

# H&P

**The Stanford Medical Student Journal**

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## Checking Our Pulse

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## H&P

The Stanford Medical Student Journal

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# Editors' Note

As students, medical school constitutes a unique period in our life. Overwhelmed at first by the information and responsibilities that await us, we slowly find ourselves more comfortable in our new community. What seemed so distant before – the deep, threatening water – begins to feel like a warm pond brimming with opportunities and ideas, where we find ourselves encouraged to flourish, develop, and contribute.

This increased level of comfort is enmeshed with the self-assurance and maturity acquired through training. Consider how novice hands awkwardly gripping new stethoscopes eventually become confident appendages carefully moving around a patient's belly. In this issue, we wish to focus on the experience of making this remarkable transformation. By more closely examining the lives of our fellow students, we hope to underpin the singularity of the journey and revel in the uniting similarities of their uniquely individual experiences.

This quarter's issue, as always, begins with two clinical case reports. The first, written by Yannis Paulus and Dr. Terence Sanger focuses on acute focal neurological deficits in a patient with systemic lupus erythematosus (SLE). In the second, Liz Zambricki takes us through an intriguing workup of newly evolving symptoms in a patient with a history of multiple myeloma.

In this edition we also present two essays in an inaugural section on international health – a section we have created to reflect the school's growing interest in the field and one we hope will continue to attract enthusiastic opinions and stories in the future. In the first piece, Asya Algunik recounts her international health experience abroad by a moving and illustrative tale of a young, sick child and his medical care in Guatemala. In the second, Shane Wong carefully delineates the disparity between health needs and research funding in developing countries as well as the outlook for the situation ahead.

Continuing the perspectives section we introduced last issue, we present opinion pieces by Ryan Schubert and Jeremiah Ray. First, Ryan Schubert takes a closer look at HITECH – the component of the president's stimulus package that seeks to improve healthcare information technology. His informative evaluation of the program is illustrative of future possibilities in this arena. The second piece, by Jeremiah Ray, considers the conflict that physicians have between advocating perfect health and pursuing pleasurable interests that are detrimental to health.

Our features section strives to present unique vistas of the student experience. First, Danica Lomeli marvelously illustrates a Sunday in her life as a student. Then, in a cleverly structured piece, David Craig presents an entertaining perspective about second-year medical students making the transition to their final years. Finally, Andy Chang concludes the section with a descriptive narrative on a rewarding experience with other medical students in rural South Dakota.

Our humanities section this edition features a wonderful photoessay compiled by David Carreon, whose work showcases various candid moments in medical student life. We've also included some moving poetry by Atalie Young and Rachel Sussman, whose poems deal with the unique medical school experience of dissecting cadavers.

Last but not least, this edition concludes with a Leader in Medicine interview, a section in which we strive to highlight the achievements, story, and personal values of a respected figure in our school. This quarter Roberto Valladares interview Dr. Terrence Ketter, a renowned Professor of Psychiatry and expert on bipolar disorder who not only lets us into his personal life, but offers advice on dealing with the stressors of medical school.

Vital signs are deemed "vital" because they are quick but critical measures of a patient's state of health. As medical students, we're not only trained to accurately take vital signs but to crucially weigh their importance in evaluating our patients' health. In this issue we hope to introspectively take the vital signs of our own community – not to gauge our own health but towards a slightly different goal: to try to get a better insight into experiencing the remarkable metamorphosis that somehow transforms an overwhelmed student of medicine into a caring, confident bedside physician.

Sean Sachdev  
Mike Sundberg  
Editors-in-Chief, H&P

*The title H&P reflects the importance of the basic history and physical examination in clinical medicine in every corner of the world. It also represents Hygeia and Panacea, two daughters of Asclepius. In Greek mythology, Hygeia is the goddess of welfare and the prevention of sickness, while Panacea is the goddess of healing and cures. We believe that these figures represent the two facets of our medical education—to treat and cure illnesses while promoting the welfare of our patients by preventing disease. The title H&P also reflects our interest in the metaphors of medicine. What an illness means to a patient may be as important as the diagnosis itself, and a practitioner of the art of medicine attends to each of these meanings.*

# Cerebral Aspergillosis in a Pediatric Case of Systemic Lupus Erythematosus

Yannis M. Paulus, SMS IV, & Terence Sanger, MD, PhD

EL is a 15-year-old right-handed boy with a history of recently diagnosed systemic lupus erythematosus (SLE) with class IV lupus nephritis on Solu-Medrol (methylprednisolone) who presents with a seven-hour history of difficulty speaking. His mother reports that on awakening today at 5:30am she noted that he seemed to talk funny and slur his words. She again noted this at 7:00am and 8:30am. She also noted that when he would drink, fluid would dribble from the side of his mouth. He has a history of general weakness for two months but denies any acute changes. He presents to the emergency department, and a stroke code is called.

Sudden onset of dysarthria immediately leads one to consider stroke. The American Heart Association and American Stroke Association have created a *Stroke Chain of Survival* which emphasizes rapid diagnosis and treatment of stroke to minimize brain injury. Certain centers are known by Emergency Medical Services (EMS) to be stroke centers, which seek to fulfill the following goals of care for rapid assessment and treatment of patients who have potentially suffered a stroke:

1. Immediate general assessment by an expert within 10 minutes of arrival.
2. Neurologic assessment by the stroke team within 25 minutes of arrival.
3. Interpretation of a computed tomography (CT) scan within 45 minutes of arrival.
4. Initiation of fibrinolytic therapy in appropriate patients within one hour of hospital arrival and three hours of symptom onset.
5. Admission time within three hours of arrival.[1]

The immediate care of our patient included the above five goals, along with frequent neurologic checks, aspirin 325 mg by mouth, and permissive hypertension for one week (up to 150mm Hg) to ensure adequate cerebral perfusion.

**Following stroke protocol, EL received a CT, which showed low-attenuation foci consistent with acute cortical infarcts in the left putamen, left caudate head, and the left frontal lobe. Fibrinolytic therapy is deemed inappropriate and further work-up commences.**

EL had been discharged only two days prior to admission. He had been hospitalized for two weeks for a second course of Cytoxan (cyclophosphamide) therapy with 36 hours of bladder washes. One day after his previous admission, he developed emesis and profuse, invasive diarrhea. His stool was negative for *C. difficile* toxin, stool bacterial culture,

stool ova and parasites, stool rotavirus antigen, and stool cryptosporidium. His diarrhea spontaneously resolved without antibiotics. In his previous hospitalization, he also developed a coagulopathy of unclear etiology, pancytopenia, neutropenia with an absolute neutrophil count in the 170s, and severe deconditioning. He receives hemodialysis three times per week and produces 0.5 mL/kg/hr of urine.

EL denies any headache, fever, chills, dyspnea, abdominal pain, nausea, vomiting, numbness, or tingling. Review of systems is otherwise negative. He is in tenth grade and developmentally normal. There is no family history of hematologic or autoimmune disorders. He spent three weeks in China eight months ago and spent most of his time in the cities. His father lives in China and recently visited one month ago. Physical examination is remarkable for bilateral, pretibial pitting edema, moon facies, acne along his cheeks and chest, abdominal striae, no visual field cuts, right facial droop, dysarthria including difficulty with object naming, midline tongue and uvula, right pronator drift, dysidiadokinesia more pronounced on the right, bilateral symmetric decreased muscle tone, and reduced deep tendon reflexes bilaterally.

Of note, EL has a known diagnosis of SLE which holds the title as “the great imitator” along with syphilis due to its possibility of presenting in many different ways. SLE is a syndrome defined by four of 11 criteria for SLE being positive (Table 1).[2] These criteria have been found to have a sensitivity and specificity of 96 percent. Eighty-five percent of SLE patients are female. SLE carries an improved prognosis, with a 10-year survival of 85 percent. The leading cause of death in patients with SLE is now infections of the renal and CNS systems due to opportunistic infections.[3] Lupus can have many effects on the CNS, including causing inflammatory changes through vasculitis and neutrophil aggregation, antibody-mediated changes, and cytokine-induced neurotoxicity.

Initial laboratory studies show a white blood cell count (WBC) of 18.8 with 92 percent neutrophils, hemoglobin 11.2, hematocrit 32.8, platelets 111. A basic metabolic panel is remarkable for a blood urea nitrogen (BUN) of 81 and creatinine of 1.7. Total bilirubin is 0.5, aspartate aminotransferase (AST) 127, alanine aminotransferase (ALT) 188, alkaline phosphatase (AP) 177, and albumin 2.3.

A brain MRI/MRA/MRV without gadolinium reveals

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acute ischemic stroke at the left frontal region. There is evidence of flair abnormalities at the left parietal region, but some areas in the left parietal region are not visualized due to metal artifact from his dental braces. The lesions show an irregular border spanning several vascular territories. EL is given prophylactic amoxicillin and his braces are removed.

A hypercoagulable workup shows an International Normalized Ratio (INR) of 1.0, prothrombin time (PT) 12.7, partial thromboplastin time (PTT) 23.5, fibrinogen 276, d-dimer is elevated at 2752, homocysteine level is elevated, protein-C activity is elevated at 207, and antithrombin III antigen is elevated at 136. Dilute Russell-Viper Venom Test panel was normal at 38.4, and heparin-induced antibody was negative.

At this time, EL is remarkable for the fact that his presentation does not fit a classic disease box. Given his history of SLE, we must continue to keep our differential broad. The findings on imaging are consistent with stroke, and thus the highest etiology on our differential is acute stroke. The etiology of this stroke in his case could be secondary to vasculopathy (hypertension or diabetes), embolic stroke, vasculitis, or cortical vein thrombosis. A hypercoagulable work-up showed some abnormalities, likely a result of the stroke itself rather than a hypercoagulable state causing the stroke. However, he is immunocompromised, given that he is on steroids and receiving dialysis, and thus infectious causes need further investigation. Also, his initial MRI raises a strong suspicion for an infectious process given the irregular border of the lesions and the apparent cavitory lesions without evidence of involvement of a specific vascular territory.

Lumbar puncture (LP) shows WBC 149 with 81 percent neutrophils, 11 percent lymphocytes, and nine percent monocytes. LP also shows eight red blood cells (RBC), glucose 64, and protein 58. Antibiotics and antivirals are started, including ceftriaxone, vancomycin, doxycycline, and acyclovir. A transthoracic echocardiogram is unchanged from previously, showing a mild pericardial effusion consistent with SLE.

Repeat noncontrast MRI without braces shows multiple areas of signal abnormality in the left putamen, the left caudate head and body, the right insular cortex and subinsular white matter (Figure 1). This is thought to represent areas of evolving ischemia and less likely related to vasculitis or atypical infections such as aspergillosis.

The lesion seen on the first scan was limited, but the lesions appeared to have grown in size with this second MRI, so EL underwent fluorodeoxyglucose positron emission tomography (FDG-PET) to see if there was increased glucose uptake in these lesions to determine stroke versus infectious cause. PET showed photopenic regions in the left lentiform nucleus and

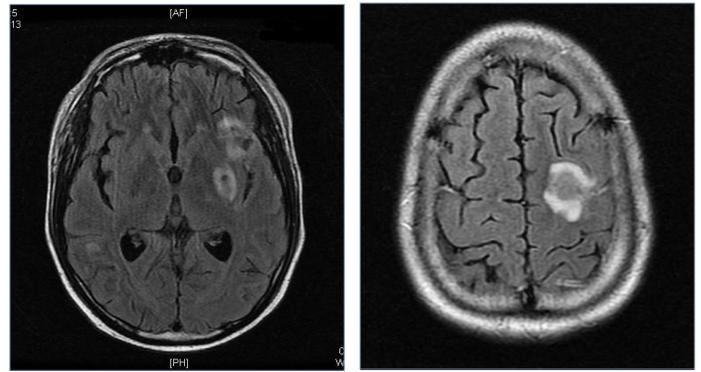


Figure 1: Non-contrast MRI showing multiple areas of signal abnormality in the left putamen, the left caudate head and body, the right insular cortex and subinsular white matter.

left periventricular region consistent with infarct. Increased FDG uptake was seen in the left insula, left frontal lobe, and right posterior temporal lobe corresponding to areas of enhancement on MRI, consistent with either infection or vasculitis.

EL's LP with a neutrophilic WBC count is concerning for meningitis/ meningoencephalitis. His MRI study was limited due to the decision not to inject gadolinium contrast given his renal function. Patients with advanced renal failure (eGFR <15/mL/min/1.73 m<sup>2</sup>) can have a rare complication of nephrogenic systemic fibrosis (NSF).[4] Between 2003 and 2006, the incidence of NSF was 36.5 cases per 100,000 gadolinium-enhanced procedures. After the US Food and Drug Administration (FDA) warning in December 2006 regarding this association, the rate decreased to four cases per 100,000 gadolinium-enhanced procedures. Given this concern for meningoencephalitis, the patient was covered with broad-spectrum antibiotics. Our differential also includes lupus cerebritis.

**Gram stain, culture, HSV, and varicella in the cerebrospinal fluid were all negative along with blood cultures, and infectious disease consult thought this was highly unlikely to be an infection and recommended discontinuing all antibiotics, which was done. However, the patient did not improve clinically. At this point, an MRI with contrast is**

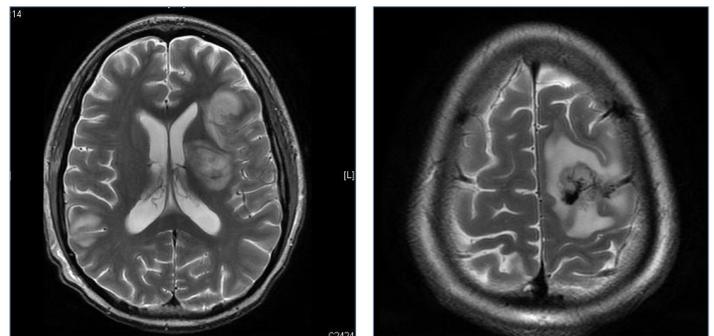


Figure 2: Gadolinium-enhanced MRI showing an increased size and edema with the lesions, including a left posterior frontal lesion with surrounding edema with an enhancing rim and multiple lesions throughout the brain.

performed, which showed an increased size of the lesions and surrounding edema. A left posterior frontal lesion with surrounding edema showed rim enhancement and multiple lesions throughout the brain suggested a miliary process and an infectious cause, such as fungal infection, or neoplasia (Figure 2).

The patient is restarted on broad spectrum antibiotics, voriconazole, ambisome, and caspofungin, and neurosurgery was consulted for biopsy of the specimen. EL underwent a left frontal image-guided bur hole and evacuation, drainage, and subtotal resection of a region involving the left posterior frontal lobe. Gross pus was noted intraoperatively. Biopsy (Figure 3) showed non-specific reactive changes with focal neutrophilic

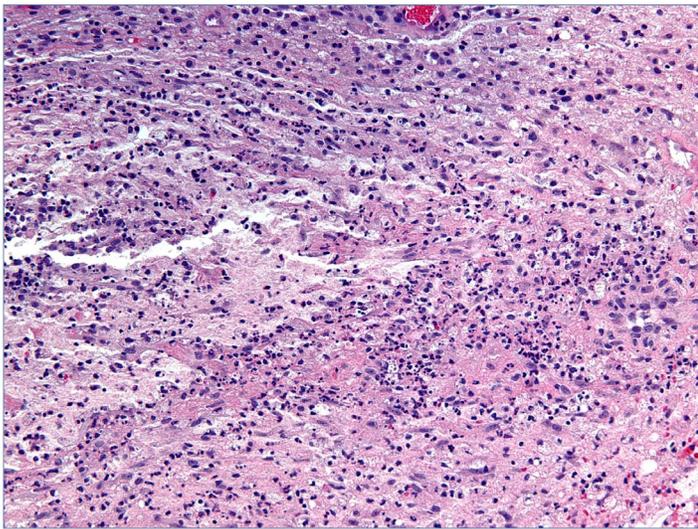


Figure 3: Brain biopsy stained with Hematoxylin and Eosin (H&E) stain (20x) showing non-specific reactive changes with focal neutrophilic microabscesses and scattered perivascular neutrophils, plasma cells, and macrophages on a background of reactive gliosis.

microabscesses and scattered perivascular neutrophils, plasma cells, and macrophages in a background of reactive gliosis. Fite and Gram stains did not show mycobacterial or bacterial organisms. GMS stains showed clusters of fungal hyphae branching at acute angles (Figure 4). This is consistent with fungal cultures of the specimen, which was positive for *Aspergillus fumigatus*.

A work-up for additional abscesses commenced. Right eye fundus examination showed a solitary, quarter-disc diameter, irregular, white lesion superotemporally without evidence of vitritis, likely representing cotton wool spots and/or possible aspergillosis. MRI of the abdomen shows no evidence of abdominal abscesses. CT of the chest, abdomen, and pelvis shows a cavitory lesion in the right lower lung (Figure 5) and spine MRI showed a focal high signal in the cervical spinal cord at the C6 level.

Two weeks into his hospitalization, a rapid response team

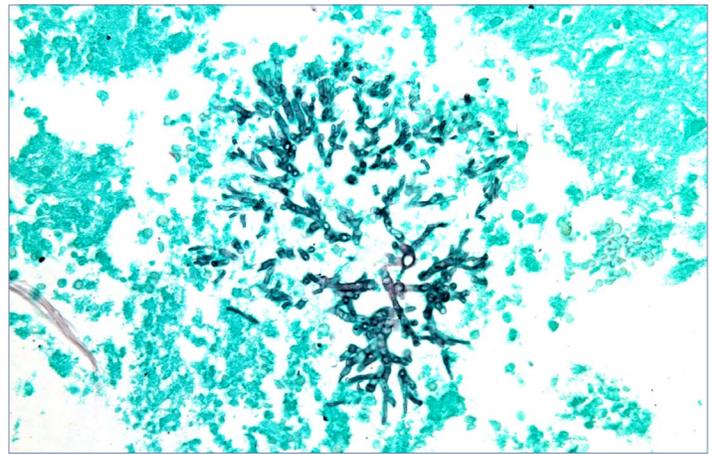


Figure 4: Brain biopsy stained with Gomori methenamine silver (GMS) stain (40x) showing clusters of fungal hyphae branching at acute angles.

was called since EL was having seizures. CT scan shows a massive left intracranial hemorrhage (8.1 by 5.4 cm) with midline shift and uncal herniation. Two physicians noted EL to have pupils of 5.0mm that were fixed and non-reactive to light, doll's eyes, no corneal reflex, no cold calorics, no cough or gag, and no withdrawal to pain. Apnea test showed an initial arterial blood gas of 7.45/42/364 that after six minutes showed 7.26/71.1/175 with no spontaneous breaths. EL was noted to have brain death with no residual brainstem reflexes, the family was informed, and the decision was made to withdraw ventilatory support.

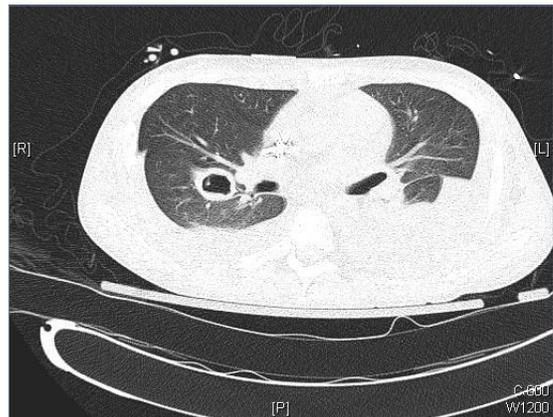


Figure 5: CT of the chest showing a cavitory lesion in the right lower lung.

## Commentary

Fungal meningoencephalitis is typically encountered in immunocompromised patients. The brain is usually involved late in the disease progression after widespread hematogenous dissemination. Typical fungal organisms include *Candida albicans*, *Mucor*, *Aspergillus*, *Cryptococcus*, *Histoplasma*, *Coccidioides*, and *Blastomyces*. Invasive aspergillosis typically precedes meningoencephalitis, with vascular invasion, thrombosis, and ischemic or hemorrhagic infarction

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that becomes septic from ingrowth of the fungus.

Invasive aspergillosis is a major cause of death in immunocompromised populations. A recent large study of immunocompromised post-transplant pediatric patients found that up to five percent of infections were due to aspergillus.[5] A study of 595 patients with invasive aspergillosis found 55 percent of patients presented with pulmonary disease, 20 percent with multisystem disease, 5 percent each with skin, paranasal sinus, or CNS infections, and 10 percent with another infection.[6]

The prognosis for patients with invasive aspergillosis is grim. Severely immunosuppressed patients were shown to have a complete or partial response in only 28 percent of cases. Patients with less severe immunosuppression had a response of 51 percent.[6] The prognosis is particularly grim with cerebral aspergillosis, in which the mortality rate is 65-90 percent.[7]

SLE is a rare underlying etiology leading to invasive aspergillosis. In a study of 595 patients with invasive aspergillosis at a large academic medical center, 32 percent of patients were status-post bone marrow transplant, 29 percent had a hematologic disease, 9 percent had solid organ transplant, 8 percent had AIDS, and 9 percent had other pulmonary diseases.[7]

This case is particularly atypical in that all blood fungal cultures were negative. Likely aspergillus foci were also noted in the spinal cord at the C6 level, the right eye, and the right lower lung. At least 31 cases have been reported of SLE leading to aspergillosis,[8,9] and these cases are predominantly of pulmonary aspergillosis[8] and invasive aspergillosis.[10]

Classically, invasive aspergillosis was treated with amphotericin B, but a recent study showed that voriconazole as initial therapy led to improved survival and fewer side effects and thus became first line therapy.[11] In this case, voriconazole would also be favored due to its cerebral

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penetration. Combination therapy with voriconazole and caspofungin was further shown to improve three-month survival versus voriconazole therapy alone.[12]

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The authors would like to thank Jason Karamchandani, MD, in Pathology for providing the pictures of EL's brain biopsy.

## Table 1: Criteria for the classification of SLE

1. Malar rash
2. Discoid rash
3. Photosensitivity
4. Oral ulcers
5. Arthritis
6. Serositis
  - a. Pleuritis OR
  - b. Pericarditis
7. Renal disease
  - a.  $>0.5$  g/d proteinuria OR
  - b.  $\geq 3+$  dipstick proteinuria OR
- c. Cellular casts
8. Neurologic disease (without drug or metabolic etiology)
  - a. Seizures OR
  - b. Psychosis
9. Hematologic disorders
  - a. Hemolytic anemia OR
  - b. Leukopenia ( $< 4,000/mL$ ) on 2+ occasions OR
  - c. Lymphopenia ( $< 1,500/mL$ ) on 2 or more occasions OR
  - d. Thrombocytopenia ( $< 100,000/mL$ )
10. Immunologic abnormalities
  - a. Positive LE cell preparation OR
  - b. Antibody to naïve DNA OR
  - c. Antibody to Sm OR
  - d. False-positive serologic test for syphilis
11. Positive antinuclear antibody (ANA)

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# A Case of Multiple Myeloma and Associated Acute Renal Failure

Elizabeth Zambricki, SMS IV

**LR is a 55-year-old man with a past medical history significant for light-chain multiple myeloma, chronic renal insufficiency, and hypertension, who presented to his cancer clinic with a two-week history of slight hematuria, dysuria, and decreased strength of urinary flow following the initiation of a course of Revlimid (lenalidomide) for his multiple myeloma. Over the past 24 hours, his hematuria has increased, and his urine is now bright red.**

Multiple myeloma is a hematologic cancer characterized by the proliferation of a single clone of plasma cells producing a monoclonal immunoglobulin. This plasma cell clone proliferates in the bone marrow resulting in extensive skeletal destruction with osteolytic lesions, osteopenia, and pathologic fractures. Other common findings include anemia, hypercalcemia, and chronic renal insufficiency. The cause of multiple myeloma is unknown. However, exposure to radiation, organic solvents, and insecticides may play a role.

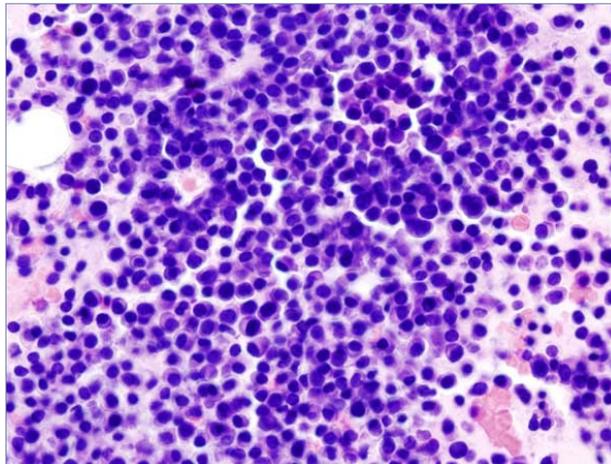
Multiple myeloma accounts for approximately one percent of all malignant diseases and approximately 10 percent of hematologic malignancies in the United States. It occurs in all races and geographic locations, and is slightly more frequent in men than in women. The disease is twice as frequent in the African-American population as compared to Caucasians and the median age of diagnosis is 66 years (with a range of 20 to 92 years).

Patients often present with bone pain, typically in the back or chest and less frequently in the extremities. Movement usually induces the pain and the patient's height may be reduced secondary to vertebral collapse. On physical exam, patients are frequently pallid secondary to their anemia, but palpable hepatomegaly, splenomegaly, and lymphadenopathy are uncommon. Spinal cord compression occurs in approximately five percent of patients and should be suspected in those presenting with severe back pain, weakness, paresthesias, or bladder or bowel incontinence. Bone resorption in multiple myeloma is accelerated due to production of various cytokines leading to stimulation of osteoclastic activity as well as inhibition of osteoblastic activity. This increased bone resorption leads to the characteristic punched-out lytic lesions

stereotypical of patients with multiple myeloma.

**LR was diagnosed with multiple myeloma approximately three years prior when the patient acutely lost his ability to walk. While in the emergency department, a pathologic fracture of his T1 vertebral body was discovered and further studies yielded a diagnosis of multiple myeloma. Over the last several years, the patient has been experiencing chronic renal failure with a baseline creatinine of 4.0.**

Renal disease is a common co-morbidity of multiple myeloma. There is a general correlation between the presence and severity of renal disease and a patient's survival. Interestingly, response of the renal disease to therapy also seems to have prognostic value. Chronic renal involvement in multiple myeloma is typically the result of monoclonal immunoglobulin light chain deposits and can affect the glomerulus, tubules, or interstitium of the kidney. Myeloma cast nephropathy occurs with buildup of light chain proteins in the renal tubule and is the most common diagnosis of multiple myeloma patients with renal dysfunction. Light chain deposition in the glomerulus should be suspected in patients with significant proteinuria. Acute renal failure can also occur in the multiple myeloma patient and may be due to volume depletion, hypercalcemia, and commonly, nephrotoxic drugs.



Multiple Myeloma, Public Domain

**While at the cancer clinic for his hematuria, it is found that LR's baseline creatinine of 4.0 has increased acutely to 8.2. Additionally, moderate eosinophils are found on his urine analysis. Acute interstitial nephritis, potentially caused by his Revlimid therapy course, is thought to be the most likely culprit.**

Acute interstitial nephritis (AIN) is characterized by the abrupt onset of renal dysfunction, but can otherwise be extremely heterogeneous in its presentation, laboratory findings, and outcome. AIN is caused by an inflammatory cell infiltrate within the kidney interstitium and tubules, while sparing the glomeruli and blood vessels. The classic clinical signs/findings of AIN include a triad of rash, fever, and eosinophilia, however this complete triad only occurs in five percent of all cases. Eosinophiluria is 67 percent sensitive and 83 percent specific for AIN, and AIN should be included on the differ-

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ential of all patients who present with eosinophiluria. The most common cause of AIN is drug-induced disease (over 70 percent of cases), and there are a vast range of culprit drugs, including antibiotics, non-steroidal anti-inflammatory drugs (NSAIDs), diuretics, and others. AIN can also be caused by infection (bacterial, viral, mycoplasma), immune mediated disease (systemic lupus erythematosus, sarcoidosis), glomerular disease, or may be idiopathic. Although Revlimid is not known to cause AIN, LR's symptoms and time course make this drug strongly suspect as the cause of his acute renal decline. Treatment of AIN is supportive therapy including discontinuation of the drug or treatment of the underlying infection. Corticosteroids have also been used to reverse the renal damage caused by AIN, however, there have been no prospective, randomized trials on their efficacy.

**The patient also notes that he has been experiencing increased fatigue for approximately the past week. He states that he was previously able to walk approximately two miles before tiring, he now can only walk a few blocks before becoming winded.**

While there are many potential etiologies of LR's increasing fatigue, the most likely cause of this relatively abrupt onset of fatigue is uremia. Uremia is a term that is used loosely to describe the buildup of waste products, including nitrogenous waste. The presenting symptoms of uremia are generally quite non-specific and usually include fatigue, lethargy, and anorexia. Currently, the only true treatment of uremia is replacing kidney function, either by renal transplant or by dialysis. While dialysis can slow the course of declining kidney function, the five-year survival rate for patients on dialysis in 1999 was still under 35 percent and quality of life is often considered to be low.

**LR was started on a course of corticosteroids. However, his renal function did not improve while on a two-week course of prednisone. Ultimately, he started dialysis, a fate that he believed truly marked his ultimate decline. He was discharged, and returned to his home in Sacramento to continue treatment for his underlying multiple myeloma as well as hemodialysis.**

### Commentary

Renal failure can occur either acutely or chronically. Acute renal failure (ARF) is defined as an increase of creatinine  $\geq 0.5$  mg/dl in less than two weeks. More generally, ARF is considered the abrupt loss of kidney function resulting in retention of urea and nitrogenous waste products along with dysregulation of extracellular volume and electrolytes. ARF can be classified in three broad categories: pre-renal, intrinsic renal, and post-renal diseases.

Pre-renal disease arises from suboptimal renal perfusion. Several etiologies are responsible, including a decrease in effective arterial volume, local renal vasoconstriction, or direct vessel insult. A decrease in effective arterial volume is caused by systemic hypovolemia, decreased cardiac contractility, or systemic vasodilation. Importantly, drugs can be a cause of renal vasoconstriction leading to pre-renal failure. NSAIDs, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, and calcineurin inhibitors are some of the major culprits that either constrict the afferent renal arterioles or dilate the efferent arterioles, leading to decreased glomerular filtration capacity. Thrombosis or embolism to the renal vessels can also directly preclude renal perfusion. There are several methods that can be used to determine if the renal failure is indeed due to a pre-renal cause. Observing hyaline casts in the urine or a blood urea nitrogen to creatinine ratio of  $>20$  is suggestive of a pre-renal etiology. However, a FENA of  $<1.0$  percent proves that the kidney is desperately attempting to retain sodium in order to retain water and fix the underlying cause of the renal hypoperfusion. If a patient is taking a diuretic, a FEUrea (analysis of the percent urea excreted) must replace the FENA.

Intrinsic renal failure is equally complex and can be caused by numerous etiologies as well. Major categories of intrinsic renal failure include acute tubular necrosis (ATN), AIN, small-vessel disease, and glomerulonephritis. The hallmark feature of ATN is "muddy-brown" casts in the urine and can be caused by a variety of factors including progression of pre-renal disease, drugs (aminoglycoside antibiotics, amphotericin, cisplatin), or elevated levels of myoglobin, hemoglobin, or immunoglobulin light chains. One of the most common causes of ATN is contrast given prior to radiographic imaging. Therefore several precautions are taken prior to radiocontrast studies to ensure adequate hydration and dilution of contrast. AIN is a rare cause of intrinsic renal failure and was discussed above. Small vessel intrinsic nephropathy can be caused by cholesterol emboli or thrombotic microangiopathy.

Post-renal failure is defined as a blockage of the urinary tract distal to the kidneys and can be the result of prostatic hypertrophy or cancer, neurogenic bladder, or direct physical blockage of the ureters or urethra. In the event that a post-renal etiology of renal failure is suspected, ultrasound of the kidneys and bladder should be ordered to assess hydronephrosis or hydroureter.

Acute renal disease is complex, yet diagnostically manageable and in many cases potentially reversible. Therefore, prompt follow-up studies and attempts to treat the underlying cause of the renal failure should be pursued shortly after the diagnosis is made.

# Challenges to Standards of Care in Low-Resource Health Settings

Asya Agulnik, SMS IV

My research team had already visited fifteen families to weigh children and administer our questionnaire on the day I first met Eric David. The meeting didn't come without warning. Earlier that day, with another family in the village, a grandmother told us in a whisper that a month ago her daughter-in-law had committed suicide. There was a child who was left behind. It was a tragedy, she said. We only learned the full story later on.

From a distance, his house looked just like the other brick houses with tin roofs built by the Mayan families in this community. This house, in fact, was in a great location – across from the local health promoter's home, which doubled as a convenience store, and close to the main road. Even the family – grandparents, aunts, and cousins – did not seem out of the ordinary. There was poverty, sure, but that was the norm. And so we expected to go through our regular routine: one health promoter would weigh the baby while I would interview the mother, with help translating into Katchiquel, recording answers on our questionnaire. The child would

have second-degree malnutrition by the World Health Organization standards. I would give the family some vitamins while a health promoter would explain the level of malnutrition and what the family could do to help. Maybe the child would have diarrhea and we would dig medicine out of our backpacks, or arrange to follow-up in a few days.

But Eric David was different. From the beginning, we could tell there was a problem. He was fussy and lethargic with pale, dry skin. He had eyes crusted with bright-yellow discharge, his belly swollen from parasites and malnutrition. When I listened to his lungs, there was the see-saw of pneumonia calling back at me. Finally, when we weighed him, we couldn't believe he was twenty months old – his weight was that of a normal twelve-month-old. His grandparents were worried – Eric David wouldn't eat and he seemed sicker than the other children. It was only when we asked about his mother that the reasons for his illness became clear.

Eric David's parents once lived together, but a year ago his father abandoned the family to work in America. His mother, left with an infant and no source of income, moved to live with her parents. She was young and soon met another man in the village. They decided to get married. Everything was working until after the marriage, when the new husband forbade Eric David from moving with his mother to his new home. The mother, distraught and confused about what to do, swallowed insecticide. For a while, she was



Asya Agulnik

## international health

sick. Her family tried everything, including taking her to the local hospital, but they had no money and were turned away. Eventually, she passed away, leaving Eric David alone. Still breastfeeding at the time of his mother's death, Eric David refused formula or solid food. He became progressively malnourished and difficult to console. This is how we found him – with conjunctivitis, scabies, intestinal parasites, pneumonia and worse malnutrition than we had ever seen.

Just as the realization of the urgency of this child's condition was sinking in, Vicente, the head health promoter, asked me what we should do. As a medical student and outsider to this community, I didn't feel prepared to answer. I threw the question back at him – what do you think we should do? Vicente said the thing we were all thinking; he said he thought the boy was very sick. Everyone was silent.

In a way, the answer to Vicente's question was simple. If we were in America, I would admit Eric David to the hospital, give him IV fluids, antibiotics and anti-parasitics. The reality of our immediate management of Eric David in rural Guatemala was only slightly different. Nearby there was a temporary clinic of visiting doctors with all the medicines needed for his treatment. Although he could not be admitted to the local hospital, having a health promoter living next door was the next best thing. So I took Eric David and his youngest aunt to the nearest consulta staffed by an internal medicine doctor from Wisconsin, paying their pick-up fair, skipping the long line of patients waiting to be seen and translating, impatiently, the history I already knew by heart. As an insider to the American medical system transplanted to Highland Guatemala, I was able to force this intervention, moving Eric David outside the rules of his community and into mine. He did not need to travel miles with his family to seek care, or wait in line for hours. Here, among the US physicians, my anxiety was instantly heard; people moved quickly and medicine was administered. Eric David, unwillingly, took his first dose of antibiotics. His aunt smiled and I began to relax.

It was only in the pick-up truck on the way back to his village that I began to question my own quick assumption of the correct answer to Vicente's question. Undoubtedly, I acted as my gut and my heart instructed me – in the most primitive sense, I wanted to save Eric David. And I did so by using my membership in the American medical system I trusted. In fear, I ran where I knew I could get help. But what if my team wasn't in the village that day? And what of the thousand Eric David's in other rural villages all across Latin America who don't have my resources and connections to push them through the health care system? How would I answer Vicente's question if I myself wasn't there; if it were just the promoters and the local hospitals and the family itself as it has been in the past and will be in years to come.

I have told this story dozens of times to the travelers and volunteers I have met during my time in Guatemala. I feel compelled to do this not because of its tragedy, or unfairness, or success – Eric David, after all, is still alive, healthy, and growing one-and-a-half years after our first meeting. It is particularly because this situation is so common in resource-poor regions, and so impossible, that I find myself repeating – what was the right thing to do? This question became more poignant as I encountered other cases. I remember a girl with Down's syndrome and a heart defect who in America would have had surgery and lived a normal, happy life. Instead, in rural Guatemala, she passed away for lack of the same treatment. In theory, it would have been possible to send her to the capital, or even to the US, for therapy. And yet, there are thousands of children who could be vaccinated or fed on the money it would take to accomplish this intervention. What is the right thing to do?

I still don't know if my intervention with Eric David was the right answer for Vicente. I know that I acted on my own morals, my own strong belief as a future pediatrician that it is a great injustice when a child dies from a disease that can be easily prevented elsewhere. But in a country where children die every day for lack of food, housing, and water, I am not convinced that my American morals hold firm ground. It is possible to imagine that Eric David, his aunts, grandparents, and community would have been better served if I had encouraged them to trust their own medical system, their own rules of life and death, rather than mine.

I have learned from speaking to others with more experience working in resource-poor settings that these questions are universally challenging. For me, the mere existence of this moral ambiguity is reassuring. In the American medical community, we have long since moved away from the patriarchal system of practicing medicine, and those in the international health community have as well. The Western doctor no longer dictates what the "correct" method of medical care is in developing nations – successful programs have created local networks and infrastructure that respond to the goals and desires of the communities they serve. Persistently, we emphasize sustainability and independence from outside aide. Yet even at our best, we harbor our foreign ideals of justice and standards of care, ideals that frequently conflict with the foundation of our work abroad. We may have to challenge our traditional ideals in order to achieve lasting progress in low-resource healthcare.

# Home-Grown Health Research Bridging the 10/90 Gap

Shane Shucheng Wong, SMS I

In 1990, it was estimated that over 90 percent of the world's burden of preventable death occurred in developing countries, but only ten percent of health research resources were applied to them. Since then, the term 10/90 gap has become widely used to capture this major imbalance between the size of disease burden and the resources devoted to addressing it. However, in recent years, the landscape of global health research has evolved in very significant ways to begin bridging the gap. Global expenditure on health research applied to developing country problems has more than quadrupled to over \$125 billion. Many more actors are now engaged in funding and conducting health research relevant to the needs of developing countries. Most importantly, there has been a rapid growth of local research and innovation capacity in developing countries directed towards their own health needs.



Meera Sridhar

One strong incentive for developing countries to boost health research is the growing awareness of health research as a potential development tool. Even conservative estimates suggest that health investments often yield the highest rates of return compared to other public investments. For example, every dollar invested toward combating smallpox, polio, onchocerciasis and malaria has been estimated to reach more than \$10 in the rate of return. The 1993 “Investing in Health” report from the World Bank – often cited as a profound influence by Bill Gates – made the case that increasing funding for battling diseases in poor countries would not only reduce the burden of disease but also dramatically improve the economies of poor nations. In response, developing countries such as Brazil, Cuba, India and Mexico are now spending over two percent of health care dollars on health research, a significant increase from a decade ago.

India has already approved an ambitious \$1.6 billion National Biotechnology Development strategy, which emphasizes the utilization of novel technology platforms to build a strong foundation for discovery and innovation. In parallel, the renowned Indian Institute of Technology recently established a new School of Bioscience and Bioengineering. Likewise,

Mozambique has invested its limited resources towards developing a Ministry of Higher Education, Science, and Technology, which has as one of its tasks the promotion of collaboration with external research partners. Improving the contribution of national science, technology, and innovation sectors, including health and traditional medicine,

is also a national priority in China's current and previous five-year plans.

One change in recent years that has supported the growth of local health research infrastructure has been successful efforts in bridging the knowledge and digital divide, which had previously cut off large sections of the globe from research progress. Free access to the most current information is critical for conducting research. Yet, many countries simply cannot afford institutional subscriptions to scientific journals, let alone personal subscriptions by aspiring scientists. Recognizing these deficiencies and the importance of rapid and steady flow of information, WHO took the initiative to provide electronic access to biomedical journals for qualifying countries. It is now easier for developing countries to establish electronic access to libraries at lower costs. Similarly, other notable journals, such as the Lancet, BMJ and the PLoS journals, have enabled developing countries to access their journals electronically at no cost.

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With increased funding and access to information, both India and China are home to a growing research-based health biotechnology sector. Local health needs, including diseases that predominantly affect the poor, have driven much of this success. Discoveries are now being translated into innovative health products predominantly for the poor. In India, a recent collaboration between local researchers in Delhi and the Malaria Vaccine Initiative helped identify a candidate vaccine for *Plasmodium vivax*, the main type of malaria in the region. The research was partly funded by the Gates Foundation through the Program for Appropriate Technology in Health. Now, the translation of research to development of the *Plasmodium vivax* vaccine is relying on a local company, the Bharat Biotech International of Hyderabad, India. Similarly, the Shantha Biotechnics (Hyderabad) developed a cost-effective manufacturing process for a hepatitis B vaccine (Shanvac-B), India's first indigenously developed recombinant DNA product, driving down the price from \$15 per dose for the imported product to \$0.50, and is now supplying about 30 percent of UNICEF's global requirement for hepatitis B vaccine. In China, the Shanghai United Cell Biotech developed the only tablet formulation

of a cholera vaccine. The Serum Institute of India (Pune), through its 138-country global distribution network and relationships with United Nations Children's Fund (UNICEF) and Pan American Health Organization (PAHO), provides one of every two doses of vaccine given worldwide. In addition, drug manufacturers in China and India – specifically, Cipla, Ranbaxy, and Hetero – are well known in the global health community for manufacturing and selling low-cost antimalarial and antiretroviral therapies in Africa.

The emergence of local health research infrastructure, in the form of innovation-based biotechnology industries and government research programs, will continue to play an increasingly important role in addressing global health needs. While burgeoning success stories in building local health research programs and translating discoveries are highly promising, there remains a demonstrated need for further increasing health research targeted toward resource-strapped developing countries. While the 10/90 gap may no longer accurately represent the current landscape of global health research, it remains a symbol of the continuing mismatch between global health needs and research investment.



Meera Sridhar

# The Impact of HITECH: Designing a Creative Health Information Technology System

Ryan Schubert, SMS I

“LOWER HEALTHCARE COSTS: TO SAVE NOT ONLY JOBS, BUT MONEY AND LIVES, WE WILL UPDATE AND COMPUTERIZE OUR HEALTH CARE SYSTEM TO CUT RED TAPE, PREVENT MEDICAL MISTAKES, AND HELP REDUCE HEALTH CARE COSTS BY BILLIONS OF DOLLARS EACH YEAR. \$2 BILLION IN THIS BILL, AND \$20 BILLION OVERALL, FOR HEALTH INFORMATION TECHNOLOGY TO PREVENT MEDICAL MISTAKES, PROVIDE HEALTH CARE TO PATIENTS AND INTRODUCE COST-SAVING EFFICIENCIES.”

-TEXT OF THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009

## What is HITECH?

The American Recovery and Reinvestment Act (ARRA) of 2009, known popularly as the stimulus package, has been portrayed as vastly expensive and broadly expansive. The portion of the ARRA detailing the Health Information Technology for Economic and Clinical Health Act, or HITECH act for short, is a revolutionary piece of health care legislation. The HITECH act details how \$19 billion dollars will be allocated for the creation, development, implementation, and management of a health information technology (HIT) system that supports electronic health records (EHRs) in medical care facilities throughout the country. The goals of HITECH are to improve health care delivery, reduce costs by increasing efficiency, establish a framework for better assessing health care quality, and support innovation in health care. The law begins by expanding the resources and authority of the Office of the National Coordinator of Health Information Technology (ONCHIT) at the Department of Human Health and Services. The National Coordinator will have several responsibilities, chief among them being the establishment of a nationwide health information system. The law also describes two statutory advisory committees that will provide guidance to ONCHIT, and the number of politicians, health care experts, software developers, industry leaders and labor workers that will advise it. Additionally, HITECH establishes the HIT Standards Committee for the purpose of recommending to the coordinator standards,

implementation specifications, and certification criteria to be adopted by the coordinator no later than December 31st, 2009.

The law directs that an HIT system be designed based on considerations of interface, voice-recognition ability, interoperability among systems, software dependability, measurements of the impact of HIT on quality and productivity, health information management, health information security and integrity, and on ability to reduce medical errors. Those wishing to help develop the system can apply for funding



President Barack Obama signs the ARRA on February 17, 2009.  
Source: U.S. Federal Government, Public Domain

in the form of grants from the agency. Other details include grants for establishment of loan programs designed to facilitate widespread adoption of certified EHR technology, grants for institutions of higher learning that seek to train health information technology professionals, and grants for medical schools that integrate HIT into their curricula. Finally, the law finishes with a slew of provisions on privacy and regulation that appear directed against those who would try to hack or defraud the system.

## Financial Incentives for Physicians

For physicians, the most important part of the act will likely be the \$17 billion dollars allocated as financial incentives for the adoption and ‘meaningful use’ of ‘certified EHRs’. For individual physicians, this could mean collecting upwards of \$44,000 for the “meaningful use” of certified EHRs over a period of five years starting in 2011. This is slightly more than the estimated cost of installing and implementing an EHR system in a small practice. Participating hospitals will receive a one-time grant of \$2 million for the same undertaking, and a four-year financial add-on to Medicare diagnosis-related group (DRG) fees. For any hospitals or practices seeing a high volume of Medicaid patients, the incentives are proportionally larger. The bill also threatens penalties for those who do not adopt an EHR system by 2015 in the form of a 1%, 2%, then 3% reduction in Medicare payments each year through 2017.

## Designing a New Health Care System

The HITECH act is ambitious, but it leaves one wondering—what should a national electronic health system look like? The bill provides some guidance here, but to answer this question, it might be illustrative to think about other large successful software innovations.

The iPhone is one such example. During a typical medical school lecture, many students will occasionally peer down at little computer screens to check e-mails or view the most recent headlines from the New York Times. Whether or not this tendency leads to inattention during key learning hours is debatable but the inescapable conclusion from such observations is that many students have iPhones and use their features with convenience. The iPhone is a testament to the genius of the platform model of interoperable and substitutable system components.

The iPhone platform has an openly published interface, allowing software developers the ability to create applications and offer them to users through a delivery medium like iTunes. This interoperability has allowed for the development of thousands of applications that are now easily accessible to users. The platform also puts the power in the user’s hand to precisely control the content received - because the programs are substitutable, meaning a user can pick a program, then later delete it or swap it for something else if unsatisfied. The system also has a built-in feedback mechanism, allowing users to rate and comment on whether or not they liked a particular application and why.

Software implementation like with the iPhone, Facebook, Google, and Mozilla are all successful models for how to design efficient, easy-to-use software that is both popular

and useful. Certified EHR platforms should be similar. For example, a single platform might be set up as a foundation upon which software developers could design content for sale or free distribution to all users of the platform. Applications could be designed to give physicians the ability to quickly and easily access the most up-to-date medical information. Another application might allow a physician to compare such information with national or statewide trends while another might enable a physician to review ongoing clinical trials and decide whether some of his or her patients



Personal medical records are still largely paper-based.  
Source: U.S. Federal Government, Public Domain

might be eligible. Applications that perform these functions are already available for download on the iPhone, so an EHR platform ought to offer the same.

Thinking globally, a program that allows health care providers to integrate their medical records with patients via text messaging makes a lot of sense in developing countries where cell phones offer a simple and widespread means of doctor-patient communication. This is the premise of FrontlineSMS, a software program being developed by medical students here at Stanford for use by Non-Governmental Organizations abroad as they seek to improve communication between health care providers in clinics and patients in rural communities where access to services often presents a significant barrier to adequate health care for devastating infectious diseases.

A health care system designed on a platform that can be further enhanced by software developers offering both interoperable and substitutable programs would be exciting and revolutionary. The HITECH act is a significant downpayment towards such a system, and offers a tremendous opportunity for the health care system to reduce costs, improve quality, and enhance the doctor-patient relationship. Now is the time for research and development in this arena, and for students at an institution like Stanford, there will be plenty of opportunities for involvement.

# Miserably Healthy

*Jeremiah W. Ray, SMS III*

For every benefit one seeks in life there are associated risks. Falling in love exposes one to possible heartbreak and disruption of monoamine cascades resulting in depression. Enjoying a nightly glass of a favorite cabernet exposes one to possible cirrhosis from cytochrome P450 enzymatic depletion, resulting in hepatotoxic accessory pathway utilization. The flight to a Hawaiian vacation exposes one to deep venous thrombosis and solar irradiation, and that's if the plane does not crash on the way there.

Although we tend towards perfectionism, the modern physician does not advise against all activities with inborn risks. He/she stratifies behaviors, identifies those with suspected or known high risks and educates accordingly. It is a unique quality of humans to pursue high-risk situations for a high endocrine response, consequently resulting in pleasure. Animals do not cliff dive for sport. It does not serve a Darwinian purpose. Humans are a curiosity in this aspect. We gleefully exert energy in fields not related to continuing our gene line—in fact potentially halting it.

Continue this line of thinking to a less severe, more tangible arena, one physicians are increasingly drawn in to educate patients about: food. Imagine the most biologically purposeful, physiologically beneficial diet. Imagine the diet that does nothing but optimize cellular respiration. Deduct all

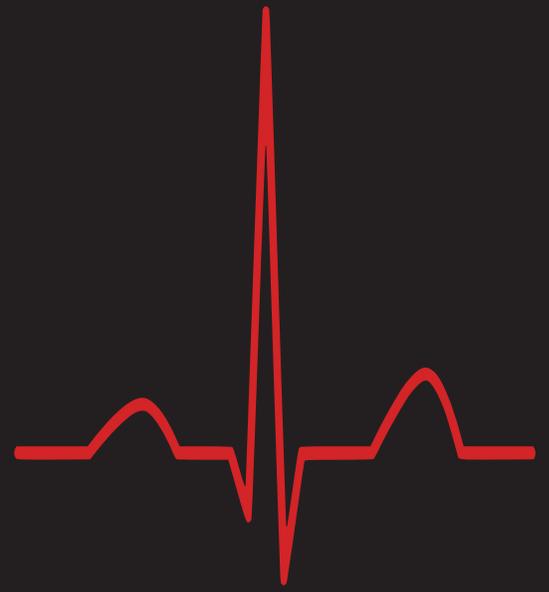
aspects that do not directly and exclusively benefit metabolism: sushi dipped in soy sauce, all barbequed foods, beer, wine, cake and ice cream, to name a few. This diet is perfectly balanced, bursting with fiber and includes all essential cofactors for metabolism. The consumer of said diet would have decreased colon cancer, heart disease, breast cancer, orthopedic injuries – the list is extensive. However, if I had a biologically perfect diet, I would go mad. Across every culture, aside from strict asceticism, dietary indulgences provide daily pleasures and are the true centerpieces of all major holidays.

The key to healthful happiness is balance. We strike a compromise between our non-Darwinian pleasure-driven, human emotions and our Darwinian driven, animalistic understanding that we want to live. Every person has his or her fulcrum in a different location. They have different pleasures applying various pressures to their scales. I find this a beautiful aspect of our human condition. The ceaseless diversity in our axonal architecture yields some who love soccer and others who love bridge. Some love Philly cheese steaks. Some love tattoos. As humans, particularly as physicians, we must remember that each individual has their own balance of risks and pleasures on their own scale of life. Who are we to judge?



Richard Gaster

*H&P Winter 2009*



**Features**

# Sunday Morning

Danica Lomeli, SMS I

I don't set the alarm on Sunday mornings. The sunlight slants through the eastern windows, waking me at first tenderly and then abruptly. Defiant, I screw my eyes shut and curl into Ben, breathing slowly and straining to slip back into my dream. When I can't shut the daylight out any longer, I stretch, dress and fix the oatmeal -- hot and milky and spiced with cardamom. We pile brown sugar into our bowls, and I flip lazily through my mom's splattered cookbooks. Ben offers me a sip of his coffee, and I take it, even though we both know I can't stand the bitterness.

Done eating, I rise to collect my notes. No matter what I do, my morning ritual takes twenty minutes. Should I study immunology today, or neuro? What about the upcoming anatomy walkabout? And I'm getting behind on HHD.

I feel the panic rising and pause to calm myself. I reason that I shouldn't pack all my notes, since they only overwhelm me. I decide to bring my pathogen chart and immuno notes. The rest can wait. I throw some carrot sticks in my bag, along with a mango yogurt and a tupperware filled with cold stirfry. I return to the bedroom and pack my running shorts and a change of clothes. By the time I'm ready to go, I'm loaded down with a backpack and two side bags. Ben jokes he's dating a bag lady, and I say he likes it.

Once we step outside, the crisp February air hurries us to the car. As Ben warms up the engine, I admire the

winter greenness of Woodside. Delicate clover, bowed under the morning dew, rings our little cottage. An herb garden would be nice, if I could only find the time to plant it. Ben pulls out of the driveway, and I curl my toes on the dashboard. Sunday cyclists buzz past, blurs of white polycarbonate and red spandex. We drive a few miles down Alameda until Ben pulls into a parking space behind Trader Joe's.

We grab our old canvas bags and join the crowd of families and dogs at the farmers' market. He pecks my cheek and strides off to haggle with the mushroom farmer. I stop at the first stall and greet Sylvia, a matronly vendor whose hair falls in precise silver curls. I sift through the small irregularly shaped apples, testing their cool brown skin

beneath my fingers and admiring the rare blushes of pale pink. These apples look nothing like Safeway's shiny red pyramids, but they taste like crisp honey. Sylvia chuckles at me for buying ten pounds, but she admits that apple season will end in two weeks and I should eat them while I can. As I count out eight dollars, I ask her if she will return to the market, and she replies oh yes, her apricots are almost in.

Before long my bags are weighed down with carrots, Asian pears, and a surprise -- the first asparagus of the season. We load our bags into the trunk and Ben turns the car onto El

Camino. A heaviness settles inside me as we approach the medical school. I ask Ben what he will do today, and he says he'll probably take a hike in the foothills, since the clouds have burnt off and



Sudeb Dalai



Agnieszka Czechowicz

it's turning into a bright California day. He admits he'll miss me but understands that finals are only two weeks away. I almost tell him how much I want to hike with him, how hard it is to spend every weekend locked away from him in my basement study room. But I can't say this, because he'll tell me that I make the choice to study so much, and I can choose to come with him instead. It's easier to pretend I have no choice. In a hollow voice I tell him to have a wonderful day. I'll call him to pick me up when I'm done studying, hopefully within ten hours. And with that, I kiss him goodbye.

By the time I settle into my study room, with my notes and textbooks fanned out around me, I'm hungry again. I reach into my bag and pull out one of Sylvia's apples. As I polish it on my jeans, I think about our trip to the farmers' market, and how some weeks this ritual is the only thing that makes me feel human. I glance at my immunology notes and despair that I can ever memorize the random jumble of letters and numbers. At least Amanda and Rachel will arrive soon, and we can laugh together at the absurdity of it all. But underneath the jokes, I really believe I am losing something. The work wears me down. I don't have much time to read novels or poetry any more, and medical school has co-opted my imagination anyway. Pathogen charts swim beneath my eyelids as I lie in bed at night. Even my dreams have become

strange and urgent. They are always about forgetting. I wander from Ben in a park and forget where I left him, and then search desperately, fruitlessly to find him. The dream fades into a new one. This time I misplace my problem set. I wail and run searching until my frenzy wakes me, gasping, from my sleep. And those nights I struggle with a shameful truth – losing my homework scared me more.

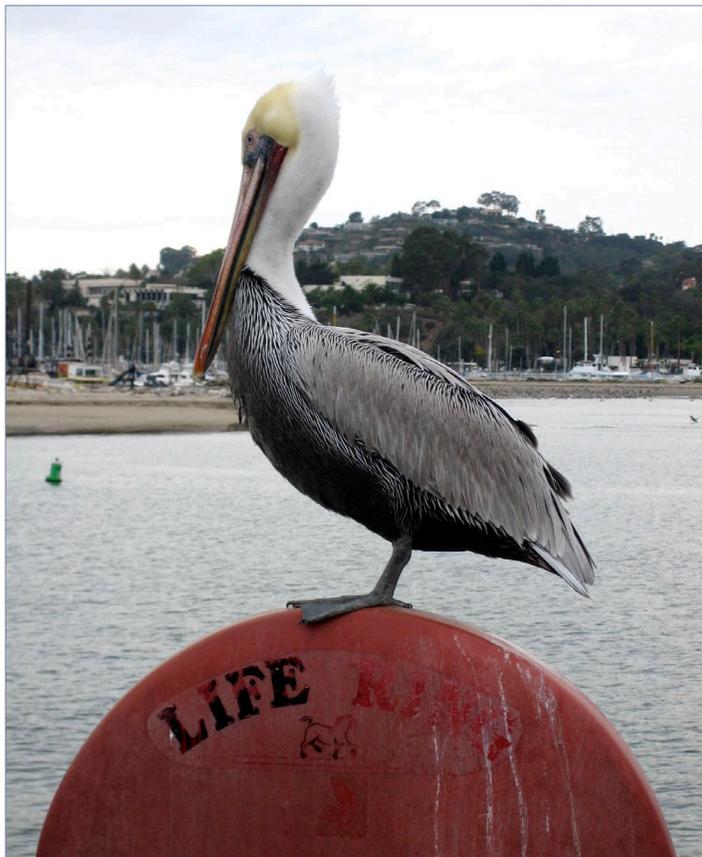
The lights go out in the study room, interrupting my thoughts, and I wave my arms to activate the motion detector. As the lights click on, I glance up through the basement window. I watch two pairs of tennis shoes tread along the catwalk above and imagine a couple hiking the foothills. I would give anything to be them. Then, finally, I understand. Ben is right. I don't have to spend this perfect day burrowed in a basement that reeks of formaldehyde. I could actually live the rich life that I savor for a few hours every Sunday morning. We could live that life, together. Stanford is pass/fail, after all. I reach for my phone to call Ben, to tell him to come back for me. But even as I do, my eyes return to my notes. My pathogen chart spreads out before me with its hundred tiny rows and columns. I drop the phone, turn away from the February sun, and pick up my pen.

# Goodbye, Classmates

David Craig, SMS II

Spring is finally here in earnest. Campus is teeming with new stalks and buds, the squirrels are running under bike tires, hell, people are even cramming their Patagonia fleeces back under their beds to hibernate. The diseases of yesteryear HHD and clerkships seep from the memory as if the WHO had announced their eradication, and bitter fourth-years prepare for graduation while their last complaints and advice disappear into the open bars of match week. It is truly a time for smiles and sunny barbeques.

Enter the second-year medical student, who knows not this “springtime.” Like a particularly wretched and yearly cicada, these poor creatures shed their fun-loving and socially-adjusted carapaces each April and crawl into the sun-shielded depths of Lane Library. There, they will feed on day-old budget pastries from Alway for months on end until they have mastered every disease that can possibly prevent a baby from absorbing any given obscure subset of essential amino acids. They will know the chromosomes where these defects localize. They will have mnemonics for them. They will know what the diapers should smell like. In the medical circle of life, these second-year students are preparing for an event known as “the boards”: that glorious day in mid-June



Anna Lonyai

or July when they will emerge to take one splendid and standardized eight-hour preclinical mating flight, joining student to testing computer at long last in a dizzying explosion of knowledge and passion, question after question, finally finishing to relax their sphincters for the first time in months and plopping down dead as the earth reclaims what’s left of their lame bodies. Ashes to ashes, MCAT to USMLE Step 1, for standardized tester thou art, and unto standardized testing shalt thou return, forever and ever, amen. And this year, darn it, my classmates and I are the second-years.

Say goodbye to us while you still can. If you see one of us outside of Lane after this point, it’s probably just one of our old, molted exoskeletons. To find out for sure, try inviting the suspected second-year to a party or something else involving more humans than review books. If he or she responds quietly with, “yeahhh,” followed by eye shifting, a few seconds of silence, and then quick mumbling that sounds like “flashcards” or “First Aid,” then you are talking to a shell and nothing more. The words it speaks are the result of its only remaining neurological function: a primitive reflex that is designed to weasel meekly out of social events.

Do not cry for us, though, for we will return after boards as beautiful and knowledgeable butterflies, unique and dazzling creatures who will take our noble places of distinction as clinical medical students. What’s that, current clinical students? What are you saying? LALALA I can’t hearrrrr youuuu LALALA clinics will be awesommme and I am getting a ponyyyy for my birthdayyyy. You see, we must see our future as bright, even as our class heads to its imminent and inevitable destruction as a coherent entity. The unified and proud ship of SMS07 has sailed the preclinical waters for nearly two years now, but it will soon hit the iceberg that is the end of Q6 POM, the end of our shared class schedule. All 80-whatever of us will scatter out on lifeboats, women and children first (goodbye, my roommate), and we will all end up in different places. Some of us will settle in labs, furthering the basic science of converting taxpayer money into Qiagen prep kits. Others will spend a year or two quantifying the clinical significance of some risk factor in a widespread and multigenic disease for which everything, including breathing and thinking dirty thoughts, is a risk factor. A few more stragglers will be picked up by educational rescue boats, such as the USS MPH or the USS MBA. But most of us, well, we’re going to clinics.

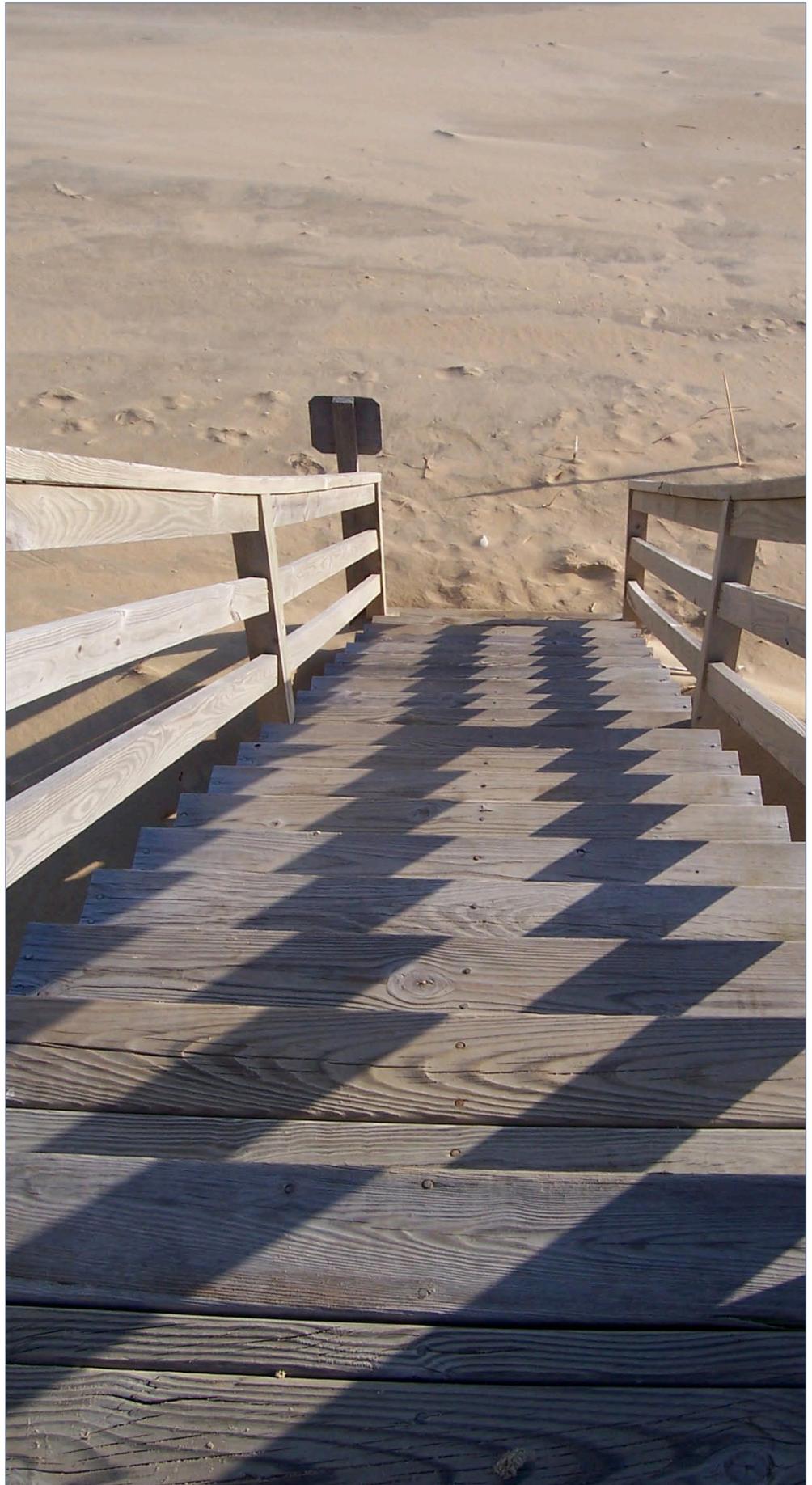
And those clinics are coming at us like an inescapable iceberg. Yes, like another iceberg. Work with me here; I can only come up with one decent metaphor per day, and to-

## features

day is iceberg day. If you don't like what I cook for dinner, then maybe you can try getting back from work half an hour earlier and cooking for yourself! Anyway, like the old saying about rearranging deck chairs on the Titanic, we see those clinics coming, and we're frantically rearranging our draw schedules, trying to minimize immediate pain and maximize matching into a painful residency.

Theoretically, of course, the pain eventually stops. The paychecks become positive, the debt begins to decrease, the hooptie turns into a sports car, and maybe, if we keep the faith long enough, the incompetence gives way to skill. And we are keeping the faith; Moses may have had to wander around the desert for a while, but at least he didn't have to pay to be there. The delayed gratification of the medical student is unique among all professional fields, and nothing has driven this home for me quite like the boards have. When you are standing in line after two years and \$100,000 of school to buy a review book for a test that you also had to pay for, a test that you are taking so that you can pay to work for two more years so that you can get a job that pays effectively minimum wage for three to five years so that you can eventually one day be a doctor – when you are standing in that line and this concept hits you, many things go through your head. Many things and all at once.

And as those things go through your head, my classmates, as we prepare to say goodbye to our shared preclinical life, I hope that one of those things is still “I want to be a doctor.” And if you find that occasionally the faith wavers, then know that you're not alone. Good luck on boards, and let us say goodbye to our class without saying goodbye to each other.



Brian Pridgen

# Mitakuye Oyasin: An Alternative Spring Break on the Rosebud Lakota Reservation

Andy Chang, SMS I

“Have you ever heard of the white buffalo?” asked Rose.

When I told her that I hadn’t, the elderly Lakota woman lying in front of me cleared her throat and continued. “In the old tradition, it was a sacred symbol of healing. There were great stories of medicine men who would use the parts from them to fix even the dying.” She waved her hands at the beeping vital signs monitor behind her and chuckled. “Sometimes, I think they were better off back then than now.” I glanced at Rose’s apparatus and thought back at how it had only been a day and half ago that I was memorizing the effects of pro-inflammatory cytokines and thalamic relays.

Instead of traveling either back home or to warmer climes after the exam, a group of first-year students had decided to go instead to Mission, South Dakota, to build houses with Habitat for Humanity and volunteer at the Rosebud Comprehensive Care Facility on the Rosebud Indian Reservation. I was lucky enough to join them on the trip.

Rosebud is home to one of the largest Lakota populations, the Sicangu people. Known informally as members of the Souix tribe, the 25,000 members of the reservation reside in Todd County, the fourth-poorest county in the country according to the last U.S. Census. Despite the peaceful pine forests and endless grasslands that surround the reservation, the majority of residents are unemployed, as the local economy provides few opportunities outside of small-scale agriculture and ranching.

Due to the remote location of the reservation, the quickest direct flight from San Francisco took us to Denver. From there, we made an eight-hour drive through Nebraska, then into South Dakota. From the minute we crossed state lines, we knew we were in the Midwest—there was a calm, straw-colored prairie all around us, accompanied by a warm, earthy smell in the air. The sense of place was incredibly clear: alongside gas stations and grocery stores stood traffic signs



Shane Wong

## features

proclaiming the foreign-sounding street names of Sicangu, Oyate, and Makizita Wakpa.

We began work immediately upon arrival, laying drywall for one of the modular homes – each rising one after another in the flat fields behind our dormitories. Eric, our large, silent Lakota foreman, provided an orientation and tools, patiently fixing our blunders. Occasionally, he would mention a thoughtful fact or two about the reservation. Though I knew our ability to help would be largely symbolic, it felt good to get my hands dirty on the job, a welcome respite from the weeks of bookish activity characteristic of the preclinical years.

The following morning, the first group of volunteers headed out to Rosebud Hospital (RCHCF), the sole reservation health center serving the 882,416 acre catchment area. Dr. Lehman, the acting clinical director, welcomed us and described the state of health in the region. RCHCF's team of mostly-general practitioners was currently seeing 15,000 patients a month. At the time of our visit, there were only seven full-time physicians on staff. Rosebud also has only one general surgeon, and cannot provide advanced specialty services to its patients. As such, most must travel to Nebraska or make the six-hour drive to Rapid City, South Dakota, for more complicated surgeries and referrals. Dr. Lehman mentioned that the biggest issue with staff recruitment had always been the location of the reservation. The nearest movie theater and coin-operated washer is an hour's drive away. To compensate, many physicians leave their families in Sioux Falls or Rapid City, driving in on the weekdays and sleeping in the hospital dormitories. In fact, one of the ER doctors works alternating two-week shifts between Rosebud and his permanent home in Los Angeles. Not everyone is willing to make such sacrifices, however.

Despite the high workload, Dr. Lehman noted the role of the physician in the Indian Health Services (IHS) and the

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rewards inherent in the line of work. “We function much like the GPs of decades ago,” he said, “treating the majority of cases. Since there are no specialists on staff, IHS doctors must be able to tackle just about anything they see.” The challenge is certainly a worthy one, as the patient population has a very high prevalence of Type II diabetes, hyperlipidemia, alcoholism, hypertension, and chronic pain.

The distance issue became even more apparent when we visited the Porcupine Clinic, an independent non-profit health clinic located in the adjacent reservation lands of Pine Ridge. Constructed in the early 1990s, the handsome wooden building with the words “Mitakuye Oyasin” inscribed on its side



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stood silent on the Wednesday morning of our arrival. Its fully-furnished exam rooms were empty, and the only administrator left on staff explained that funding cuts had left the clinic without a doctor. The single public health nurse stationed there served primarily as a driver, picking up residents who did not own cars and delivering them to Pine Ridge IHS Hospital. A brightly-colored dialysis center and gleaming white ambulance collected dust in the back of the facility, a reminder of past promises unfulfilled.

Our work that week was punctuated with a tour and meeting at Sinte Gleka University (the reservation school) to speak with Cheryl Medearis, professor of education. There, she explained to us the meaning of “Mitakuye Oyasin” the most sacred of all Lakota prayers. “It means we are all related,” she said. The significance stretches beyond just a sign of goodwill—it recognizes the inherent interrelatedness of all people, living things, and the earth. “I would hope that you would think of us, your family on the reservation, wherever you end up in the future,” she told us.

The last night on the reservation found us at a pow-wow. Held on the floors of the Winner Town Armory, the hall was packed with women, children, and men dressed in full Lakota regalia: a brilliant blur of colors, feathers, and beads.

The locals were holding competitions in various classes including the traditional dance (imitating the recreation of a successful hunt or battle), the grass dance (a celebration of growth), and the shawl dance (a more contemporary use of colorful capes). Other aspects of the festival had made accommodations to modern culture including the “fancy dance” category that incorporated elements of hip-hop and break dancing into routines. Most heartening of all, however, was the presence of youth. I was reminded of Cheryl’s words from the night before when she said, “It’s wonderful to see that young people are getting interested in their cultural heritage once more. In the past, there were only old people at these pow-wows. Every gathering just saw them getting older. Now, we even see grandchildren sitting on the laps of their grandparents, playing the drums together.”

The rising and falling wail-like Lakota cadences that night stayed in my head for the remainder of the trip. As we pulled out of Rosebud for the last time, we passed a herd of buffalo on the road. The few remaining animals, once so plentiful across the Great Plains, are now a protected population managed exclusively by the reservation. I hoped that I would be able to remember the white ones and the role we would play in the days to come.

A Photoessay on the Student Life of the  
Stanford School of Medicine, Class of 2008



Most of student life is lived right here. Or watching a video of right here.

# unconventional

By David Carreon. These photos were chosen as being most representative of student life by a vote of the class of 2008.



**Students listen attentively to Dr. Chu at his outdoor MoBio office hour during the first mini-quarter. In the picture, it looks almost like the students want to learn.**

**At orientation, students are told, "Your white coats are in a box in the courtyard." This frenzied digging would become their White Coat Ceremony (Stanford uses up all the pomp on the giving out of the stethoscopes).**





On top of their studies, some students are also building their families. They have claimed that newborns are not always as agreeable as this picture implies.

Joyous student on a hike while on SWEAT, a pre-orientation outdoor-sey bonding experience. Friendships were first formed here, and not just by jumping ability.



**“This is an unconventional medical school”**

**– Dean Pizzo, in remarks given at orientation to the incoming class of 2008**



Students embrace after conquering the dreaded Winter Quarter of First Year. All is right with the world, particularly the friendship here captured, a friendship forged in the fiery furnace of Med School, friends so close they are like family.

# Cadaver

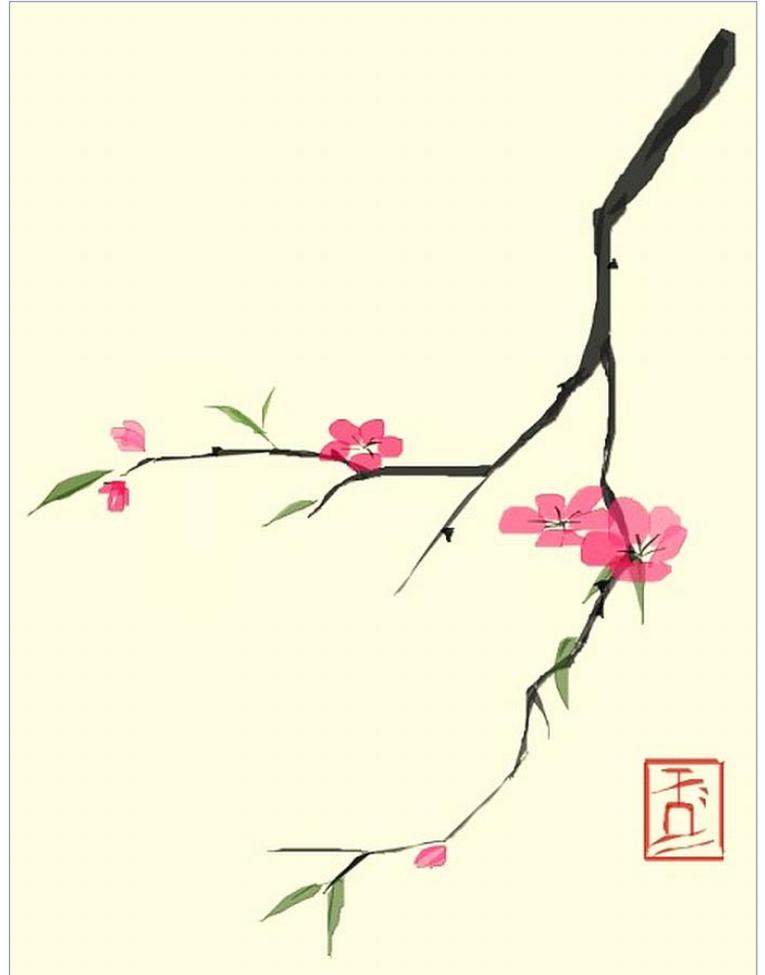
Atalie Young, *SMS I*

This blue  
coffer zippers smoothly round  
your limp  
limbless body  
knee cracked, liver left askew  
the haven of your heart disturbed  
as your lung root so curiously released  
from its heart-root  
ambulates about with heaviness  
for its loss.

As I muse I can't resist  
this mysterizingness within me  
for I probe  
poke and proffer explanations,  
hesitating at each new layer unveiled,  
wondering on your old haunts  
and asking why and how  
your altruism brought you to sojourn here.

When your chest recoiled into the void  
between us  
did you know that I would take  
the saw and rent your being asunder,  
wander round those crevices unknown  
to those most dear to you—  
take my hand and peel away  
the fat that kept you warmer,  
break your ribcage just so  
I could hold your heart?

I opened all  
and yet the aperture of your life remains  
sheathed in subtlety,  
the secrets of your life secured  
by steely silence—  
your bolted spine shuts the door against my in-  
quiries  
as your relics rest in the shadows still  
fully unexplained.



Danny Shen

## Maude

*Rachel Sussman, SMS I*

Before she died, her children knew  
her pencil arms, her rounded back,  
her cinnamon-gray hair.

She had always known about her wayward  
lean of spine, left above her hips.

And she knew her quilted belly,  
with folds that run  
into a midline scar.

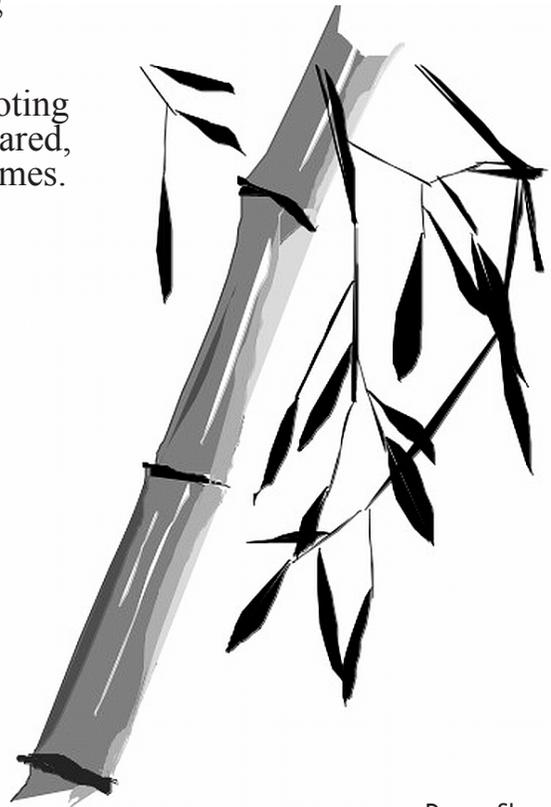
But only we have seen  
beneath, no womb,  
an ovary nodding on its stalk.

We know the melon-heft  
of lungs, pulled out from her.

Who else would know the span  
of bones in those  
cleanly peeled hands?

And only we know the odd turns taken  
by her veins, twisting  
towards her heart.

We are just students, parroting  
the names of parts, and scared,  
you know, of knowing names.



Danny Shen

# Leader in Medicine: Dr. Terrence Ketter

Roberto Valladares, SMS I

*Dr. Terrence Ketter, Professor of Psychiatry and Behavioral Sciences, is the Chief of the Bipolar Disorders Clinic. As an internationally-renown scientist, he seeks to better understand the neurobiology of mood disorders and use brain imaging techniques to more effectively target treatments for patients with bipolar disorders. His research interests include brain imaging and the use of medications, with an emphasis on anticonvulsants for the treatment of bipolar disorders.*

**You had an interesting choice of major in college - mathematics. Do you see any connections between mathematics and medicine?**

An obvious connection is that between statistics and performing statistical analysis. Something that is perhaps a little less obvious with relationship to psychiatry is brain imaging. Brain imaging data analysis involves a lot of pretty complicated mathematics.

**You've studied in Australia – what was that experience like?**

Whenever you travel to a different environment you have experiences that broaden your way of thinking. For me, living in Australia exposed me to more Asian culture than I had ever been exposed to while growing up in Toronto. I think it was important for me to get exposure to different cultural influences and it even led me to research cultural influences on psychiatric disorders in medical school.

**What led you to psychiatry?**

I spent some time on a neurology unit where they were performing seizure surgery and taking people off of anticonvulsants. I found it very interesting that many patients developed seizures before they started having mood symptoms. This interest in neurology and anticonvulsants eventually led me to psychiatry.

**How did you become interested in bipolar disorder?**

I was in residency at UCSF right around the time when interest in Carbamazepine (Tegretol) was starting to grow. Dr. Robert Post, a leading investigator who was developing a theory for Carbamazepine's mechanism and exploring its clinical utility, was at the National Institute of Mental Health. I applied for



a fellowship to work with him and ended up catching his enthusiasm for understanding bipolar disorder.

**Do you see any connections between the current economic downturn and the development or exacerbation of bipolar disorder?**

With respect to different types of crisis, if you have an increase in stress you usually get an increase in symptoms. In bipolar disorder there is a tendency for early episodes to be triggered by stress and later episodes to be spontaneous. This is the so-called “kindling” theory of bipolar disorder. The spontaneous episodes can increase in frequency, severity, and ultimately may become

more resistant to treatment. The kind of stress that is going on now could in fact help to “kindle” bipolar disorder and move it forward a notch. The demand for services here at the Bipolar Disorders Clinic are as high as ever and we certainly see individuals who have lost their job and/or are having financial troubles and are doing worse as a result. I don't see too many people thriving or feeding off the stress we have now. The lucky folks are able to weather the stress and get through it somehow.

**How have brain imaging methods allowed us to gain a greater understanding of the neurobiology of mood disorders?**

In the last couple of decades brain imaging has helped us figure out where in the brain mood, emotion, and cognition lie. At this point, the neuroanatomy of mood disorders is well established. What has not been established (as well) is the neurobiology, specifically the biochemistry, of mood disorders. This will be a much tougher challenge. Someday

# leaders in medicine

we would like to identify the depletion of a specific chemical and prescribe a medication that works to restore that balance—thereby treating the mood disorder. We are still a long way from that capability.

## **Can you describe some of the projects that you are involved in and their most rewarding aspects?**

We are doing brain imaging and working on something called voxel-based morphometry (VPM). VPM allows us to study the relationships between brain structures and creativity. We do this by looking at the relationships between creativity test scores and MRI scans. We have established a creative advantage in patients with bipolar disorder and it seems to be driven by a combination of access to negative and changeable feelings as well as open-minded and intuitive thought processes. Our bipolar patients have creativity scores that are about 50 percent higher than healthy controls. Their scores are in the same range that we see in graduate students here at Stanford in product design, fine arts, and writing.

## **What are the most difficult or challenging aspects of your career?**

We have a medical system that is not well. We have 47 million uninsured patients in this country and that just needs to be fixed somehow. It is enough work just treating people without having to fight the insurance companies for payment authorizations. Psychiatry is enormously rewarding and can do an awful lot of good. It is exciting to see people get better—but, as with the rest of medicine, it is not free of problems and challenges.

## **Are medical students more prone to developing psychiatric symptoms?**

One of the potential silver linings of bipolar disorder is occupational and/or educational achievement. There has been a long dialogue as to whether people who achieve success at work or school have an increased rate of mood disorders. Whether mood disorders are a cause or an effect of success still remains to be established. Mood disorders are very common and it is not rare for students to have them. Fifteen percent of our patients here are Stanford students. They are not all medical students but they all tend to do very well following treatment. Just because an individual has a mood disorder does not mean that they can't achieve their life goals—be that in medicine or in another field. It could even be that the very thing that makes a person passionate enough to devote this kind of energy to something is also a marker of some vulnerability to developing a mood disorder. If any medical students are experiencing mood problems it is very important to get past any feelings of stigma and get help. If one is not interested in taking any medicine, psychotherapy can work exceedingly well. Part of taking care of yourself as you go through a stressful experience like medical school is to get

treated if you think you may have a medical problem.

## **Do you have any advice for medical students in dealing with the day-to-day stresses of medical school?**

Having deadlines and the anxiety that they can create helps one mobilize resources to get things done. In light of this, I think that it is important to build up a certain degree of stress tolerance. I don't think you can be in this field and avoid stress—it is more about managing stress. To manage stress when your plate is really full you have to find out a way to say no to something that is extra or optional in order to avoid being overextended. Make sure that you get adequate sleep because you really don't want your sleep going below 6 hours each night. Healthy eating, exercise, and staying away from problems that can be related to drugs or an excessive use of alcohol are also very important. Many people are tempted to cram around exam time and some people can get away with it but other people can't. Just knowing what kind of stress you can take and what kind of stress is too much on an individual basis is important. Part of the training experience in medical school is figuring out a way to manage the demands that are being put upon you.

## **How do you balance your personal life with your career?**

This can be kind of tricky. It turns out that my wife is a physician as well and also has times when she is incredibly busy. We try to set things up so that we will both be busy at the same time. If one of us has to travel for a conference, we will try to tag on a few vacation days at the end. For my wife and me, the main thing is just being in town together when we are not working. We do a lot of outdoor activities but that would only be possible if we engineered it so that we are around. In the balancing act, at least for me, the way it's worked is by me saying no to certain travel. There is always a wealth of interesting things you could be doing, but every time you are away at a conference on a weekend you are missing out on the rest of your life. We don't have kids and I have admiration for people that are able to have kids and balance a family and a career.

## **What are your interests outside your career?**

I have an ongoing interest in art. I am interested in the relationship between creativity and mood and it has led to my weakness for artists with mood disorders. I have written pieces for the Cantor Bulletin on Art, traveled to different shows, and gone to places like Monet's garden in France. I enjoy traveling and being outside. My wife is East Indian and I find Indian culture very interesting. We have traveled to India and other places in the Far East. On our travels we always make an effort to go on art tours and visit art galleries. Getting away from work is an important thing to do.

# H&P

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