Chandra Will Investigate:
The Creative Violence of Supernovae

What is a supernova?
A supernova is a catastrophic explosion of a massive star. In our galaxy this occurs, on average, about once every 50 years.

What causes a massive star to explode?
When a massive star uses up its nuclear fuel, it collapses. The interior of the star is crushed to higher and higher densities, eventually reaching temperatures of billions of degrees. Under these extreme conditions, more energetic nuclear reactions occur violently and the collapse is reversed. A thermonuclear shock wave races through the now expanding stellar debris, fusing lighter elements into heavier ones, and producing a brilliant visual outburst that can be as intense as the light of ten billion suns!

Why are supernovae important to our existence?
Without supernovae many of the elements necessary for life would not be available on Earth. Elements such as carbon, nitrogen, and oxygen are manufactured deep in the interior of stars. They remain there until a supernova spreads them throughout the galaxy.

Elements heavier than iron, such as gold or iodine, cannot be produced from reactions in normal stars. A supernova is the only process in the universe energetic enough to form these heavier elements.

Why is an X-ray telescope useful for observing the effects of a supernova?
The shell of matter thrown off by a supernova plows through the surrounding matter and creates a bubble of multimillion-degree gas. This hot gas will expand and produce X-ray radiation for thousands of years. Chandra will make it possible to study, better than ever before, the carbon, nitrogen, oxygen, silicon, calcium, iron, and other elements created by stars and spread by supernovae.

Supernovae are creative flashes that renew the galaxy. They seed the interstellar gas with heavy elements, heat it with the energy of their radiation, stir it up with the force of their blast waves and cause new stars to form.

Look at a periodic table of the elements and find the elements numbered higher than iron. How would life be different if there were no supernovae and these elements were never created?