. Another tactic of the less-than-reputable schools is to tell you to make your choice on price alone. There's a reason that wise people like my daddy taught me that you get what you pay for. The schools (and I use that term loosely) that advertise heavily in the popular press (including the tabloids) place their emphasis on the fact that they are the cheapest. What they do not tell you is that their education is the shoddiest, and likely no one—certainly not a reputable national—will give you a shot at testing once you have your newly-minted "diploma" in your hand. Is it really such a bargain? Sadly, the people who are "investing" their money are probably the very people who can least likely afford to lose it. And yet I hear not a plaintive voice, but a veritable chorus: "We chose the XYZ school because it was the cheapest." How sad. Inevitably people from these schools end up going to another, more reputable school to learn what the first school did not teach them. How cost- and time-effective is that?

3. **You can always learn the "old fashioned way"—on the job**. The ways of learning transcription have changed drastically in the last ten years. When I was a grad student (back in the ancient Sixties), a hospital willingly took me on, based solely on my premedical education and the fact that I was a lightning-fast typist. A kind woman took me under her proverbial wing, taught me all she knew, and the rest is history. Alas, there are no more opportunities like that. Hospitals now outsource the work, and employers expect you to arrive at the workplace ready to sit down and belt out those lines. Transcription supervisors have neither the time nor the inclination to handhold. They, like the transcriptionists, have production quotas, which hang like the Sword of Damocles over their heads. It is therefore more important than ever to choose the right venue for obtaining one's education.

Having painted the picture of today's transcription workplace, allow me to offer questions to ask as you pursue your education. (In forensic medicine, it is often the case that asking the right questions can provide more valuable information than making declaratory statements; the same is true for one seeking to become a transcriptionist.)

1. **Where are your graduates working? Can you give me the names of two or three grads who would be willing to share their experience with me?** Even if the school is

unwilling to provide names of graduates, surely they can provide names of nationals, hospitals, and clinics who have hired them. Call the recruiters of several of the large nationals (Medquist, Spheris, Transcend, etc.) and ask them if they hire graduates from the school you are considering. What has been their experience with their graduates? Would they consider allowing you to test after you have successfully completed the course?

2. **How long have you been in business? Are you a private entity? A sole proprietorship? Who are the principals? How are your instructors chosen?** Ask probing questions. You are about to embark on a journey in which you will spend thousands of dollars and countless hours of your time. You want to invest them wisely. What credentials do the principals and instructors hold? Check to make sure that all credential information given is correct and current. Are the people with whom you will be dealing representing themselves accurately?

3. **Do your financial homework**. Call the Better Business Bureau and the Department of Business Regulation for the locality in which the school operates. Have there been complaints? Have they been resolved to the satisfaction of all parties?

4. **What form(s) of financial aid do you offer?** Many very reputable schools do offer some form of payment plan or loan program. Many times a "first choice" school is not as unattainable as it might seem at the outset. Remember that you are making an *investment* in yourself and in your future. This is just as much an *investment* as is a new house or car. It is perhaps a more important investment, because, properly done, it will keep on giving as long as you want to use it. How often I have been sad because those who could least afford it quite literally threw their money away. A careful check of financial aid programs might have enabled them to attend a legitimate school in the first place rather than having to redo their education.

5. **How accessible are your instructors and by what means? E-mail only? Are telephone calls allowed?** In the case of a serious problem, is there someone who can guide you through it? I have never been a fan of the "self-graded" system of learning; how can you teach yourself what you do not know? (I recall a difficult physics class in my long-ago past; a kind teaching assistant with a gift for explanation saved me. I never could have figured out the arcane mysteries of that science with an answer key only!)

6. **Does your program use authentic physician dictation such as in *The SUM Program*?** You want to be certain that what you will be transcribing is actual physician dictation. Many programs use scripts read by actors. That does not work; you are *not* going to be transcribing for actors; you are going to be transcribing for physicians. You need to become familiar with their dictation, with its unique challenges and nuances from day one. In my opinion, the HPI SUM Program is far and away the best method of doing this. I could not recommend any program that does not utilize actual physician dictation.

You want to be certain that what you will be transcribing [in school] is actual physician dictation. Many programs use scripts read by actors. That does not work; you are not going to be transcribing for actors; you are going to be transcribing for physicians. You need to become familiar with their dictation, with its unique challenges and nuances from day one.

7. **What type of follow-up does the program offer? Can you "retake" any portions of the course with which you have difficulty? How many tries are you given to pass the final?** What you are seeking to do here is to draw up a sort of "road map" and resource bank for your education—and beyond.

8. **Utilize the wisdom of those to whom I affectionately refer as "old salts."** Those of us who have been in this business for more than twenty years have seen changes aplenty; most of us have gotten well-connected throughout our careers, and we have also heard our share of the scuttlebutt. If the Acme Fly-By-Night-School of Transcription Success routinely rips people off, one of us is likely to know about it.

Medical transcription education is challenging and exciting; it has also become a big business. There are many wonderful schools out there whose staff care deeply about their students—deeply enough to make them work hard, deeply enough to provide rigorous, exhaustive programs that will put them through their paces in preparation for The Main Event—that first transcription job. It is your job and your duty to yourself to seek out the best possible education for yourself. I welcome you to our fascinating world, I pray that you will choose well and wisely, and I wish you all the best.

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Teaching Tips

Teaching Disease Processes

by Ellen Drake, CMT

An important skill, if not the most important skill, in medical transcription is the ability to comprehend what the dictator is saying, evaluate it for accuracy and sense, and apply critical thinking skills, when needed, to correct, modify, or edit the dictation. In fact, every word transcribed actually involves decision-making, if not problem-solving. Isn't that the definition of critical thinking? At its most basic level, this skill involves correcting grammatical errors and adding or deleting punctuation. At an intermediate level, it is how we know that what we are typing is correct. At its most advanced level, it is the fine art of transcribing what the dictator means—not just sounds. I say "not just sounds" because so often some will say, "I just typed what he said." But that's not true. What they typed was what they heard. There's a difference.

As a teacher, I've struggled for years with how to teach this skill. What knowledge do we need to impart, what exercises and activities can we develop that will provide students the foundation for this most important skill? At times I've despaired that it can be taught; maybe you either have it or you don't. When I try to analyze what takes place when I problem-solve in transcription, I realize that the process involves the distillation or synthesis of all that I know (about the subject in question). It also requires the quick recognition of clues within the text of the report and the extrapolation of an answer to a question by correlating these clues to my background knowledge.

This, however, is *not* an article on critical thinking; it is an article on how to teach disease processes in a way that helps students develop these problem-solving skills. I believe that a course in disease processes, perhaps more than any other academic course, requires that students correlate and integrate existing knowledge with new knowledge. The methods I discuss will help your students integrate what they already know with what they are learning. These techniques suit different learning styles and require students to be *actively* involved in learning, rather than memorizing facts just to regurgitate them for a test. Students need a thorough understanding of disease processes, including diagnosis, treatment, and outcomes, in order to make the kinds of decisions that are required almost moment-by-moment while transcribing medical dictation.

Too often, it's taken for granted that students will learn about disease processes through the combination of terminology/anatomy study and transcribing. Certainly, that's the way many of us learned it on the job. But that was then; this is now. Medicine is entirely too complex to leave something this important to chance. I'm awed, as are others in our field with whom I've talked, by the numbers of new disease entities, operative procedures, and diagnostic techniques today that were unknown when I started transcribing over three decades ago. We cannot use 30-year-old training techniques to prepare students for a profession as scientifically complex as medical transcription is today.

A formal course in Disease Processes should be included in every transcription training program. Begin the course with a brief overview of pathophysiology of the human body and the diagnostic process. A cursory review of structure and function should be followed by detailed study of prevalent diseases of each system. Infectious diseases, genetic diseases, and cancers may be covered separately or by body system. For each disease entity, the student should learn its etiology, symptoms, clinical presentation (physical findings), relevant diagnostic studies, and its treatment and course. Diagnostic studies include not only laboratory tests but imaging, invasive diagnostic procedures, and pathological investigations. The student should learn both normal and abnormal laboratory values and the implications of the abnormal values when found. The study of treatment should be detailed; for example, it's not enough to simply say an infectious process is treated with antibiotics. Different antibiotics are used to treat a GU infection than those used to treat a URI.

If you are just instituting a course in Disease Processes, I recommend the Disease Processes Course Description and Outline from *The SUM Program Teachers Manual* (reproduced on pp. 9-11) as well as the *Human Diseases* workbook by John H. Dirckx, M.D.

Class Activities

Oral Presentations: Everyone has been ill at one time or another, and they all like to talk about it. This can be used to advantage in class if such discussions are controlled by specific guidelines. At the beginning of the term, have students complete an information form that includes the usual questions in addition to listing any disease(s) with which they are intimately familiar. The student need not have had the disease; their knowledge could come from a relative, close friend, or other healthcare work experience (since many MT students cross over from other health-related careers). They should be told not to reveal any personal, private, or confidential details on their information sheet or to the class.

Each student, over the course of the semester, can prepare an oral presentation on the disease they know the most about. Require them to do some additional research to fill in gaps in their knowledge. If the disease was one of those covered by the textbook, they must find out something about it that was not included in the textbook description. Have them give their oral presentation during the week the pertinent system chapter is discussed in class.

If the oral presentations are given at the beginning of each class, they help draw students' attention away from outside activities and focus it on the current class. Some of the presentations will be moving; relatives, even children, may have died or are dying from the diseases being discussed. To keep the presentations from being maudlin, focus on the objective presentation of the information. You can allow for a small amount of discussion about the effects of serious illness on quality of life for the patient and family as well as a discussion of support services and agencies available for specific conditions.

After the students give their presentations, discuss specific points and terminology that might appear in dictation. If a student presents data that is questionable, ask for a source for that piece of information and discuss whether the source is reliable. Discuss things that affect the outcome of clinical studies, such as cause and effect, comorbid conditions, placebo effect, and coincidence.

If time constraints don't permit individual oral presentations, allow students to work in groups. Group presentations may be straightforward oral reports or may take the form of skits, such as radio talk show format, a medical conference, a hospital's publicity director reporting on the progress of a "famous" ill patient, or a doctor being interviewed by the media.

Internet Activities: The Internet is packed with information on diseases. Prior to assigning research activities, however, discuss how to evaluate the quality and accuracy of information found on the Internet. Also, encourage students to access content written for healthcare workers rather than that written for patient education. Sometimes the professional sites require registration and even the payment of fees, but there is a great deal available for free.

It isn't sufficient just to ask the students to "write an essay" on their research. They need to use the data in some substantial way that simulates the type of problem-solving they may be required to do in transcription. Prepare students for their Internet research assignment with specific questions to answer, such as "What is the prevalence of _____ disease in the U.S. population?" "Are men or women more at risk of acquiring or dying of this disease?" "Why?" "Is age a factor?" "Ethnicity?" "Is the illness hereditary, congenital, acquired, immunological, the result of life style factors, etc.?"

It is important that students incorporate new learning into the knowledge bank gained from other academic courses. This is done by correlating (comparing and contrasting) new information with old, by making logical connections (e.g., if this is true, then that is also true or not true), and by applying new and old knowledge to evaluate new data or circumstances.

The Internet abounds with case studies which you can use to develop analysis and decision-making skills in students. A Google search for *"case studies"* (in quotation marks) plus *medical* yields 4.5 million pages. To find case studies that correlate with the chapters in the textbook, you could search for "case studies" plus the body system being studied. *"Case studies"* plus *gastrointestinal* yields over 77,000 pages; plus *cardiology* yields 108,000 pages. Students should proceed through case studies in a step-by-step fashion.

For example, break the case study down as follows: Give the students the patient's presenting symptoms and past history. Then ask questions such as "Based on the patient's history, list three possible diagnoses." "What physical findings might you expect to find or not find?" Next, give them the physical examination findings and ask, "How does this new information change your differential diagnoses?" "What laboratory studies and other diagnostic procedures would you order to further narrow the possibilities?" After giving them the diagnostic findings, proceed with similar questions about how these findings narrow the diagnostic possibilities. "Can you make a definitive diagnosis now?" "If not, what other diagnostic procedures might be necessary?" Finally, ask "How would you treat this illness," and "What is the expected course and prognosis of this patient's illness?"

If you are teaching this course concurrently with transcription, have the students research the specific illnesses or procedures that appear in the reports they will be transcribing. Questions for this activity might elicit specific terminology and information that they will encounter in the dictation itself, especially if the dictations require some editing. For example, if the dictator uses "varicoces" for "varices" and "recannulization" for "recanalization," you could have the students research the prevalence of these spellings on a Google search, evaluate the citations, and determine which spellings are correct and why.

An Internet "scavenger hunt" can be fun and educational. This requires a little more work on your part because you have to come up with the "objects" (information) to be found.

Review the dictation that goes with the system being studied, making a list of key terms, especially any unusual expressions that may be difficult to find in standard references. These might include things like "find the word *angry* used to describe the appearance of a lesion," or "find the word *mouse* used to describe a loose body in a joint." The student who finds all the "objects" first wins a prize, gets extra credit, or gets to skip a quiz.

Textbook Activities: Most human disease textbooks treat each disease as a separate entity. There is little to no integration, other than that all the diseases in a chapter affect a particular body system. This may be useful in terms of using the textbook as a later reference, but it doesn't do much to teach the students to problem-solve.

An activity, excellent for small groups, that helps students evaluate similarities and differences between illnesses affecting a single body system is to have them prepare a **chart** that lists the diseases down the left-hand column. Additional columns can be added for symptoms and physical findings, listing these across the top. The students can then place a check mark in each column that applies for each disease, something like comparing the features of competing products. When finished, they have a visual study guide summarizing and comparing the symptoms and physical findings of the diseases studied for that system.

A **mind map**, a visual representation of knowledge, is a good way for a student to take notes and summarize key points in a chapter or those related to a particular disease. This activity is also excellent for groups. One mind map might consist of a rectangle centered at the top of a page. Inside the rectangle is the name of the body system being studied. Draw lines from that rectangle to additional rectangles, one for each disease studied. From the disease rectangles, draw additional lines and boxes for symptoms, physical findings, differential diagnoses diagnostic procedures, and treatment.

Have a student group work on a super-sized mind map, perhaps using poster board or several feet of paper from a roll of freezer wrap or banner paper, and hang their maps on the walls for study and review. This type of mind map is also useful for comparing and contrasting diseases as well as for analyzing case studies. In a mind map for a single disease, the disease name may be in a rectangle or circle in the middle of the page with the added topics radiating out from the center. These activities can be adapted for on-line student groups who create "electronic posters" to be displayed on the class Web site. Pie charts, good for comparing epidemiology, and graphs also appeal to visual learners.

Testing: Multiple-choice questions are fine for preparing students to take standardized tests (such as part I of the CMT exam), but try to prepare at least some questions that require the students to apply what they've learned, not just regurgitate facts. Careful wording of multiple-choice questions can call for a certain level of decision-making. Some examples of excerpts from dictation are as follows (the distractors resemble the correct answer in sound, not meaning):

Sample Multiple-Choice Questions

The blistering is typical of _____. I would go ahead and give her 2 million q. 6 h. of the penicillin and modify therapy according to culture report.

strep
straps
stress
stretch

Urologic evaluation revealed a blockage in the right _____, and this was "cleaned out" cystoscopically, at which time scar tissue was found.

urethra
ureter
uterus
urachus

Physical examination showed, covering most of the back and also the medial central buttocks, confluent, erythematous, scaly _____ with some crusting. Similar _____ were also present on the anterior legs. (Both blanks are the same word.)

wax
packs
flacks
plaques

However, only essay questions can really demonstrate a student's grasp of more complex issues. As difficult as these are to grade, essay questions serve two purposes: (1) They require the student to practice problem-solving, organize knowledge, and think and write logically; and (2) they test the student's understanding of the material studied. In the box below are examples of essay questions that challenge a student's reasoning abilities.

Sample Essay Questions

1. Compare and contrast the methods of transmission of Lyme disease, chickenpox, syphilis, and the common cold. What methods can be used to control transmission of these diseases? In your opinion, which of the diseases might be the most difficult to prevent, based on the method of transmission. Why?

2. What are the risk factors for HIV and AIDS? In terms of reining in the AIDS epidemic, do you think prevention or treatment is more important? Justify your answer.

3. The abbreviation *PDA* can stand for *patent ductus arteriosus* or *posterior descending artery*. What information in your study of the chapter on cardiovascular disease can help you determine which translation to use in Excerpts 1 and 2 on the following page? What were the clues that helped you make a decision?

Excerpt 1

This echocardiogram was obtained from a 3-hour-old twin infant with a cardiac murmur and cyanosis. . . . There is evidence of retrograde diastolic flowing in the main pulmonary artery, indicating the presence of a PDA. In addition, there is evidence of moderate tricuspid regurgitation. There is also evidence of left-to-right shunting across the interatrial septum.

Excerpt 2

PROCEDURE PERFORMED

1. Left heart catheterization.
2. Left ventriculogram.
3. Coronary artery angiography.

The right groin was prepped and draped. . . . The RCA is a dominant artery. It gives off a large PDA and posterior left ventricular branches; both branches are widely patent.

Web Sites for Teachers and Students

http://www.emedicine.com/specialties.htm
http://www.medscape.com/pages/homepages/index-homepages
http://www.fpnotebook.com/index.htm
http://www.casepath.org/
http://www.labcorp.com/datasets/labcorp/html/chapter/

Critical thinking activities and challenges should be incorporated into every academic subject in the medical transcription curriculum, but without the knowledge base afforded by specific and focused study of human diseases, teaching students to make the innumerable decisions necessary for the accurate transcription of a single report, much less a lifetime of work, is like transcribing with one hand tied behind your back.

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Human Diseases *or* Disease Processes
Course Description

Course Description: A comprehensive study of disease processes (causes, symptoms, diagnosis, and treatments), organized by body systems.

Recommended Prerequisites/Concurrent Courses: Anatomy and Physiology, Medical Terminology.

Recommended Course Length: 45 hours (3 hours per section).

Course Objectives

1. Describe how diseases are named and classified.
2. Identify common genetic disorders.
3. List common infectious diseases.
4. Define *immunity* and identify common immunological diseases.
5. Define *neoplasia* and differentiate between *malignant* and *benign*.
6. Identify common traumatic injuries.
7. Identify common diseases for each body system.
8. Pronounce and spell common disease names.
9. Define common abbreviations for symptoms and disease processes for each body system.
10. Identify methods of diagnosis for each disease studied.
11. Distinguish between normal or physiologic and abnormal findings on laboratory tests and imaging studies.
12. Identify methods of treatment, including surgical, for each disease studied.

SECTION 1: THE NATURE OF DISEASE; DISEASES OF THE SKIN

1. Introduction to course and overview of contents.
2. The nature of disease; how diseases are named.
3. Common disease terms.
4. Anatomy and physiology of the skin.
5. Signs, symptoms, and diagnostic procedures of the skin.
6. Diseases and disorders of the skin.

SECTION 2: GASTROINTESTINAL DISEASES

1. Anatomy and physiology of the digestive system.
2. Signs, symptoms, and diagnostic procedures of the gastrointestinal system.
3. Diseases and disorders of the digestive system.

SECTION 3: TRAUMA AND POISONING

1. Types of trauma.
2. Poisoning.

SECTION 4: DISEASES OF THE RESPIRATORY SYSTEM

1. Anatomy and physiology of the respiratory system.
2. Signs, symptoms, and diagnostic procedures in respiratory diseases.
3. Diseases and disorders of the respiratory system.

SECTION 5: DISEASES OF THE CARDIOVASCULAR SYSTEM; DISORDERS OF BLOOD CELLS AND COAGULATION

1. Anatomy and physiology of the cardiovascular system and blood.
2. Signs, symptoms, and diagnostic procedures of the cardiovascular system.
3. Diseases and disorders of the cardiovascular system.
4. Disorders of blood cells, blood-forming tissues, and coagulation.
5. Diagnostic procedures in hematologic disease.

SECTION 6: DISEASES OF THE EARS, NOSE, THROAT, AND EYES

1. Anatomy and physiology of the ears, nose, throat, and eyes.
2. Signs, symptoms, and diagnostic procedures of the ears, nose, throat, and eyes.
3. Diseases and disorders of the ears, nose, throat, and eyes.

SECTION 7: GENETIC DISORDERS; DISORDERS OF METABOLISM, NUTRITION, AND ENDOCRINE FUNCTION

1. Disease features and procedures diagnostic for hereditary diseases, disorders, and chromosomal abnormalities.
2. Anatomy and physiology of the endocrine glands.
3. Physiology of metabolism and nutrition.
4. Disorders of the principal endocrine glands: pituitary, thyroid, parathyroid, adrenal.
5. Disorders of the pancreas.

SECTION 8: DISEASES OF THE EXCRETORY AND MALE REPRODUCTIVE SYSTEMS; SEXUALLY TRANSMITTED DISEASES

1. Anatomy and physiology of the excretory system and male reproductive system.
2. Signs, symptoms, and diagnostic procedures of the genitourinary system.
3. Diseases and disorders of the male reproductive system and excretory system.
4. Sexually transmitted diseases.

SECTION 9: THE FEMALE REPRODUCTIVE SYSTEM; BREAST DISEASES

1. Anatomy and physiology of the female reproductive system and breasts.
2. Signs, symptoms, and diagnostic procedures of the female reproductive system and breasts.
3. Diseases and disorders of the female reproductive system and breasts.
4. Pregnancy and childbirth.

SECTION 10: MUSCULOSKELETAL DISORDERS

1. Anatomy and physiology of the musculoskeletal system.
2. Signs, symptoms, and diagnostic procedures of the musculoskeletal system.
3. Diseases and disorders of the musculoskeletal system.

SECTION 11: INFECTIOUS DISEASES

1. The concepts of infection and immunity.
2. Transmission of infectious diseases.
3. Infecting organisms.
4. Diagnosis and treatment of infectious diseases.

SECTION 12: DISEASES OF THE NERVOUS SYSTEM

1. Anatomy and physiology of the nervous system.
2. Signs, symptoms, and diagnostic procedures of the nervous system.
3. Diseases and disorders of the nervous system.

SECTION 13: PSYCHIATRIC DISORDERS

Mental disorders and psychiatric illness.

SECTION 14: THE IMMUNE SYSTEM

1. Function of the immune system.
2. Immunodeficiency, autoimmunity, and allergies.
3. Signs, symptoms, and diagnostic procedures of the immune system.
4. Diseases and disorders of the immune system.

SECTION 15: NEOPLASIA

1. The nature of neoplasia.
2. Common cancers and warning signs.
3. Diagnosis and treatment of malignancy.

Looking at Language

Dr. Johnson's Dictionary

by Richard Lederer, Ph.D.

He was, according to his biographer James Boswell, a huge man. When he was barely out of infancy, he contracted scrofula, a disease that severely impaired his eyesight and left his face horribly disfigured. He attended Oxford University but, because of family finances, did not take a degree. For a while he operated a private school, but that failed.

Yet a quarter of a millennium ago, on April 15, 1755, Samuel Johnson—fat, ugly, blind in one eye, and incompletely educated—produced the first modern dictionary. "Languages are the pedigrees of nations," he proclaimed, and, in compiling his wordbook, Johnson conferred a pedigree on the English-speaking nations. In garnering the rich, exuberant vocabulary of 18th-century England, the *Dictionary of the English Language* marked a turning point in the history of our tongue.

There had, of course, been earlier English dictionaries, the first being one Robert Cawdray's *A Table Alphabeticall*, compiled, as he described it, for "ladies . . . or any other unskilfull persons." Published in 1604 and consisting of but 120 pages and just three thousand words, *A Table Alphabeticall* had as its purpose, as did the other lexicons that appeared during the 17th century, the treatment of only the hardest and most scholarly words in our vocabulary.

Johnson set himself the task of making a different kind of dictionary, one that would include all the words in the English language, not just the difficult ones. In addition, he would show how to divide words into syllables and where words came from. He would establish a consistent system of defining words and draw from his own gigantic learning to provide, for the first time in any dictionary, illustrative quotations from famous writers. Johnson's lexicon, like its modern descendants, is a report on the way writers actually used the English language. When the volumes were published a quarter of a millennium ago, they were hailed as a standard by which all dictionaries could be measured.

When a friend of his pointed out that it had taken forty French scholars forty years to accomplish what he proposed to do in three, Johnson replied, "Let me see: forty times forty is sixteen hundred. As three is to sixteen hundred, so is the proportion of an Englishman to a Frenchman."

And what an Englishman! Johnson, underfunded and working almost alone in a Fleet Street garret room, defined some 43,000 words and illuminated their meanings with more than 114,000 supporting quotations drawn from every area of literature. The task took nearer nine than three years, but the results more than justified Johnson's ambitious hopes. He captured the majesty of the English language and gave it a dignity that was long overdue. The two huge tomes, each the size of a lectern Bible and each of which would fill about five fat volumes today, were an immediate success upon their publication.

Johnson defined a lexicographer as "a writer of dictionaries, a harmless drudge that busies himself in tracing the original and detailing the signification of words." But he was obviously far more than a harmless drudge, and his dictionary was by far the most comprehensive and readable that had appeared. The reputation of the *Dictionary of the English Language* was so great that it dominated the field for a century after its publication and established a mighty line of thorough and scholarly English dictionaries that simply is not approached by those in any other language.

England and America are dictionary nations. According to recent polls, 90% of all households in the two countries possess at least one dictionary, a higher percentage than those that own Bibles or cookbooks. That so many English speakers are not only literate but "dictionarate" is part of the inheritance handed down 250 years ago through the loving labor of a half-blind but far-sighted scholar.

See next page for a list of Lederer's books and ordering information.

Richard Lederer, Ph.D., is the author of more than 3,000 books and articles about language and humor. His syndicated column, "Looking at Language," appears in newspapers and magazines throughout the United States. E-mail: **richard.lederer@pobox.com.**

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Student Scope

A Brief Review of Comma Usage

by Ellen Drake, CMT

Commas are the bane of many MTs. Fortunately for us (and everyone else), there are fewer rules for commas, and the use of commas is declining. For instance, when I was in school, we were taught to put a comma after every introductory expression. See today's rule (#3) below. Review the comma rules below and complete the exercise.

1. Use a comma before a coordinating conjunction (*and, but, for, nor, or, yet, so*) in compound sentences (two independent clauses). *Example*: The patient **was discharged** in improved condition, and he **will follow up** with me in one week. (Two subjects, two verbs.)
2. Use a comma after a conjunctive adverb or transitional phrase in a compound sentence joined by a semicolon. *Example*: The patient was discharged in improved condition; however, he is still quite disabled.
3. Use a comma after an introductory (a) clause (contains a verb), (b) phrase of more than 4 words, or (c) common introductory word like *yes, well,* etc.
4. Use a comma to separate 3 or more (a) nouns, (b) phrases, (c) adjectives of equal weight, or (d) clauses (known as elements or items in a series).
5. Use a comma to separate coordinate adjectives (adjectives of equal weight). *Example*: Gross examination revealed ratty, discolored tissue. *Note*: If the adjectives are cumulative (add to or build upon one another), adding to the description, and are not of equal weight, no comma would be used. *Example*: The dissection revealed a dark green muddy fluid behind the pancreas.
6. Use a comma to set off nonessential (nondefining, nonlimiting) (a) words, (b) phrases, (c) clauses, including (d) appositives. *Example*: Mrs. Johnson, whom you referred to me last week, cancelled her appointment and has not rescheduled. *But*: The patient whom you referred to me last week never showed up. (In this sentence, the *whom* clause is essential.
7. Use a comma to set off words or phrases at the end of a sentence that refer back to beginning or middle of the sentence. *Example*: Blood work was obtained, which showed sodium 134, potassium 3.4, chloride 101. (Note that the results of the blood work are separated from the name of the test by a verb.)
8. Use a comma near the end of sentence to set off a contrasting element or indicate a distinct pause or shift. *Example*: Fungal cultures grew yeast, not thought to be *Candida albicans*.
9. Use a comma to set off an absolute phrase at the beginning or end of a sentence. An absolute phrase is one that modifies the entire sentence or one in which it is difficult to determine what is being modified. *Example*: All options being considered equal, the patient opted for surgery.
10. Use a comma in direct quotations to set off the quotation from the rest of the sentence.
11. Use a comma to set off (a) geographical names [city plus state or state/region plus country], (b) year in full dates, (c) titles or credentials, (d) direct address.
12. Use a comma to prevent confusion. *Example*: The patient came in, in acute distress.

Twelve simple rules summarizing most uses of the comma!

Now, try this exercise. Place commas where they should be, according to the rules at the beginning.

1. Approximately a year and a half ago immediately concomitant with her radiation therapy she developed a persistent and intensely pruritic dermatitis at the radiation port on the midchest.
2. The scar is well healed and there is no evidence of local or deep recurrence.
3. NEUROLOGICAL: Oriented to time place and person with no gross deficit.
4. Bacterial cultures grew mixed flora including pseudomonas lactobacillus and group D streptococci.
5. He is showing more comedo formation and a higher proportion of pustular lesions than before and he now has a scattering of cysts over his upper back.

6. This patient returned today with a spreading rash on her shoulders upper chest and back which has been present for over the last couple of months.
7. His urticaria has not been present for longer than 3 months; therefore I have elected to treat him only with drug therapy.
8. Examination of the submental anterior and posterior lymph nodes was negative.
9. Since her last visit to my office I attempted to get her off steroids but she prefers the use of long-term every-other-day prednisone in an attempt to decrease her costs for other medications.
10. The patient recently moved from Indianapolis Indiana to Central Florida.
11. Thank you, Bob for asking me to see this patient and should she have no improvement I will keep you informed of the results of her endoscopy.
12. This is a 16-year-old patient whose last menstrual period was March 11 2004 nearly 7 months ago.
13. I cannot tell at this point how long this will last but it certainly could be several months or longer depending on his clinical course.
14. Physical exam is quite benign except that he is pale sweating restless and in considerable distress with tenderness at the left costovertebral angle and in the left upper quadrant over the kidney and ureter.
15. The patient's condition permitting we will discharge him in the morning.
16. He had 95 units of insulin the day prior to admission and I believe 80 units of combined NPH and regular insulin the day of admission.
17. In very rare cases these tumors have when uncontrolled resulted in a patient's death.
18. The patient had a total protein of 5.4 albumin level was 3.2 chloride was 106 and a total bilirubin was 1.2.
19. He is to take prednisone 40 mg q.a.m. for 3 days 20 mg for 3 days 10 mg for 3 days 5 mg for 3 days 2.5 mg for 4 days and then off.
20. It is noted however that the patient only used Loprox for about 3 months and no debridement was done.
21. He was seen evaluated in the office and had a panel drawn.
22. If at a future date the patient requires increasing dosage of NSAIDs her stools should be reexamined and if at any time they are positive I would proceed with gastroscopy.
23. Past traumas include a sprained wrist a torn knee cartilage on the left and an injury to her left eye during a shoe fight at school.
24. Dr. Anderson the surgeon of record has discharged the patient; when her attending signs off we can discharge the patient.
25. "I'm here for my third round of chemotherapy" explained the patient.

Answers and Explanations

1. Approximately a year and a half ago,[3b] immediately concomitant with her radiation therapy,[6] she developed a persistent and intensely pruritic dermatitis at the radiation port on the midchest.
2. The scar is well healed,[1] and there is no evidence of local or deep recurrence.
3. NEUROLOGICAL: Oriented to time,[4a] place,[4a] and person,[7] with no gross deficit.
4. Bacterial cultures grew mixed flora including pseudomonas,[4a] lactobacillus,[4a, optional] and group D streptococci.
5. He is showing more comedo formation and a higher proportion of pustular lesions than before,[1] and he now has a scattering of cysts over his upper back.
6. This patient returned today with a spreading rash on her shoulders,[4a] upper chest,[4a, optional] and back,[7] which has been present for over the last couple of months. Note: The *which* phase modifies *rash*.
7. His urticaria has not been present for longer than 3 months; therefore,[2] I have elected to treat him only with drug therapy.
8. Examination of the submental,[4c] anterior,[4c, optional] and posterior lymph nodes was negative.
9. Since her last visit to my office,[3b] I attempted to get her off steroids,[1] but she prefers the use of long-term,[5] every-other-day prednisone in an attempt to decrease her costs for other medications.
10. The patient recently moved from Indianapolis,[11a] Indiana,[11a] to Central Florida.
11. Thank you, Bob,[11d] for asking me to see this patient,[1] and should she have no improvement,[3a] I will keep you informed of the results of her endoscopy.
12. This is a 16-year-old patient whose last menstrual period was March 11,[11b] 2004,[11b] nearly 7 months ago.
13. I cannot tell at this point how long this will last,[1] but it certainly could be several months or longer,[9] depending on his clinical course.

14. Physical exam is quite benign,[8] except that he is pale,[4c] sweating,[4c] restless,[4c, optional] and in considerable distress,[7 or 9] with tenderness at the left costovertebral angle and in the left upper quadrant over the kidney and ureter.

15. The patient's condition permitting,[9] we will discharge him in the morning.

16. He had 95 units of insulin the day prior to admission and,[6c] I believe,[6c] 80 units of combined NPH and regular insulin the day of admission.

17. In very rare cases,[3b] these tumors have,[6b] when uncontrolled,[6b] resulted in a patient's death. *Note*: Although the introductory phrase is only 4 words, using a comma adds emphasis to the phrase and is probably appropriate here.

18. The patient had a total protein of 5.4,[4d] albumin level was 3.2,[4d] chloride was 106,[4d, optional] and a total bilirubin was 1.2.

19. He is to take prednisone 40 mg q.a.m. for 3 days,[4b] 20 mg for 3 days,[4b] 10 mg for 3 days,[4b] 5 mg for 3 days,[4b] 2.5 mg for 4 days,[4b or 8] and then off. *Note*: I would not omit the final comma in this series.

20. It is noted,[6a] however,[6a] that the patient only used Loprox for about 3 months,[1] and *no debridement was done*. *Note*: It's a toss-up here whether the clause no debridement was done goes with the word *that* and is part of the object of the verb *noted* [It is noted that … no debridement was done.] or whether it is an independent clause, part of a compound sentence. I chose to treat it as an independent clause. Also note that it is unclear whether the word *only* modifies *used* (took no other measures), *Loprox* (only Loprox and nothing else), or *for about 3 months* (only for about 3 months). Unless there were other clues as to what the doctor meant, you have no choice but to leave *only* where it is.

21. He was seen,[4d] evaluated in the office,[4d, optional] and had a panel drawn.

22. If at a future date the patient requires increasing dosage of NSAIDs,[3a] her stools should be reexamined,[;] [1] and if at any time they are positive,[3a] I would proceed with gastroscopy. *Note*: The prepositional phrases (*at a future date* and *at any time*) in each of the introductory clauses are nonessential, but to set them off with commas would really clutter things up, and they're not that interruptive. Also, many would substitute a semicolon for the comma separating the independent clauses.

23. Past traumas include a sprained wrist,[4b] a torn knee cartilage on the left,[4b] and an injury to her left eye during a shoe fight at school.

24. Dr. Anderson,[6d] the surgeon of record,[6d] has discharged the patient; when her attending signs off,[3a] we can discharge the patient.

25. "I'm here for my third round of chemotherapy,"[9] explained the patient.

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Bioethics in the Laboratory: Perspectives on Embryonic Stem Cell Research

by John H. Dirckx, M.D.

Because biomedical research is phenomenally expensive and deals with critical issues of life and death, it has traditionally faced two major types of limitation: financial and ethical. Sometimes those two become entangled, as when funding is tied up by restrictions based on ethical principles. That is the case with human embryonic stem cell research, currently the focus of intense controversy because of sharply opposing viewpoints on the morality of its methods.

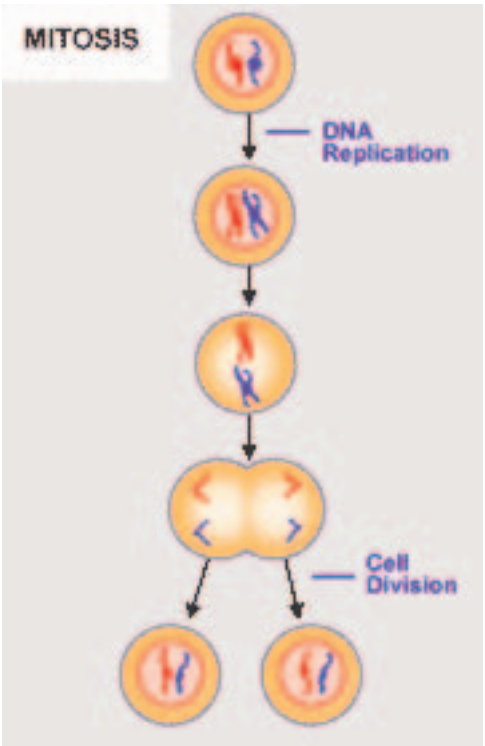
This article reviews basic cell biology, explains the nature of stem cells and their role in biomedical research, and describes the ethical dilemmas faced by those involved in such research.

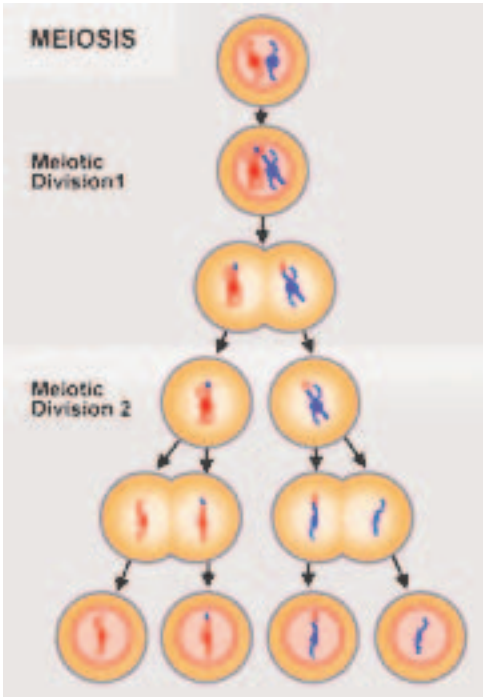
One of the most fundamental concepts in biology is that living things are made up of microscopic units called **cells**. Since the 19th century it has been axiomatic that all cells—from the solitary one that constitutes the entirety of a bacterium or ameba to the countless trillions that make up a human body—are derived from preexisting cells and that, despite their broad structural and functional diversity, they all follow the same basic morphologic and biochemical blueprint.

The cell is isolated from its physical and chemical environment by a membrane that serves as a selective barrier, actively pumping water and an immense variety of substances in or out to maintain internal composition and equilibrium. Chemical substances inside the cell (inorganic ions, proteins, lipids, carbohydrates, and other substances) are suspended in a fluid medium, the **cytoplasm**, along with organelles such as the nucleus, the endoplasmic reticulum, ribosomes, and mitochondria.

The **nucleus** is a compact mass of nucleoprotein that determines the unique identity of each cell and directs its functions and activities. Genetic material is stored in the nucleus in the form of long coiled strands of DNA, which are called chromosomes. In the nucleus of a somatic (body) cell, the chromosomes occur in pairs, one of each pair having been contributed by each parent. Nuclei containing chromosomes that are thus paired are said to contain the **diploid** (i.e., 'double') number (in human beings, 46 chromosomes or 23 pairs).

Many types of cells can multiply by splitting into two identical daughter cells. As a preliminary to cell division, the nucleus first forms two identical daughter nuclei by a process called **mitosis**, during which each chromosome splits in two—more precisely, generates a copy of itself. After mitosis nothing





Illustrations from Genetics, GlaxoSmithKline, **http://genetics.gsk.com/chromosomes.htm**

remains of the original nucleus except the two daughter nuclei, and after cell division nothing remains of the parent cell except the two daughter cells. (See illustrations, page 20.)

Many cells are adapted to perform highly specialized functions. In the human body, for example, muscle cells contract and glandular cells secrete mucus, enzymes, or hormones. Specialization of function often dictates differentiation of form. Thus, a nerve cell has unique processes (dendrites and an axon) that conduct nerve impulses to and from the cell body respectively. Some of the cells lining the respiratory tract bear hair-like cilia whose whipping action keeps the mucus film in constant motion and thus performs a cleansing function.

Gametes or sex cells (sperm and oocytes) differ from somatic cells in that the chromosomes in their nuclei are not paired. That is, each nucleus contains 23 single chromosomes (called the **haploid** number, from a Greek word meaning 'simple') instead of 23 pairs. That condition results from a type of nuclear splitting called **meiosis** or reduction division. Fertilization, the fusion of a male sex cell and a female sex cell, results in the formation of a **zygote** (fertilized oocyte) whose nucleus again contains the full diploid complement of 23 pairs of chromosomes.

A **stem cell** is a relatively immature or undifferentiated cell that has both the capacity of replicating by repeated cell divisions through many generations and the potential of differentiating into a more specific cell type. The range of this potential depends on the cell's composition and its degree of maturity. The specific line of development that an individual stem cell follows depends, at least to some degree, on the needs of the organism of which it is a part, as expressed to it by transcription factors and other biochemical signals.

While some of the cells belonging to a stem cell line mature and differentiate to take up specific functions, others simply keep on dividing so as to ensure a continuing supply of undifferentiated cells. In this way, for example, stem cells in bone marrow constantly replenish the body's stock of red blood cells, white blood cells, and platelets throughout life. Mesenchymal stem cells in connective tissues play a role in the growth, development, and repair of bone, cartilage, tendons, and ligaments.

The stem cell par excellence is the zygote (fertilized oocyte), because that one cell gives rise, through repeated division and differentiation, to all the numerous and various cells that compose the adult body, as well as to the fetal membranes and placenta. The zygote, and indeed all the cells making up a very early (1- to 4-day) embryo, are said to be **totipotent**, meaning that, given the proper biological environment and stimuli, they can develop into any type of human cell whatsoever. Each of those cells can become a complete human being, and if two or three of them mature simultaneously, the outcome will be twins or triplets.

As embryonic cells continue to divide, mature, and differentiate, each cell's range of possible development narrows. The inner cell mass of a 4-day embryo (blastocyst) contains **pluripotent** cells that can develop into any somatic cell of the mature fetus but not into placenta or fetal membranes, and hence cannot form a complete human being.

If stem cells could be artificially made to differentiate into more specialized cells, their introduction into a human host might permit the development, regeneration, or repair of deficient, abnormal, or injured tissues.

Among pluripotent embryonic cells are some that will eventually develop into gametes (sperm or oocytes, depending on the sex of the embryo). Because, throughout the first decade and more of life, human beings are sexually immature and therefore do not form gametes, these **germline** cells continue to propagate by mitosis just like somatic cells, and their nuclei contain the diploid number of chromosomes until some time after sexual maturity is attained. Only then does meiosis reduce their chromosomal complement to the haploid number.

With further specialization, embryonic pluripotent cells become **multipotent** cells. Although these too are stem cells, in that they can either continue to divide or develop into any of several types of mature cell, their range of differentiation is more limited. Multipotent nerve cells, for example, are genetically committed to produce various kinds of neuron but cannot develop into muscle or skin cells.

During the 19th century the pioneer microbiologists Rudolf Koch, Louis Pasteur, and others developed techniques for artificially propagating pure strains of bacteria, yeasts, and fungi in the laboratory. Later workers refined and adapted those techniques to permit culturing animal and human cells. Cell cultures play vital roles in modern laboratory medicine. For example, because viruses can survive and replicate only within living cells, a colony of such cells is an absolute necessity for culturing viruses.

In 1951 George and Margaret Gey at Johns Hopkins University established the first human tissue culture with cells taken from a malignant uterine tumor. This line (called HeLa cells after Henrietta Lacks, who died of the tumor in 1952) continues growing to this day and is represented by billions of cells in hundreds of laboratories around the world.

As recently as 1998, two independent researchers, James Thomson at the University of Wisconsin and John Gearhart at Johns Hopkins University, announced the successful propagation in laboratory culture of pluripotent stem cells harvested from human embryos. Because during normal embryonic and fetal development these cells can differentiate into virtually every type of cell present in the adult body, the ability to culture and manipulate them in the laboratory is widely believed to hold the key to positive interventions in many diseases and disorders that are currently untreatable.

Other suggested benefits of stem cell research include gaining further information on various reproductive issues (infertility, miscarriage, contraception), on embryonic and fetal development, and on the causes of congenital diseases (that is, those existing at birth, whether genetic or induced during intrauterine development).

If stem cells could be artificially made to differentiate into more specialized cells, their introduction into a human host might permit the development, regeneration, or repair of deficient, abnormal, or injured tissues. For example, normally functioning beta cells producing insulin might be introduced into the pancreatic islets of persons with type 1 diabetes mellitus. Patients with Parkinson disease might be helped by the insertion into their central nervous systems of neurons producing normal amounts of dopamine. Healthy cardiac muscle cells might be substituted for tissue that has been damaged by myocardial infarction, and new skin might be generated for burn victims.

Of crucial importance in the preceding paragraph is the recurring word *might*. No one knows at present whether the goals and promises of embryonic stem cell research are realistic and humanly attainable or whether they pertain to the realm of fantasy and science fiction. The answer to that question can be sought only through intensive and expensive research, and that is where funding and moral issues complicate the picture.

Gearhart started his cultures with germline cells derived from the primordial reproductive tissues of aborted early embryos. Thomson, in taking somatic cells from embryos that had been produced by in vitro fertilization at an infertility clinic, damaged them lethally.

There is no societal consensus in this country as to the ethics of destroying a human embryo in order to preserve or enhance the life of one or more other human beings. Although the U.S. Supreme Court decision in the case of *Roe v Wade* (1973) withdrew the status of personhood from human embryos and fetuses and made abortion legal at the federal level, many religious groups and individuals consider abortion to be morally wrong and, in effect, homicide.

There is a subtle juridical distinction between the sources of cells used by Gearhart and Thomson. An aborted embryo is essentially cadaveric tissue, in that its expulsion from the uterus of the mother terminates its life by making its survival and further development impossible. Gearhart's removal of cells from embryos that had already been aborted was therefore not responsible for their destruction. In contrast, Thomson's dissection of living embryos that had been created by in vitro fertilization did indeed directly destroy them.

Those who date human personhood from the moment of conception object not only to abortion but also to in vitro fertilization, which involves the artificial creation of human embryos that will never have the opportunity for implantation and that will eventually be destroyed. Most pro-life advocates, adducing the principle that a good end cannot justify an evil means, would therefore ban both of the ways in which embryonic stem cell lines have been started and all research activities based on them.

The use of germline cells instead of somatic cells to start colonies of embryonic stem cells raises ethical issues apart from the question of embryonic survival or destruction. A line of such cells, once established, could theoretically mature and differentiate into gametes that could be used for in vitro fertilization. Some bioethicists have expressed concern that permitting such research could open the door to germline manipulation in the name of eugenics, with the ultimate aim of genetic "enhancement"—modifying the germline to select genetic traits deemed positive or advantageous by the researcher.

To date, the National Institutes of Health (NIH), a federal agency, has provided the chief financial support for research on embryonic stem cells. President George W. Bush, responding to conservative pro-life positions and his own personal convictions, has limited eligibility for federal support of embryonic stem cell research to work conducted with the 19 cell lines that had already been established as of 9:00 p.m. on August 9, 2001. Embryonic stem cell research that is not funded by the federal government is not subject to federal restrictions but is illegal in many states.

Embryo vs. Fetus

For the first 8 weeks after conception, the developing human being is called an **embryo**, and from 9 weeks to birth, it is called a **fetus**. It is therefore incorrect to refer to the work discussed in this article as "fetal stem cell" research. This is not a mere quibble about semantics. Because federal statutes and regulations currently allow certain kinds of transplant research involving **fetal tissue**, the persistent and widespread use of the wrong term for embryonic stem cell research could create a false frame of reference, favoring legal loopholes that might subvert the purpose of legislators.

Gearhart and his colleagues took primordial germ cells from the gonadal ridge and mesentery of 5- to 9-week embryos and cultured them on a feeder layer of mouse fibroblasts (partially differentiated connective tissue cells) that had been exposed to gamma irradiation to prevent them from proliferating. The cultures were enriched with nutrients and growth factors including fetal calf serum, leukemia inhibitory factor (LIF), basic fibroblast growth factor (bFGF), and forskolin.

Because the primordial germ cells had not yet undergone differentiation into gametes through meiosis, they had the full (diploid) number of 23 pairs of chromosomes. And although they would ultimately have served a reproductive function, they were still pluripotent cells at the early embryonic stage at which they were harvested. As these cells grew and multiplied in vitro, they spontaneously formed variable numbers of **embryoid bodies.** These are ill-defined and unpredictable mixtures of partially differentiated cells that represent all three of the embryonic germ layers—endoderm, mesoderm, and ectoderm. Cells isolated from embryoid bodies were used to start colonies of partially differentiated cells.

Thomson obtained his starter cells from frozen spare blastocyst-stage embryos produced by in vitro fertilization (IVF), a technique designed to enable infertile couples to have children. In this procedure, a sperm and an oocyte are artificially combined in a laboratory setting rather than within the female reproductive tract. The resulting zygote is then implanted in the uterus of the woman.

Because the outcome of any individual fertilization is uncertain, it is standard procedure to fertilize several oocytes at the same time. After one or more of these have been implanted in the uterus, the remainder are frozen and stored for future use, which may include either a later uterine implantation or research. Embryos that have not been used by an arbitrary expiration date are destroyed.

Thomson took cells (blastomeres) from the inner cell masses of 36 fresh or frozen human embryos at the blastocyst stage. The protective outer covering (trophectoderm) of each embryo was first destroyed by the application of antibody. Although this process did not damage the blastomeres, it made further development of the embryo as an organism impossible. The cells were cultured on feeder layers of embryonic mouse fibroblasts like those used by Gearhart, but without the addition of LGF, bFGF, and forskolin.

As with Gearhart's cultures, Thomson's cells proliferated and displayed some spontaneous differentiation. When injected into immunosuppressed laboratory rodents, these human embryonic stem cells formed teratomas (tumors) containing a variety of cell types, an indication of pluripotentiality. Embryoid bodies did not form, but clumps of homogeneous-looking cells were isolated and used to start new cultures. After several repetitions of this procedure, several lines were started with single cells from these cultures.

A **telomere** is a repeating sequence of double-stranded DNA at either end of a chromosome. As cells divide and differentiate throughout the lifespan of an organism or cell line, the occasional failure of a telomere sequence to be replicated during mitosis leads to gradual shortening of chromosomes. This genetic erosion plays an important part in normal aging and sets a natural limit on the number of times that such cells can undergo mitosis. It also accounts for the fact that differentiated somatic cells in a laboratory culture eventually stop dividing, a phenomenon called replicative senescence.

A few types of cell, however, can propagate indefinitely without suffering this attrition of telomeres. At a critical stage in mitosis, these cells express the enzyme **telomerase**, a reverse transcriptase that not only prevents or delays the loss of DNA at telomeres but actually adds DNA sequences. Telomerase expression is a feature of some normal cells (germ cells and bone marrow stem cells) and of many tumor cell lines (including HeLa cells).

Embryonic stem cells in laboratory cultures also display high levels of telomerase activity. A cell line that is capable of indefinite propagation is said, by a slight stretch of language, to be "immortal." Although lines of embryonic stem cells maintained in laboratory culture are immortal because they produce telomerase, they are also genetically unstable and become more so with the passage of time. Pluripotency is gradually lost.

Advocates of human embryonic stem cell research base their hopes and claims on the assumption that these cells can be artificially induced to differentiate into any of the more than 200 types of normal cell found in the mature human body. Investigators working with embryonic stem cells have thus far reported only limited success in inducing embryonic stem cells to differentiate into heart muscle cells, pancreatic islet cells, nerve cells, and hematopoietic precursor cells (marrow cells capable of differentiating into blood cells).

Other suggested benefits of stem cell research include gaining further information on various reproductive issues . . . , on embryonic and fetal development, and on the causes of congenital diseases . . . .

Cells lines derived from human embryoid bodies differentiate spontaneously into many kinds of cell. Their differentiation can be partially directed by exposure to various growth factors, including retinoic acid, epidermal growth factor (EGF), bone morphogenic protein 4 (BMP4), activin-A, hepatocyte growth factor (HGF), and nerve growth factor (NGF). Cultures treated with retinoic acid differentiate into cells that resemble neurons and express neurofilament H. Cells in activin-A–treated cultures form a **syncytium** (a multinucleated mass of fused cells) resembling muscle. But to date only haphazard differentiation of stem cells has been achieved in vitro, and no one has ever produced a clone of normal and fully differentiated cells.

A clone is any aggregation of cells, ranging from a colony of a few dozen cells in a laboratory dish to a complete, mature organism such as a mouse or a sheep, that are all derived asexually from a single ancestral cell. A human being or an animal that was conceived and born in the normal way is not a clone, because it was produced sexually and its genetic makeup contains elements contributed by both parents.

But a colony, whether of bacteria or embryonic stem cells, that have all descended from a single ancestral cell is properly termed a clone. The fact that all of the cells in a given culture are known to be genetically identical is an enormous advantage in many kinds of laboratory work. Monoclonal antibodies, produced by clones of immune system cells (actually hybridomas formed by fusion of immune cells with established tumor cell lines), are widely used in diagnostic tests, in the manufacture of drugs and biologicals, in the therapy of certain inflammatory and malignant diseases, and in research.

Therapeutic cloning is a method intended to yield a pure strain of healthy differentiated cells—heart muscle cells, bone cells, or nerve cells—with which to replace diseased, damaged, or absent cells. The first step in therapeutic cloning is **somatic cell nuclear transfer**. Removing the nucleus from an oocyte deprives that cell of its genetic individuality but not of its character as a stem cell and its totipotentiality. If what remains of the cell—its membrane and cytoplasm containing supporting organelles and nutrients—is made to fuse with a somatic cell derived from the prospective recipient of the generated tissue,

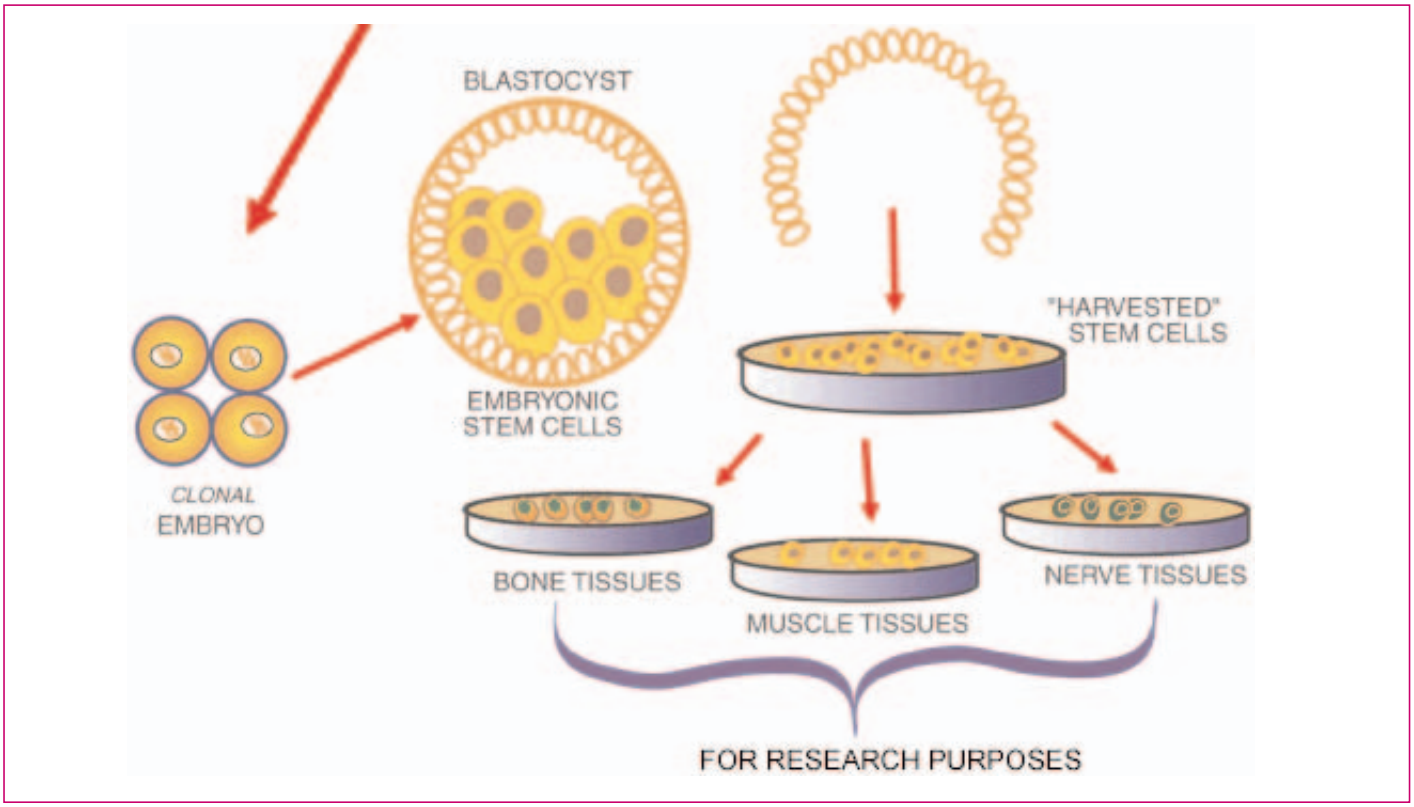


Illustration of nuclear transfer and therapeutic cloning from **http://www.genetics-and-society.org/technologies/cloning/research-science.html**

the resulting **chimera** (ki-mé-ra, named for a monster of Greek myth) has the genetic makeup of the donor cell but the developmental potential of a primitive germ cell.

Because the oocyte nucleus with its haploid number of chromosomes has now been replaced by a somatic cell nucleus having the diploid number of chromosomes, the resulting chimera has the same developmental potential as a fertilized oocyte. In 2004 a South Korean research group led by Woo Suk Hwang announced the successful creation of 30 human chimeras, which were permitted to develop as far as the blastocyst stage. Such a chimera could theoretically be a source of stem cells that are genetically identical to all the other cells in the body of the person from whom the somatic cell nucleus was derived. Grafts formed from such cells should be compatible with that person's tissues and hence unlikely to elicit rejection.

Pro-life advocates regard human chimeras created for purposes of therapeutic cloning as living human beings, and oppose both their creation and their destruction. Moreover, they point out that therapeutic cloning is just a step away from reproductive cloning, the artificial, asexual production of an entire organism from a single somatic cell. In 1997 Ian Wilmut and his colleagues at the Roslin Institute in the U.K. announced the birth of the sheep Dolly, the first mammal cloned asexually from a single cell of an adult animal. Since then, other workers have cloned animals belonging to other species.

If a human chimera resulting from nuclear transfer and intended for therapeutic cloning were to be implanted in a human uterus instead of being grown in a laboratory culture, it would have a substantial chance of developing into a mature fetus. No responsible scientist is likely to attempt such a feat, and to date, as far as is known, no one has cloned a human being.

Inserting a somatic cell nucleus of 46 human chromosomes into an enucleated oocyte from another human being is something like transplanting the hard disk of a Mac into the central processing unit of a PC, or maybe like moving the controls from the cockpit of a transatlantic jetliner to the bridge of an ocean liner. A chimera contains an admixture of nuclear DNA from the somatic cell with cytoplasmic mitochondrial DNA remaining in the denucleated oocyte. Although no one can accurately predict what that would mean to future generations, the likelihood is strong that it would introduce permanent deleterious alterations into the germline. Among cloned animals the incidence of spontaneous abortion and birth defects is higher than among products of natural reproduction, and these animals are subject to premature aging, impairment of immune response, and sudden and unexplained death.

For those and other reasons, reproductive cloning of a human being has been formally banned in more than 30 countries, including the U.S. A bill passed by the House of Representatives that would permit therapeutic cloning but would ban reproductive cloning and sentence violators to prison and impose fines as high as $1 million has still to be considered by the Senate.

Debate by members of the United Nations on a global ban against all medical applications of human cloning continues at

the time of writing. All UN countries favor a treaty that would ban the creation of cloned human babies, but a U.S.-backed proposal put forward by Costa Rica that sought to extend the ban to therapeutic cloning encountered intense opposition from countries such as the U.K. and the Netherlands that want the right to pursue new medical treatments based on cloning.

Broad ethical principles on which most people of good will agree can yield widely differing interpretations when applied to specific moral questions and issues, especially when those questions and issues are unprecedented. The debate between advocates of stem cell research and their opponents has often become polarized along political, philosophical, and religious lines. Tolerance of embryonic stem cell research, of whose methodology the destruction of living embryos is an integral part, is seen as further erosion of respect for every human life that began with legalization of abortion and euthanasia during the latter part of the 20th century. Scientists conducting basic stem cell research have been depicted as irresponsible meddlers who seek to play God with utter disregard for possible adverse consequences. Conversely, opponents of stem cell research are often stereotyped as religious dogmatists or fanatics.

Some bioethicists have suggested a compromise position whereby embryonic stem cell research might be made morally acceptable. According to this view, even though a new life begins at conception, the primitive blastocyst lacks the complexity and organization required for true personhood, which begins only at the fetal stage. Additionally, some have held that a zygote produced in the laboratory, and to an even greater extent a chimera, differ so radically from a product of natural conception that they lack the moral and legal status of a human being. Strict pro-life advocates find these views impossible to reconcile with the undoubted fact that, from their earliest stages of existence, such organisms have the potential to develop into mature human beings.

Parthenogenesis ('virgin birth') is the production of a mature organism from an unfertilized oocyte. This process occurs naturally in some lower animals. Monkey oocytes have been induced in the laboratory to begin dividing so as to form embryos without being fertilized and without having gone through meiosis with reduction in their chromosomal complements. The morality of undertaking such experimentation with human oocytes for the purpose of starting embryonic stem cell lines is far from clear. Given that the resulting embryo has the theoretical potential of developing into a human being, its moral status is essentially the same as a zygote produced by nuclear transfer.

The climate of ethical debate over embryonic stem cell research and the relevant restrictions on federal support have prompted many researchers to seek alternative sources of pluripotent or multipotent cells. Although embryonic stem cell lines are theoretically the most versatile and useful for replacement or supplementation of diseased tissue, experimentation with such lines has thus far yielded no practical results. Meanwhile, other types of stem cells, not derived from embryos, have been used successfully in reparative (or regenerative) medicine.

Bone marrow appears to be particularly promising as a source of adult stem cells. . . . Umbilical cord blood is another readily available and ethically unobjectionable source of multipotent stem cells.

Adult stem cells are precursor cells, found in small numbers in adults, that give rise to specific tissue types, such as blood, muscle, and nerve. Bone marrow appears to be particularly promising as a source of adult stem cells. Until recently, transplanted marrow cells have been viewed only as a means of restoring marrow depleted by disease or by cancer chemotherapy or radiation. But experiments have shown that marrow-derived stem cells injected into animals with damaged heart, nerve, lung, and liver tissue can differentiate into cells that contribute to the repair of those organs. Umbilical cord blood is another readily available and ethically unobjectionable source of multipotent stem cells.

Adult stem cells are difficult to isolate. They grow slowly in culture and, because they do not produce telomerase, the cultures age and eventually die out. But because work with adult cells doesn't involve the destruction of embryos, ethical opposition and funding restrictions are not a problem.

Stem cell research became a major campaign issue in the 2004 presidential election. The defeated Democratic candidate, John Kerry, had promised, if elected, to reverse President Bush's 2001 policy restricting federal funding of such experiments to cell lines already established and to expand funding to $100 million annually.

Private investors have full freedom to support the development of new embryonic stem cell lines, and so do state governments. Proposition 71, passed in California in November 2004, authorizes the state to sell $3 billion in bonds and then dispense nearly $300 million a year for 10 years to researchers for human embryonic stem cell experiments, including cloning projects intended for research purposes. This funding initiative dwarfs all previous stem cell projects in the United States, whether privately or publicly financed. The issue specifically bans reproductive cloning.

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Update

What's New in Stem Cell Research

by John H. Dirckx, M.D.

adult stem cell—an undifferentiated precursor cell, found in small numbers in the differentiated tissues of an adult, that can either divide so as to continue the line of such cells or differentiate into a specific cell type.

apoptosis—programmed death of certain cells, such as erythrocytes and epithelial cells in the adult and cells of transitional organs in the fetus; may also occur in cells damaged by environmental factors or viral infection. Cells in cultures, other than stem cells and tumor cells, undergo apoptosis after about 50 cell divisions.

blastocoel—the cavity in the blastula of the developing embryo.

blastocyst—a very early (preimplantation) embryo, consisting of 50-200 cells, produced by repeated cleavage of a zygote (fertilized oocyte). It is a roughly spherical structure consisting of an outer cell layer (the trophectoderm), which will develop into the fetal membranes and placenta; a fluid-filled cavity (the blastocoel); and a cluster of pluripotent cells (the inner cell mass), which will develop into the body of the fetus.

blastomere—a pluripotent cell of the inner cell mass of a blastocyst.

bone marrow stromal cell—any stem cell found in bone marrow that is not involved in hematopoiesis (blood cell formation). These are mesenchymal stem cells, some of which can differentiate into specialized connective tissue cells such as bone, cartilage, and fat.

cell culture—growth of cells in vitro on an artificial medium.

cell division—a process by which a single cell divides to form two daughter cells, with nothing left over; preceded by division and reapportionment of genetic material in the nucleus (mitosis in somatic cells, meiosis in gametes).

cell line—a self-perpetuating or self-renewing colony of cells grown in culture and having an indefinite life span.

cell-based therapy—a form of treatment in which stem cells are induced to differentiate into specific cells of the type required to repair damaged or depleted adult cell populations or tissues.

chimera (ki-mé-ra, named for a monster of Greek myth)—an organism composed of cells derived from at least two genetically different zygotes, from the same or different species; can occur naturally, but the term usually refers to the laboratory creation of an artificial zygote by replacement of the nucleus of a cell with a cell nucleus taken from another individual.

chromosome—any of a group of paired structures in the cell nucleus (23 pairs in human cells), consisting chiefly of long coiled strands of DNA, that determine the genetic makeup of an organism. One of each pair is contributed by each parent. Chromosomes are made up of subunits called genes, each of which codes for a specific trait.

clone—any aggregation of cells, ranging up to a complete organism, derived asexually from a single ancestral diploid cell.

cloning—generation of an embryo by somatic cell nuclear transfer.

congenital—present at birth, but not necessarily genetic.

cord blood—blood in the umbilical cord and placenta, particularly in the context of childbirth and the immediate postpartum period.

cryopreserved embryo—an embryo, usually one produced by in vitro fertilization, that has been stored in the frozen state because it exceeded the needs of the moment.

culture medium—a nutrient and protective fluid or semisolid material in which a culture is grown in vitro.

cytoplasmic inheritance—transfer of genetic material by genes present in cytoplasm.

differentiation—a developmental process characterized by an increase in the organization or complexity of a cell or tissue, accompanied by specialization of function.

directed differentiation—modification of a stem cell culture, for example by the addition of growth factors, so as to induce differentiation into a specific cell type.

DNA (deoxyribonucleic acid)—the genetic material of all cellular organisms, contained chiefly in the nucleus and forming the chromosomes. It is a polymer (long chain of repeating units) in which molecules of deoxyribose (a five-carbon sugar) are linked by phosphate bonds and carry side-chains of adenine, guanine, cytosine, and thymine. These four substances (the first two purines and the second two pyrimidines) carry the genetic blueprint for the synthesis and arrangement of all the substances and structures in the body.

dysmorphism—any developmental error resulting in an abnormal appearance or configuration.

ectoderm—the outermost of the three germ layers of the early embryo, derived from the inner cell mass of the blastocyst. As fetal development progresses it gives rise to the skin, the nervous system, dental enamel, and the ocular lenses.

embryo—an organism in the earliest stages of development; for human beings, the embryonic stage extends from fertilization until the end of the eighth week of gestation.

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embryo provider—a person who has custody of an embryo and the authority to make decisions regarding its disposition; not necessarily either biological parent of the embryo.

embryoid body—a spheroidal clump or colony of partially differentiated cells that develops spontaneously in a culture of embryonic stem cells. Cells isolated from embryoid bodies may be used to start lines of multipotent stem cells.

embryonic germ cell—a pluripotent stem cell derived from the gonadal ridge of a 5- to 8-week embryo. With continued normal development these cells differentiate into gametes (oocytes or sperm). Their properties and developmental potential are similar but not identical to those of embryonic stem cells.

embryonic stem cell—a primitive, undifferentiated, pluripotent stem cell derived from the inner cell mass of an embryo in the blastocyst stage.

endoderm—the innermost of the three germ layers of the early embryo, derived from the inner cell mass of the blastocyst. As fetal development progresses it gives rise to the respiratory and digestive systems, including the liver and the pancreas.

epidermal growth factor—a protein involved in the maturation of the epidermis; in the newborn it hastens eyelid opening and tooth eruption.

eugenics—the theory or practice of preserving genetic traits that are considered positive or advantageous within a population while annihilating traits considered undesirable; methods range from manipulating the reproductive behavior or outcomes of a population to involuntary sterilization and genocide.

ex vivo—outside the body; usually means about the same as in vitro.

feeder layer—a layer of cells (usually mouse embryonic fibroblasts treated with gamma radiation to prevent them from proliferating) on which a stem cell culture is maintained.

fertilization—the process whereby male and female gametes (sperm and oocyte) unite to form a zygote.

fetus—a developing organism from the end of the embryonic period (8 weeks of development in human beings) until birth.

gamete—a sex cell (sperm or oocyte) having the haploid chromosome number (23 single chromosomes)

gamete provider – one of the biological parents of an embryo; may not necessarily have legal custody of the embryo or the authority to make decisions regarding its disposition.

gastrulation—a process during embryonic development whereby the inner cell mass of the blastocyst differentiates into the three germ layers (ectoderm, mesoderm, and endoderm).

gene—a functional unit of heredity, consisting of a specific sequence of DNA and occupying a specific position (locus) on a specific chromosome. Each gene codes for the synthesis of a specific protein.

gene therapy – the therapeutic or medical application of somatic genetic transfer.

genetic—pertaining to transmission of traits or defects by genes.

genetic engineering—intentionally altering the genetic composition of an organism.

genome—the full complement of genetic information possessed by the chromosomes of an individual organism or species.

genotype—the genetic composition of an individual; compare phenotype.

germ cell—a gamete (sperm or oocyte) or a primordial cell that can mature into a gamete.

germ layer—any of the three primitive layers (endoderm, mesoderm, and ectoderm) into which the inner cell mass of an early embryo (blastocyst) divides as a preliminary to further development.

germ line—the line of primordial cells, identifiable in the late embryonic stage of development, that will eventually differentiate into gametes (sperm or oocytes, depending on the sex of the embryo).

gonad—an organ (testis or ovary) that produces sex cells (sperm or oocytes).

gonadal ridge—embryonic structure from which the gonads develop.

hematopoietic stem cell—a stem cell from which all red and white blood cells develop; found in adult bone marrow, umbilical cord blood, peripheral blood, and fetal liver. Adult hematopoietic stem cells can replace bone marrow that has been destroyed by disease or radiation therapy and can continue to produce mature blood cells.

human embryonic stem cell—a pluripotent stem cell derived from the inner cell mass of the blastocyst stage of a human embryo.

hybrid cell—a cell resulting from the junction of two cells of different origins, whose nuclei have fused into one.

hybridization—pairing of an RNA strand and a DNA strand, or of two different DNA strands.

hybridoma—a cell line formed in the laboratory by the fusion of normal immune cells (e.g., lymphocytes) and tumor cells (e.g., myeloma). Such cells retain the ability of their immune ancestors to produce monoclonal antibody and the capacity of their neoplastic ancestors to replicate indefinitely in culture.

immortal—referring to a cell line that is capable of indefinite propagation; see telomerase.

implantation—the attachment of a blastocyst to the uterine lining.

in situ hybridization—laboratory technique in which a single-stranded DNA probe of known sequence, radioactively or fluorescently labeled, is made to seek out and fuse with a corresponding nucleic acid sequence in a specimen.

in vitro fertilization—an assisted reproductive technique for infertile couples in which fusion of a sperm

and an oocyte is carried out in a laboratory rather than within the female reproductive tract. After the resulting zygote has developed to the blastocyst stage it is implanted in the uterus of the mother for further development.

inheritable genetic modification (IGM) (germline genetic modification, germline engineering)—a technique of altering the genetic composition of gametes (oocytes and sperm) in which viral vectors are used to insert new genes. Since these changes are inheritable, they are passed on to offspring and become part of the human gene pool.

inherited—genetically transmitted.

inner cell mass (ICM)—a small group of cells within the cavity of a blastocyst (a very early embryo), which will give rise to the embryonic disk, then the three germ layers, and finally to all the cells and tissues of the fetus except the placenta and fetal membranes. Embryonic stem cell lines are derived from cells isolated from the inner cell mass.

knockout—referring to a cell line or experimental animal from whose genome a gene has been deliberately deleted by homologous recombination.

large-offspring syndrome—a disorder of cloned cattle and sheep in which a fetus grows abnormally large; associated with dystocia, stillbirth, and birth defects.

leukemia inhibitory factor—a naturally occurring protein (so named because it suppresses development of mouse leukemia cells) that has been used to inhibit differentiation in a stem cell line.

lineage—the descendants of a common ancestor.

long-term self-renewal—the persistence of a stem cell line for months or years due to repeated divisions forming the same undifferentiated cell types.

mesenchymal stem cell—a multipotent cell found in embryonic connective tissue and, much more rarely, in adult bone marrow and connective tissue; capable of differentiating into bone, cartilage, and fat cells.

mesoderm—the middle one of the three germ layers of the early embryo, derived from the inner cell mass of the blastocyst. As fetal development progresses it gives rise to muscle, connective tissues including bone and fat, and blood cells.

mitochondria—organelles that synthesize ATP (adenosine triphosphate) and are the principal site of cellular energy metabolism through the oxidation of foodstuffs (carbohydrates, fats, and proteins).

mitochondrial DNA—genetic material in mitochondria that codes for synthesis of mitochondrial proteins and enzymes independently of nuclear DNA. Virtually all of the mitochondrial DNA in a cell is derived from the cytoplasm of the oocyte (maternal gamete).

monoclonal antibody—an antibody produced by a hybridoma (a clone of cells derived from the fusion of an immune cell and a tumor cell).

morula—a stage of embryonic development preceding the blastocyst stage; the morula is a spherical mass of undifferentiated cells.

multipotent – referring to stem cells that can develop into at least two types of mature, more differentiated cell, but not into a wide range of cell types.

multipotent adult progenitor cells (MAPC)—cells derived from adult bone marrow that can be differentiate into various connective tissue cells.

neural stem cell—a stem cell occurring sparsely in the adult brain that can differentiate into neurons and neuroglial cells.

oligopotent progenitor cells—progenitor cells that can differentiate into a limited number of mature cell types.

oocyte—a female gamete (sex cell); this term is now preferred to ovum.

ooplasm—the cytoplasm of an oocyte; its mitochondria possess genetic material (mitochondrial DNA) that functions independently of nuclear (chromosomal) DNA and is the principal source of mitochondrial source in a zygote.

ooplasmic transfer (cytoplasmic transfer)—an experimental technique of injecting cytoplasm from an oocyte of a woman known to be fertile into an oocyte of an infertile woman. The oocyte thus modified is then fertilized in vitro and implanted into the uterus of the infertile woman.

parthenogenesis—the maturation of an unfertilized oocyte to form a new individual; occurs naturally in some insects and has been artificially induced in experimental animals. A possible means of producing embryonic stem cells without fertilization.

phenotype—the sum of observable or measurable physical, biochemical, and physiologic traits or features of an individual; determined in large measure by the genotype, but distinct from it.

plasticity—the ability of stem cells from one adult tissue to differentiate into mature cell types of another tissue.

pluripotent stem cell—a stem cell with the capacity to differentiate into cells of all germ layers (endoderm, ectoderm, and mesoderm) and into most or all cell types found in the adult body. Pluripotent cells used in stem cell research are derived from the inner cell mass of a very early embryo (blastocyst) or from the gonadal ridge of a slightly more mature embryo. Pluripotent cells cannot differentiate into placenta or fetal membranes.

population doubling—the doubling of the number of cells in a line of cells growing in vitro; in non-immortal lines, differentiation potential and life expectancy decline as the number of doubling increases, while the

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likelihood of genetic mutations increases.

preimplantation genetic diagnosis and screening (PGD)—testing of embryos that have been created by in vitro fertilization for certain genetic traits, including gender, so as to direct the choice of which one to implant.

primitive streak—a band of cells appearing in the third week of embryonic development, marking the longitudinal axis of the body and the site of the future spinal cord.

primordial germ cell—an embryonic cell that can mature and differentiate into a gamete (oocyte or sperm).

progenitor cell—a cell occurring in fetal or adult tissue that can differentiate into a more specialized cell but, unlike a stem cell, cannot renew itself indefinitely by repeated cell division.

proliferation—expansion of a cell population by repeated cell division.

regenerative (or reparative) medicine—a mode of treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or depleted adult cell populations or tissues.

reproductive cloning—a process by which an entire new organism is created by somatic cell nuclear transfer from a single body cell of another organism, to which it is genetically identical; cloning of an embryo for transplantation into a uterus in order to produce a mature organism that is genetically identical to the nuclear donor.

research cloning—see *therapeutic cloning*.

somatic cell—all cells of a developing or mature organism except germline cells.

somatic cell genetics—the study of the genetics of somatic cells cultured in vitro.

somatic cell nuclear transfer (SCNT)—transplantation of the diploid nucleus of a somatic cell into an unfertilized oocyte from which the haploid nucleus has been removed. The resulting chimera has the genetic makeup of the donor cell but the developmental potential of a primitive germ cell. Cell division of the chimera yields a clone of totipotent stem cells that are genetically identical with the donor of the nucleus.

somatic genetic transfer (also called somatic genetic modification)—a process in which desired genes are introduced into the somatic cells of the body by means of a viral vector.

somatic mutation—any mutation occurring in a somatic cell rather than in the germ line.

somatic stem cell – see *adult stem cell*.

sperm—a male gamete; this abridged term is now preferred to spermatozoon.

stem cell—an undifferentiated multipotent precursor cell that is capable both of perpetuating itself as a continuing line of stem cells and of undergoing differentiation into one or more specialized types of cells.

sunset legislation—a type of legislation that incorporates an expiration date so that it must be reevaluated at a later time; this allows for changes in policy as public opinion and perceived needs change.

telomerase—an enzyme produced by germ cells, bone marrow stem cells, and tumor cells. It helps to prevent the attrition of telomeres (terminal sequences of chromosomes) during mitosis and confers immortality on a cell line.

telomere—a repeating sequence of double-stranded DNA at either end of a chromosome. As cells divide and differentiate throughout the lifespan of an organism or cell line, the occasional failure of a telomere sequence to be replicated during mitosis leads to gradual shortening of chromosomes. This genetic erosion plays an important part in normal aging and sets a natural limit on the number of times that such cells can undergo mitosis.

teratogen—any agent or factor that causes, or increases the likelihood, of congenital malformations.

teratoma—a tumor containing tissues from all three embryonic germ layers, usually arising in a gonad (ovary or testis). Can be artificially induced by injection of stem cells into immunodeficient laboratory animals, in order to assess the pluripotency of the cells.

therapeutic cloning—creation by somatic cell nuclear transfer of a clonal embryo, which is induced to divide until the blastocyst stage, during which embryonic stem cells are harvested from the inner cell mass.

totipotent stem cell—a zygote or any cell of the very early (3-4-day) embryo, which has the capacity to differentiate into all cell types that are found in an embryo, fetus, newborn, or adult, including the embryonic components of the trophoblast and placenta required to support development and birth. No artificially created stem cell line to date has been shown to have these properties.

trophectoderm—the outer cellular envelope of the blastocyst, which will develop into the placenta and fetal membranes.

trophoblast—the outer envelope of the blastocyst, containing cells that will differentiate to form the placenta and fetal membranes.

umbilical cord stem cell—a hematopoietic stem cell that is present in umbilical cord blood during the immediate postpartum period; similar to bone marrow stem cells.

unipotent stem cell—a stem cell that is capable of sustaining a self-renewing line or of differentiating into a single mature cell type.

vector—in cloning, the plasmid or phage used to carry the cloned DNA segment.

zygote—the diploid cell that results from the fertilization of an oocyte (ovum, egg) by a sperm cell.

Vera Pyle's Current Medical Terminology, 10th edition

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Enfant pediatric vision testing system—a noninvasive, child-friendly medical device that tests for visual deficits using visual evoked potential technology. It records the brain's response to light, and can detect vision problems such as amblyopia in children as young as 6 months old.

percutaneous myocardial channeling (PMC)—a minimally invasive procedure that stimulates blood flow in the heart to relieve pain from angina by creating channels in the inner wall of the heart. It is thought that these channels promote the growth of new blood vessels to improve blood supply to heart tissues in need of nourishment.

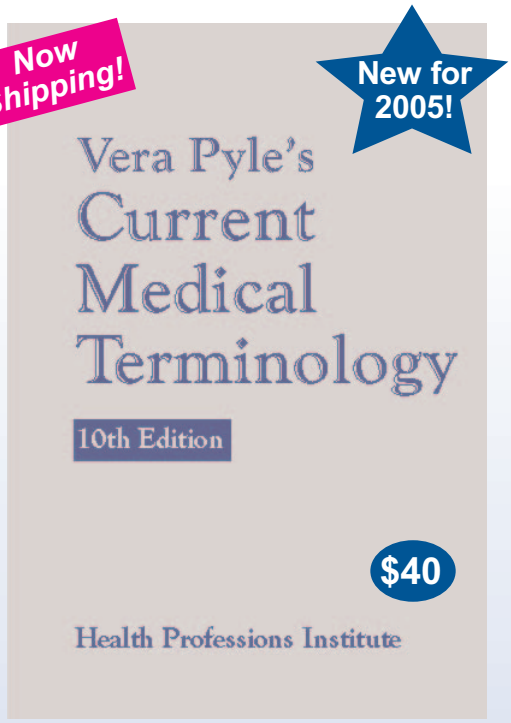
pericardial well (*not* wall)—the space around the heart where iced saline slush is placed in coronary artery bypass graft surgery.

Who is Vera Pyle?

Often referred to as the grande dame of medical transcription, Vera Pyle worked for decades to elevate the profession of medical transcription through education. A beloved writer and speaker in the transcription community, she is remembered for her quick wit and intriguing stories.

The first edition of ***Current Medical Terminology*** was published in 1985. Much of the research for the early editions was completed by Vera Pyle herself. After her death, the book was renamed in her honor and the HPI staff continues her tradition of scholarly research and insightful explanations. Her distinctive voice can be heard throughout the book, and the professionalism for which she is known characterizes each new edition.

Vera Pyle, 1917-1998



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"snick" • BilDil • sweet oil
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