

SENATOR PORTMAN; SENATORS WHITEHOUSE AND UDAL; CONGRESSPERSONS: THANK YOU FOR THE OPPORTUNITY OF SPEAKING WITH YOU THIS AFTERNOON.

MY BIT OF EXPERTISE IN THIS SUBJECT COMES FROM HAVING SPENT FIVE YEARS RESEARCHING A BOOK ON ZOO NOTIC DISEASES.

A ZOO NOTIC DISEASE IS AN ANIMAL INFECTION TRANSMISSIBLE TO HUMANS. AT LEAST SIXTY PERCENT OF HUMAN INFECTIOUS DISEASES ARE ZOO NOTIC.

THAT INCLUDES DISEASES CAUSED BY STRANGE NEW VIRUSES THAT SOMETIMES APPEAR, SEEMINGLY OUT OF NOWHERE, AND KILL HUNDREDS OF PEOPLE—SOMETIMES WITH THE POTENTIAL OF BECOMING A GLOBAL PANDEMIC.

WHERE DO THESE STRANGE NEW VIRUSES COME FROM? THEY COME FROM WILDLIFE. EVERY SPECIES OF ANIMAL ON EARTH CARRIES VIRUSES, AND IN MANY CASES, THOSE ARE VIRUSES UNIQUE TO THE SPECIES OR TO A SMALL GROUP OF RELATED SPECIES.

SOME OF THOSE VIRUSES ARE CAPABLE OF TAKING HOLD IN HUMANS, REPLICATING ABUNDANTLY, CAUSING NASTY DISEASE, AND TRANSMITTING THEMSELVES FROM HUMAN TO HUMAN. RECENT EXAMPLES INCLUDE: MACHUPO (BOLIVIA, 1961), MARBURG (UGANDA TO GERMANY, 1967), EBOLA (1976), SIN NOBRE VIRUS (FOUR CORNERS, 1992), HENDRA (AUSTRALIA, 1994), NIPAH (MALAYSIA AND BANGLADESH, 1998), SARS (CHINA, 2003), MERS (ARABIAN PENINSULA, 2012)

AND THEN THERE'S HIV. WE NOW KNOW THAT THE AIDS PANDEMIC BEGAN WITH SPILLOVER OF A CHIMPANZEE VIRUS, FROM A SINGLE CHIMPANZEE INTO A SINGLE HUMAN, IN THE SOUTHEASTERN CORNER OF CAMEROUN, BACK AROUND 1908, GIVE OR TAKE A MARGIN OF ERROR.

THAT'S AN EXCELLENT EXAMPLE OF HOW BUSHMEAT CAN TRIGGER AN INTERNATIONAL PANDEMIC.

SOME OF THESE NEW VIRUSES ALSO HAVE HIGH RATES OF MUTATION, MEANING THAT THEY EVOLVE QUICKLY AND CAN ADAPT TO NEW CIRCUMSTANCES. THAT CAPACITY FOR RELATIVELY FAST EVOLUTION MIGHT ALLOW THEM TO IMPROVE THEIR TRANSMISSIBILITY AMONG HUMANS, OR TO INCREASE IN VIRULENCE, OR POSSIBLY TO *DECREASE* IN VIRULENCE, AS THEY REPLICATE AND SPREAD. IT MIGHT ALSO ALLOW A VIRUS TO WORK AROUND A VACCINE.

WHICH VIRUSES HAVE THAT SORT OF "INTRINSIC EVOLVABILITY"? AMONG THE GROUPS AT THE TOP OF THE LIST ARE THE INFLUENZA VIRUSES AND THE CORONAVIRUSES.

THE ANIMAL IN WHICH ONE OF THESE DEADLY VIRUSES LIVES INCONSPICUOUSLY, OVER THE LONG TERM, IS KNOWN AS ITS "RESERVOIR HOST." THAT MIGHT BE A RODENT, IT MIGHT BE A MONKEY, IT MIGHT BE A BIRD. IN A LOT OF THE CASES I'VE MENTIONED, IT'S BATS, ONE OR

MORE SPECIES. HENDRA VIRUS IN AUSTRALIA—BATS. NIPAH VIRUS IN BANGLADESH—BATS. MARBURG VIRUS IN EAST AFRICA—BATS. THE SARS VIRUS—BATS.

I CAN TALK ABOUT *WHY BATS?* IF YOU WANT ME TO, BUT ONE OF THE REASONS IS SIMPLY THAT BATS ARE AN EXTRAORDINARILY DIVERSE ORDER OF MAMMALS. ONE IN EVERY FOUR SPECIES OF MAMMAL IS A BAT. SO ON THAT BASIS ALONE, IT'S LOGICAL THAT THEY WOULD *SEEM* OVERLY REPRESENTED AS RESERVOIRS OF VIRUSES THAT INFECT HUMANS.

THE CONSEQUENCE OF ALL THIS IS PROBABLY OBVIOUS: CAPTURE OR KILLING OF WILD ANIMALS FOR FOOD, OR FOR ANY OTHER REASON, BRINGS HUMANS INTO POTENTIALLY CLOSE CONTACT WITH THE VIRUSES THOSE ANIMALS CARRY. THAT'S ESPECIALLY TRUE WHEN THE KILLING OR CAPTURING IS DONE IN HIGHLY DIVERSE ECOSYSTEMS, WHERE THERE *ARE* MORE KINDS OF VIRUSES.

THE VIRUSES DON'T *WANT* TO INFECT HUMANS. VIRUSES HAVE NO WISHES, THEY HAVE NO MALICIOUS INTENT. THEY SIMPLY FOLLOW THE BASIC DARWINIAN IMPERATIVE: WHEN OPPORTUNITY PRESENTS, REPRODUCTIVE INSTINCT WILL CAUSE YOU TO SEIZE THAT OPPORTUNITY—BY INCREASING YOUR NUMBERS, BY EXTENDING YOUR EXISTENCE AS MUCH AS POSSIBLE THROUGH SPACE AND TIME. AND EVOLUTION BY NATURAL SELECTION WILL HELP YOU FIND WAYS TO SUCCEED.

THERE ARE 7.7 BILLION HUMANS ON THIS PLANET. FOR A VIRUS, WE ARE HABITAT. WE ARE OPPORTUNITY. IN FACT, FOR A VIRUS, INFECTING HUMANS IS THE ULTIMATE OPPORTUNITY.

IN PURELY DARWINIAN TERMS, THE MOST SUCCESSFUL VIRUSES ON EARTH RIGHT NOW, I WOULD SAY, ARE HIV-1 AND SARS-CoV-2.