

Comment

## War and peace

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The shadow of war - certainly the longest and darkest of all shadows - has cast a pall on the celebrations taking place this month to mark the fiftieth anniversary of the publication of Watson and Crick's paper describing the double-helical structure of DNA. It's hard to be cheerful when the products of scientific research are being used to kill other human beings in the nominal quest for weapons of mass destruction that are, likewise, the products of scientific research. Regardless of one's feeling about the validity, morally or legally, of the war in Iraq, I would guess that most civilized people (with the possible exception of some government officials in certain members of the Coalition of the Willing) would agree that anytime war breaks out it represents a failure of our collective efforts as a species to overcome our instincts for violence, to evolve into something we can be proud of.

Man isn't the only species that wages war, of course. Ants, for one, campaign ruthlessly and with great skill, and make slaves of their defeated enemies. But man is certainly the only species that wages war while agonizing about whether it's right to do so. The concept of the just war is largely Judaeo-Christian. It is most completely set out in two treatises many hundred of years old: *The City of God*, by Augustine of Hippo, and the *Summa Theologica* of Thomas Aquinas. Just war theory says that war can only be waged legitimately if the following conditions are met. First, it is the last resort. Second, it is waged by a legitimate authority. Third, it is undertaken with a reasonable chance of success. Fourth, its aim is to re-establish peace. Fifth, the suffering caused, or thought likely to be caused, by the war must be less than the suffering caused by leaving in place whatever evil you are trying to correct - such as a despot on the throne (so, it is waged only in proportion to the injury suffered). And sixth, it must discriminate between combatants and non-combatants. The Bush doctrine of preemptive war argues that expansion of this theory is necessary because, as it has been put by Chuck Colson (older readers may remember him from the good old days of Watergate - well, he's back) "waiting for the

other side to shoot first is tantamount to committing national suicide." That might be worth arguing about, but it's way too general. It implies that, for example, the US would be morally justified in waging preemptive war against anybody who has even the capacity to shoot first, regardless of how likely it is that they actually ever would (look out, England).

My personal opinion is that the war in Iraq has big problems with the first and second conditions, at least, but in any case it seems clear to me that nearly all wars in human history would have trouble satisfying these conditions. Perhaps the outstanding exception is the Second World War (if we put aside the Allied firebombing of Dresden and Tokyo, and the atom-bombing of Hiroshima and Nagasaki, where the sixth condition was blatantly ignored). World War II is of more than passing interest here, because this 'just war' gave rise to the modern system of publicly supported scientific research. Prior to 1945 nearly all scientists were doing either largely applied research funded by industry or the military or basic research funded chiefly out of their own pockets. Basic research well into the twentieth century was the province of the independently wealthy, like Robert Louis Stevenson's Dr Jeckyl. Government got into the business of funding fundamental research in a big way after World War II for two reasons: one is that Vannevar Bush, a science advisor to the US President after the war, argued successfully that science was, as he put it, "an endless frontier" that would lead to a brighter future for all mankind. But we should never forget that the other reason is that physicists (and to some extent chemists) had shown dramatically during the war that scientific research would also lead to bigger and better weapons of mass destruction.

The end of the Cold War shook the physicists' grip on the reins of science policy. With the nuclear threat diminished it was harder for them to argue for the huge chunks of money that nuclear physics, in particular, requires, and their counsel became less essential as well. Now biology is king,

for a day anyway. Again, there are two reasons: one is because biologists have argued successfully that basic biological research will lead to a brighter future in terms of human health. But the other reason is that biologists have also shown that they too can make weapons of mass destruction.

Yet if the fiftieth anniversary of the double helix teaches us anything it ought to be that great scientific discoveries are almost never made in time of war or directly for the purpose of war. Governments at war aren't really interested in basic research. The Manhattan Project, which produced the atomic bomb, was the development side of 'R&D'; the research part was mostly done prior to 1940, for no purpose other than to address fundamental questions about the nature of matter. Watson and Crick would have had neither the time nor the resources to inquire into the structure of DNA if England had still been at war; in fact, Crick was soured on physics and turned towards biology in part by his military work during World War II. Great science is the product of peace. It is a luxury that well-defended but fundamentally peaceful peoples allow themselves. It is not clear to me that it can flourish in, for example, a society that adopts a doctrine of preemptive warfare.

As is apparent from the reminiscences in Watson's 1968 book *The Double Helix*, Watson and Crick didn't only walk into a pub and announce their discovery; they also published their model for the structure of DNA because they believed it was important that everyone know all about it. "The secret of life", as Francis Crick called it with characteristic modesty, was met with a resounding yawn. (A similar chorus of yawns greeted the announcement on April 14 that the draft sequence of the human genome had now been converted into a finished sequence with less than 0.01% error rate. Why couldn't the public genome project leaders have waited a few days and timed their announcement for the exact fiftieth anniversary of the Watson and Crick paper on April 25? They then would have received the front-page coverage their achievement - completion ahead of schedule and under budget - surely deserves.) Almost no one referenced the classic 1953 *Nature* paper for a considerable time. It was ten years before Watson and Crick were awarded the Nobel Prize (many discoveries of lesser importance have been so rewarded in five). Yet eventually the structure of DNA did what they knew it must do - transform biology into a molecular science - because it was out there for anyone to look at and think about. And so the direction of biology changed forever for the right reason, because all of a sudden we understood something we had never understood before.

Fear of bioterrorism is already threatening to erode our faith in the free and open exchange of scientific information. Massive increases in research funds for previously financially moribund fields such as microbiology and vaccine development, given in the name of biodefense, are likely to shift the direction of biological research for decades to come,

but it will not be because we understand something new but because we are greedy and afraid. Some good things will emerge from all this, no doubt, but it's hard for me to be very sanguine about the future at a time when war is almost becoming respectable again. Well, happy anniversary anyway.

