LIFE

MELINA MERCOURI

THE [illegible]ER ON SUNDAY" GIRL COMES TO BROADWAY

IS THE [illegible] HOSPITAL [illegible] SICK [illegible]?

[illegible] not designed to handle patients in crisis

[illegible] UNCOMMON

A daring plan will at last make hospitals fit for patients

'It's a miracle that we save any of them'

by WARREN R. YOUNG

Sprinting through the corridors and up the stairs of the Washington, D.C. hospital, the surgeon, internist, anesthetist and oxygen technician knew they had, at the outside, only four minutes in which to restore a life. Not four fat minutes that would begin when they and their equipment reached the patient. Not even four minutes from the time the loudspeaker alarm call summoned them. But four minutes from the very instant the heart of the man in Room 714 unexpectedly had stood still. After that, even if the heart beat anew, oxygen lack would have done irreparable brain damage.

Luckily, everything meshed. The heart's sudden silence just *happened* to have been noticed quickly enough, and the four-man emergency team and the needed tools just *happened* to be near enough for instant aid. While the surgeon pounded the patient's breastbone to force blood through the heart and the anesthetist applied mouth-to-mouth respiration to ventilate the lungs, the electric defibrillator, electrocardiograph and oxygen arrived. Presently the heart began to beat and an infusion of heart stimulant plus force-fed oxygen kept it going.

The marvels of 1966 medical techniques together with unusually good team planning had warded off a sure death. But the droplets of sweat on the surgeon's face reflected more than the sudden burst of exercise.

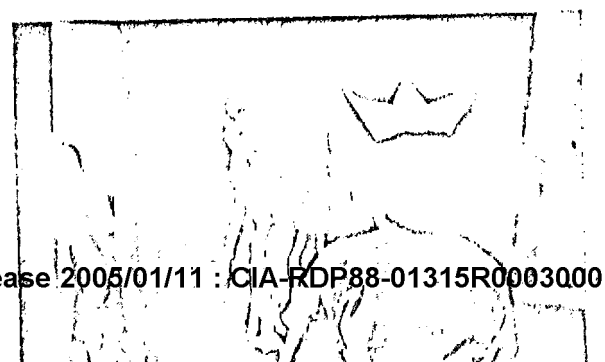
"We may have half a dozen of these in a day and sometimes I think it's a miracle that we save *any* of them," said Dr. John F. Gillespie of the Georgetown University Medical Center, where this rescue took place. "Oh yes, we saved this man, and we're better organized for crisis action than most hospitals, but look at our inefficiency. It's ludicrous. His life hangs in the balance while the medical talent demonstrates its *galloping* ability, and expensive equipment is dragged through the halls. And during the time this problem was being met, our capability for handling any other similar emergencies was drained. It's a prime example of the stupidities built into the framework of today's tradition-encrusted hospitals."

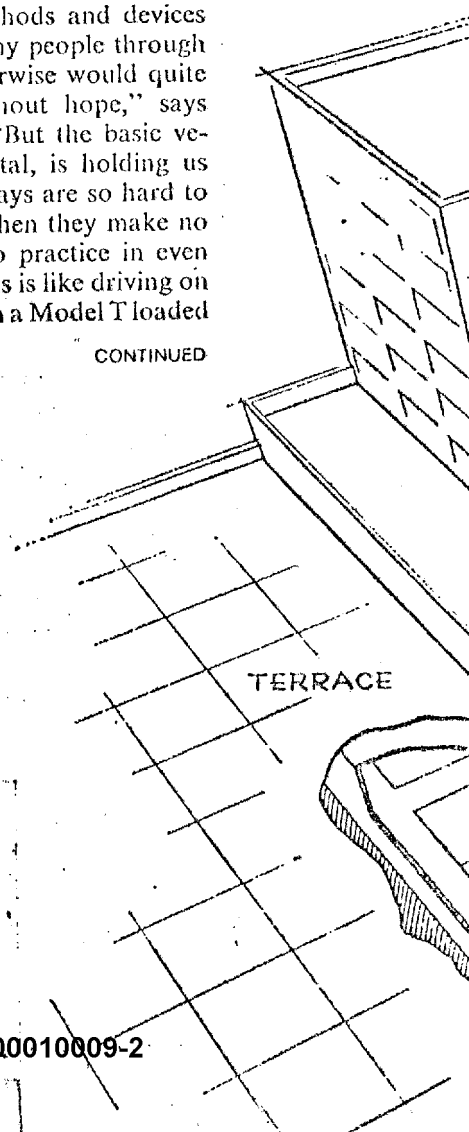
As medicine marches into the future, the nation's hospital system retreats more and more into obsolescence. The accusations against the hospitals, documented by the public and physicians, are sorrowfully familiar: Patients given the wrong medicine. Patients shockingly neglected, survival often depending upon some stranger chancing to walk past a door at the right moment. Nurses far too short in numbers, low in morale, underpaid and overwhelmed by drudgework. Red tape. Depressing food. Not enough rooms and not enough money. Germs that ambush one of eight surgical patients to imperil recovery. Wards that suit no current need and laboratories a mile from the patient. And, amid all this, rising prices for even second-rate hospital care.

Furthermore, medical staffs and hospital administrators see their problems about to expand as the population continues to swell and Medicare brings in many new patients. Ironically, all these people could be cared for if all the advances of modern medicine were more fully utilized.

"By new methods and devices we can pull many people through today who otherwise would quite literally be without hope," says Dr. Gillespie. "But the basic vehicle, the hospital, is holding us back; the old ways are so hard to give up, even when they make no sense. Trying to practice in even the best hospitals is like driving on an expressway in a Model T loaded

CONTINUED





pression engine. It's high time to design an entirely new model."

Dr. Gillespie is one of three men who are attempting to do just that. Along with his superior in cardiac surgery and research at the Georgetown University Medical Center, Dr. Charles A. Hufnagel, and the center's renowned pathologist, Dr. Charles F. Geschickter, he has set out to remodel the Georgetown hospital. They plan to transform it into a radically streamlined facility to test promising though unproven design features. Physicians and planners from large and small communities will be invited to copy or learn from the results. The U.S. Congress has authorized an unprecedented Public Health Service grant of $7 million for the project (to which the university must add another $8 million, to be raised from its alumni and friends), and after four years of quiet planning, ground is to be broken next spring.

Surgeon Hufnagel was a chief inventor of plastic heart valves, artery implants, supercooled surgery techniques, heart re-starting devices and heart pumps; with Dr. Gillespie's help, he is still bringing out new versions. Dr. Geschickter, a cancer expert, is coauthor of the three-volume classic *Color Atlas of Pathology* and other tomes. Why are three such prominent doctors diverting so much time to blueprinting the hospital of the future? "Well," says Dr. Hufnagel, "when you live in hospitals for years and complain about their clumsiness, you should *do* something constructive about it."

Dr. Geschickter has practiced medicine for 40 years, but before that was an architect and engineer. "I did two things," he has said about his approach to this project. "One, I made up my mind I wasn't going to go around with my hat in my hand to sell an old idea and, second, I told the administrators at Georgetown that I would not touch the plan unless I had their audits for the last 10 years and a chance to analyze them. I wanted to see where they were losing money and wasting space. Most important, I wanted to see where we were losing patients."

As the three doctors pored over ingly fascinated by one discovery. The facts indicated that at any given time about 80% of the patients in the hospital were merely undergoing diagnostic tests, finishing convalescence or receiving treatment for chronic ailments; they were not candidates for emergency lifesaving measures. The other 20%, meanwhile, were in serious condition, if only for a day or two after surgery. This discovery, they concluded, was the key to the whole dilemma.

"Looking at it from this angle, everybody can see how hospitals ought to be built, even laymen," says Dr. Gillespie. "There should be one section equipped to give absolutely top-quality, concentrated treatment to one fifth of the patients and a second, larger section for more casual care. But nobody gives any thought to the matter and hospitals keep on being built essentially as second-rate hotels, with the only concession to our needs being to pencil in spaces for surgical chambers in place of hotel dining rooms. The hospitals attempt to provide complete emergency care for 100% of the patients, as if any one of them might need it at any moment, and in the process not only waste money but fail to come close to the goal. They also try to spread the comforts of home around for everybody, including the 20% who are in no shape to use or appreciate them, and provide room service three or four times a day for those who are too healthy to require it."

The 400-bed, 19-year-old redbrick hospital already at Georgetown, like so many others across the U.S., is overcrowded and in need of enlargement even for continued conventional-style care. The three doctors devised the idea of turning it into a pleasant, relaxed facility for the 80% who need only minimum care. Meanwhile, they would build a modern nine-story, 192-bed concentrated-care wing for the acutely ill 20%. Into it they are pouring all the genius for modernization they can muster. Electronic computers will improve record-keeping and bedside care. Use of new materials and procedures will make the concentrated-care wing a practically impregnable fortress against germs. All 21 operating rooms will be in the new be one floor higher at the true basement level. Packed into six patient floors above will be more test equipment and emergency tools, virtually surrounding every bed with lifesaving equipment.

Ordinary hospitals have traditionally divided up the space and staff into surgical, medical, psychiatric, pediatric and obstetrical "services" and then sorted the patients somewhat arbitrarily into these categories. This method caters mainly to the convenience of the department heads and their specialty staffs, while scattering equipment throughout the building, puffing up the budget and making efficient therapy virtually impossible. A patient almost ready to go home after the most minor surgery, for example, may find himself in a room next to somebody who has just had a lung removed. In the new Georgetown plan, the most important consideration in sorting patients will be the *gravity* of their conditions.

This is daring because, first, like any true experiment, nobody knows how well it will really work; and second, it means shattering the molds of the past, discarding a multitude of seemingly small but terribly familiar patterns. For example, says Dr. Geschickter, "everybody in our concentrated-care wing will be on a liquid diet. I don't mind if some are able to eat chopped meat or custard instead of drinking or getting infusions of true liquids, so long as all that's involved is a paper cup and napkin to throw away afterwards. This facility will be devoted to the safety and recovery of patients—not to bowls of flowers and salads that wilt and big rattling food carts with china dishes."

In the minimum-care section, on the other hand, nearly all patients will be freed of the tedious wait in their rooms for food which often arrives tepid and tasteless and yet is such an expensive item on the budget. Instead they will go on their own to a self-service cafeteria contracted out to a restaurant organization. The patients will have a wider choice of foods and fresher cooking. The hospital will deal itself out of the restaurant business altogether.

A new concept for modernizing hospitals—devised by Dr. Gillespie (left), Dr. Hufnagel (center) and Dr. Geschickter—calls for the addition of a wing for exclusive care of patients in serious condition. It will have storage areas deep underground, pre-operative rooms and surgical suites in a subbasement, and pharmacy, X-ray and laboratory facilities at the true basement level. Atop that will be six stories of concentrated-care units.

A typical victim of gall bladder disease, a man known as, say, G.B., will realize even before his therapy begins how efficient the new plan is. Assuming that no emergency treatment is necessary, G.B. and his physician will tend to hospital-entrance red tape by means of pre-admission interviews, probably by telephone. Thus when check-in time arrives, G.B. will move along quickly, instead of waiting in line while an admissions clerk types up a sheaf of questionnaires. (If G.B. is brought in as an emergency case, he will immediately be wheeled in to be prepared for surgery, and an admissions clerk will trail along to get the vital data.)

Arriving the evening before his operation is scheduled, G.B. will check directly into the new sub-basement, where 31 rooms adjacent to the surgical suites will shelter pre-operative patients. His overnight room will be small, subterranean and windowless, but quite livable, with a private bathroom and a TV set. Any final tests that may be required can be performed on the X-ray and lab floor directly above.

Next morning G.B. will be roused at a reasonable hour and transferred just a few feet to one of 32 cubicles to be prepared for surgery. The proximity of the whole "pre-op" unit, with its overnight rooms and "prepping" cubicles, to the actual operating rooms not only saves much long-distance pushing and hauling but also permits a realistic relationship between the time G.B. must get ready for his surgery and the actual operation. If one of the operations preceding his takes longer than anticipated, for instance, G.B.'s "prepping" will be correspondingly postponed.

The most vital benefit expected from the pre-op unit is the defense it will raise against germs. Old-style practice requires putting a pre-surgical patient through an ordeal of scrub baths, antiseptics and changes of garment to remove all possible germs while he lies in his room far from the scene of surgery. Once the hoped-for degree of cleanliness is obtained, he is carted through the regular hospital corridors and carried on the regular elevators by [illegible] attendant and especially the wheels of the cart pick up dirt and germs. [illegible] outside the operating room to await his turn. Under the flimsy armor of a sheet, his shivering, shaved and iodine-painted carcass lies cringing as people by the dozen brush past him—including clean-up men toting slush pails and bloody, germ-stained bandages, doctors arriving hurriedly in wet coats and muddy overshoes, and wandering visitors. His brain, purposely only half-sedated, is still working well enough to overhear nurses' talk about minor mishaps and lost sponges and to sink into the worst possible frame of mind for the ordeal ahead. Finally, as a Georgetown critique points out, "This bundle of contamination is then moved directly to the operating room itself, ignoring all zoning barriers and avoiding all protective procedures." The patient is flopped onto the table, bugs and all. "And yet some surgeons still wonder," says Dr. Gillespie, "why so many surgical patients have complicating infections."

But when G.B. has his gall bladder removed in the new Georgetown facility, he will be saved from such trials. From the moment he arrives, he will be kept as sanitary as possible. And in the pre-op area, everything and everybody will be isolated from outside contamination. Even G.B. himself, once "clean" and inside the unit, will have to go out to a special lounge if he must see a visitor—and then re-enter through the main entrance, shower and change garments again. Doctors and nurses will have to take similar precautions. "Surely, it will be an extra bother," says Dr. Gillespie, "but far less painful and time-consuming than an avoidable infection."

When the operating room is ready for G.B., he must merely be wheeled in from next door and given the final anesthetic. Then—the surgery.

The operating room itself will be completely redesigned with a view to reducing the danger of infection. "Today," Dr. Gillespie says, "you see shiny square tiles on every operating-room wall and attractive terrazzo stone on the floor and you think that's pretty nice. It [illegible] pidity based on the idea that 'tile is [illegible] tween the tiles and pocks in the stone are marvelous traps for the 'bugs.' And we are bound to have some vicious ones in an operating room. There they sit, undaunted by our attempts at sterilizing the room between operations, ready to pounce."

His solution, which will greatly protect G.B. during the most vulnerable hour: wrapping the entire inside of the room—walls, floor, ceiling and all—with wide sheets of vinyl. The seams of the vinyl will be heat-sealed; the corners of the room will be rounded off and the room will be windowless. This is a room that can be made truly sterile.

G.B. may notice the absence of the traditional operating-room surgical light, which today sheds an occasional germ-ridden grain of dust from its shining reflector, its overhead gear-tracks or its movable, articulated arm. Not long ago Dr. Gillespie called in the leading manufacturers of these lights and pointed out that their products might be dandy for illumination but are not germ-free. "They explained to me very patiently," he recalls, "that this was simply the finest surgical lamp ever made. I'm not sure that I was equally patient, but I told them the best simply isn't good enough. Our goal must be perfection."

And so, on that morning when G.B. gazes up from his operating table, he is likely to see only some smooth glass plates in the arched, smooth-vinyl ceiling. Recessed above the plates will be a complete circle of spotlights which G.B.'s surgeon will adjust with foot pedals for the exact lighting needed.

If G.B.'s operation is to be observed, visiting medical men or students will be denied the free access they generally have. In these "old" days of 1966, observers often troop right into the surgical chamber. In the new facility they will watch from a small classroom immediately above the table, looking through a thick glass panel mounted in the ceiling. Medical movie cameras and closed circuit TV pick-ups will be mounted there too.

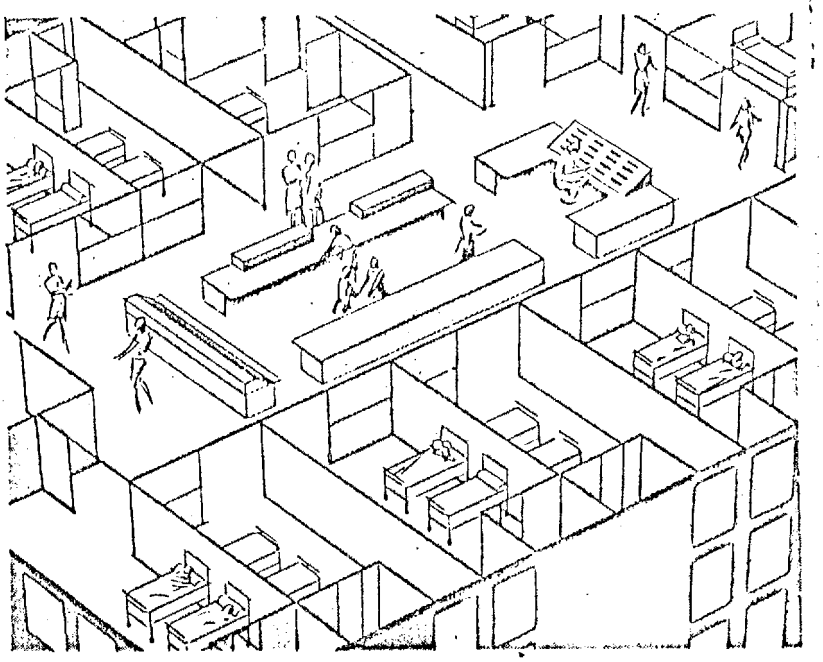
When G.B.'s operation is finished, he will not be moved into a recovery room, as would be the case in the best current hospitals;

the Georgetown medical center will not even have a recovery room. If G.B. takes a turn for the worse on the operating table, he will be kept there for as many hours or days of care as may be required. To make this possible, the hospital will have 21 operating rooms. But if there are no complications after G.B. has come out of anesthesia, he will be whisked up one of five high-speed elevators directly to his concentrated-care room. The special cart he rides on will become his bed, eliminating one delicate transfer. The cart will be rolled up to a separate, two-wheeled headboard held upright by "bayonet" prongs plugged into the wall. Cantilevered out to one side of G.B.'s headboard will be a built-in washbasin. On the other side will be a shelf for small medical apparatus. The cart-bed will stand unattached in front of the headboard.

G.B.'s room will be one of 16 arranged in a rectangle with a nurses' station planted in the middle, making up a concentrated-care unit. Two identically designed units will be on each of the six patient floors, with supply quarters, staff lockers and lounges, and major emergency equipment housed between the two units. Twelve rooms in each unit will be designated as sub-acute spaces; the other four, nearest the nurses' station and the support areas, will be for the most acute cases. The rooms housing the latter—small, lacking windows to the outside and bare of furniture except for the headboard, the cart-bed and equipment carts—will be models of efficiency. Flowers and gifts will be banned from the entire unit, and visitors will be allowed in only rarely, if ever. G.B., because he is just out of surgery, will be in one of the acute rooms under constant close watch by three duty nurses. The patients cannot see each other, since the side walls of their rooms are opaque. But the inner end walls are glass, and the nurses can see every patient at all times without leaving their station. Doctors, too, will be available on every floor at all hours.

Every patient recovering from surgery of any kind, and every nonsurgical patient with acute illness, deserves to be able to open an

A nurse sits at a console that monitors all patients



In each concentrated-care unit, centrally stationed nurses will have full view of all patients. Although rooms can hold two beds for emergency use, normally there will be only one occupant.

eye and see a trained professional standing there looking at him with all the emergency apparatus that might be needed—and not just a bowl of posies," says Dr. Gillespie. "Today, only a person who has undergone the most radical kind of inner-heart repair or an unprecedented major procedure is likely to receive such attention, except for a brief hour or two in a recovery room. Even the child who has his tonsils out or the young man with a patched hernia sometimes dies, and the post-surgery rates of death from infection, unrecognized hemorrhage and choking on their own fluids, is greater than on the table."

G.B.'s recovery will be watched not only by nurses but by electric eyes too. Sensing devices will constantly monitor his heart rate, his temperature, his respiration rate, his electrocardiogram and the blood pressure both in his veins and in his arteries. The nurses will not rouse G.B. early in the morning to poke a glass thermometer between his gums and then spend much of the day checking up on his and the other patients' conditions. They will simply [illegible] a button on the console of their station to get as many readouts as they want. G.B. will not have to hope that if he enters a crisis somebody *may* spot it.

If any single bodily function or combination of functions deviates beyond the fixed limits G.B.'s physician has programmed into a computer, lights will flash and a buzzer will sound the alarm. Within seconds, nurses, technicians, doctors and a complete array of equipment will be in action at his bedside. Computer systems are already working well in some U.S. hospitals and "eventually," says Dr. Gillespie, "our goal will be to monitor tiny changes *before* catastrophe occurs, as the computer and we ourselves gain experience. If a heart stand still can be predicted 30 seconds before it is going to occur, for example, we can attach a pacemaker and keep it from happening at all. Many of the tragedies now considered unavoidable fates are really not that at all."

Some of the sensing devices will probably have to be taped to G.B.'s skin and others inserted like needles into his bloodstream. Such sensors are used in the operating room, and at the end of G.B.'s

Some surgeons still wonder

why infections set in'

operation these sensors will be left in place. The gang plug leading from them will be pulled out and reconnected to the circuitry in his concentrated-care room so that signals will begin to flow at once to the nurses' station computer console.

The same computer setup will also plug the memory gap which brings about the appalling frequency of mistakes in medication. ("You know," says Dr. Geschickter, "that at least one in every six drug doses is given at the wrong time, in the wrong amount or to the wrong patient.") When G.B.'s doctor orders medication, it will be keyed into the computer instead of scribbled on a notepad. The order will go instantly and automatically to the hospital's pharmacy, at the same time producing an electronic record. Then the medicine itself will be sent up to the concentrated-care unit through pneumatic tubes, and the computer will not only remind the nurse each time she is supposed to give G.B. a dose but will require electronic verification through the keyboard that this has been done and done correctly. Otherwise, another alarm will sound.

The drudgery of charting G.B.'s case history as his condition changes will be handled by the computer, using the data from G.B.'s sensors. If G.B. takes an alarming but baffling turn, the computer will scan all its data on his diagnosis, medication and previous changes of condition and match them against the new signals coming in as well as against a vast encyclopedic store of correlated indexes. It will then suggest to the doctors what may be wrong and what might best be done. The doctor, of course, will decide whether to follow the suggestion, just as he would have if he had looked up something in a book.

Such sophisticated surveillance will not only help G.B. but will also boost the long-sagging morale of the nurses. Only a highly trained nurse will be able to cope with the Georgetown-type system, and her role will shift dramatically from her present preoccupation as a combination bookkeeper, supply-sergeant, walkathon champion. She will become once more a true and indispensable professional associate of the physician.

Barring complications, a gall bladder removal is only moderately serious, so after about 24 hours G.B. will be moved again. This time his cart will roll only a few feet, into one of the sub-acute rooms. There he will have a window and the computer will monitor only his pulse, breathing and temperature. He will be a few steps farther from the nurses but still in their direct view. For perhaps three more days he will thus recuperate in the concentrated-care unit, thoroughly attended and well protected against outside infection.

On the fifth day, if all goes well, the resident physicians will examine G.B. and his computerized record of progress and pronounce him fit enough for transfer to the minimum-care section of the hospital. The resident physician's authority to discharge G.B. from concentrated care, instead of having to wait for G.B.'s personal doctor, will be a radical but essential departure from current procedure.

In his minimum-care room G.B.'s life will be quite different. He will wear no sensors and he will be far from nurses and doctors most of the time, but when they do visit, he will not have to compete for their time and attention with direly ill patients. He will find the challenge of getting to the cafeteria and selecting foods a strengthening task. His visitors will not feel they have to whisper and, in short, he will begin to feel halfway back into the outside world. Eight days after his surgery, he will go home, slicing an average of at least two days off the time he would have spent in an old-style hospital with a similar gall bladder case.

pointed out a weak spot in the precautions against post-surgical infection. Dr. Carl Walter of Boston's Peter Bent Brigham Hospital, a past innovator in operating-room design, told Dr. Gillespie, "You can put all the vinyl you want on the walls, John, but how are you going to control people? If you don't, none of it is any good." Germs, after all, are not self-propelled; they are always carried.

A study was immediately begun to find out where people really need to go in a hospital—and when. After a year the answer to the people problem was found: multiple corridors with one-way traffic. Barriers, locks and blocks to wrong-way travel will rule out temptation to slight the rules or short-cut the routes. A doctor who dresses for surgery and then is inclined to step back into a dressing room for a smoke will be unable to do so because doors will have locked behind him. Visitors will not be allowed into the germ-free areas unless they go through a decontamination process.

Even the scrub sink will be changed. "Every intern is taught that he must scrub his hands and arms with germ-killing detergent for five minutes before gowning for surgery," says Dr. Gillespie. "He is supposed to do it with his elbows extended far enough in front of him so that the washing solution drips from his elbows into the sink. But except in the movies, just about every surgeon decides after the first operation or two that this awkward extra strain on his muscles is not absolutely necessary. He just holds his elbows out from his sides and the floor around the sink becomes a sloppy mess." The Georgetown solution is a sink with a circular cut-out at the front into which the surgeon steps and with side-wings extending out beneath where his elbows actually will be. "I don't know why they've never been made right before," says Dr. Gillespie. "As it is with the whole field of hospital design, everybody knows what should be done, but nobody has bothered to do it."

Many details are still being worked out. All doors, whether swinging or sliding, may be replaced with air-stream barriers. Two-way pass-through cabinets for clean and soiled linens and

room walls to reduce the number of times staff members need enter. Conveyor belts may replace supply carts. And, if an extra $1 million can be found, a pressurized-air surgical chamber may be built; it would literally saturate patients' tissues with oxygen and permit operations and therapy which would otherwise be impossible.

The new wing will be equipped to serve as a civilian disaster center, something few communities have but sooner or later nearly always need. On those rare times when a community is afflicted by air crashes, riots, tornadoes, floods or collapsed buildings, the need for mass medical aid is overwhelming. "It's shocking to think," says Theodore Mariani, head of one of the two architectural firms working with the doctors, "that even if we had a major bus accident in Washington today, no single hospital could care for more than six or seven critically injured patients at a time. In case of a full-scale civil disaster, say with 1,000 injured, all the hospitals in the entire area could accommodate would be about 100. The other 900 would just have to pile up and wait."

Architect Theodore Mariani and associates have designed the wing with flexibility for future additions, in case funds become available for more innovations.

Solving the 'people problem' with one-way corridors

The wing will have a helicopter port, entranceways for 20 ambulances to unload simultaneously, and a vast emergency area in a second sub-basement—directly underneath the surgical suites and preop unit. Here, supplies will be stored, 1,000 extra cots can be set up quickly in open wards and space will be available for at least 4,000 uninjured refugees and medical personnel. At more tranquil times the disaster spaces can be used by the hospital as spacious and efficient wards.

Also, since the wing is designed to be partially underground and requires fully filtered air to combat germs, it will be made heat- and blast-resistant as well, in order to serve as a central refuge in the event of nuclear warfare. "The need for a nuclear shelter may, of course, never come," says Mariani. "But the requirements dovetail beautifully into its other functions with only a minimum added cost for the added protection."

Because of rapid changes in medical technology, an important question has arisen: is the addition of just one new wing the best answer to the efficiency gap? "Operating any hospital for just two years costs more than its construction," says Architect Mariani. "Perhaps all the old hospitals should just be torn down every few years. Industry does it that way; a technologically obsolete factory, no matter how recently built, is just knocked down and replaced. But in the case of a hospital, the community has put so much sweat and pain and emotion in between the bricks that there is a strong urge to salvage the existing facility."

Yet if the Georgetown "concentrated artillery wing" concept really proves out—in restrained costs, saved lives and short-circuited frustrations—hospitals all over the country may be able both to save the old and incorporate the new. Adding a new concentrated-care wing of appropriate size—compact and computerized, streamlined and sterilized—may be far wiser than endlessly trying to rip out enough of the old innards to find room for modern techniques. As Dr. Gillespie puts it, "What we learn here may make it possible to design packaged medical modules that can be stacked up to any desired capacity and plugged onto virtually every hospital in the country."

"It's fairly clear," says Dr. Hufnagel, "that, immediately, we will be able to improve the level of care by at least 100%. Others can do the same. How much higher than that we can go is the only question." The urgency for such improvement in tomorrow's hospitals is revealed by another surgeon's remark: "The physical plant must be improved quickly. There's no point in a patient's going through the delicate ordeal of having a lifesaving plastic part inserted if he is going to die soon afterward of infection. We might just as well put in a piece of bubble gum."