

IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Tapping into nature: the production of tyres and medical gloves starts here, at the rubber tree.

research institute focused on natural rubber, Loadman knows about chemistry and production technology, and his presentation of the chemical aspects is technically detailed. But explaining the chemistry is not enough.

The problem comes with the physics. Load-

man claims that the physical theory of 'rubber-like elasticity' is too involved to present in any detail, so the source of rubber's elastic restoring force and of the very large elastic strains that can be attained is left unexplained. The elastic behaviour of rubber is fundamentally different from that of other, non-polymeric, solids: it is entropy made tangible, and no explanation is adequate unless it takes into account the probabilities of different microstructural arrangements of the polymer chains.

One difficulty in the book is the author's use of the word 'elastic'. He uses it to denote the capacity to generate very large reversible strains — that hasn't been the sole meaning since Hooke's work on elasticity in the seventeenth century. Furthermore, rubber, especially before it has been vulcanized, is not elastic but viscoelastic: the strain generated by an applied force varies with time under stress. This characteristic governs many features of rubber, including the adhesion of a tyre to the road surface and the comfort of someone sleeping on an elastomeric mattress.

The book is full of interesting information. But it is uneven, and the gear changes are so abrupt that the narrative tyre tends to skid. ■ Robert W. Cahn is in the Department of Materials Science and Metallurgy, University of Cambridge, Pembroke Street, Cambridge CB2 3QZ, UK.

INSTALLATION

Uranium days

The Children of Uranium

At the Museo d'Arte Contemporanea di Villa Croce, Genoa, Italy, until 18 December. In English. www.museovillacroce.it

Sylvie Coyaud

Peter Greenaway is best known as a filmmaker. But he actually trained as a painter, and his particular sense of aesthetics is exhilaratingly apparent in his new multimedia operacum-installation, *The Children of Uranium*, which opened during the Genoa Science Festival earlier this month.

Created together with theatre director Saskia Boddeke, the work explores Greenaway's longstanding concern with the history of the element uranium. It is played out in a nineteenth-century palazzo, now used as an art museum. The palazzo's first floor and the grandiose staircase leading to it were cleared and redecorated for the installation. Each of the eight rooms is home to a different protagonist — from Marie Curie to George W. Bush — all of whom have played some role in society's

evolving relationship with uranium.

The audience is free to wander between the different sets. Their senses are bombarded by a mix of science, history, politics and philosophy during 90 minutes of song, dance and recitation. The characters of the nine performers change according to the environment.

In the lobby, Isaac Newton shaves, builds something — perhaps a prism? — using wooden tools, meets a naked Eve with whom

he shares, in dance, an apple, which is suspended by an invisible thread from the ceiling. The music rises and a tenor climbs the staircase singing, in a slightly threatening chant, the names of the first 92 elements of Mendeleev's periodic table. Despite his eighteenth-century court costume, this is the angel Moroni, who led the founder of the Mormon Church, Joseph Smith, to Utah and to the uranium mines of Moab. Upstairs he becomes Smith and ushers the audience into a room made up as the Oval Office, where President Bush plays with pencils, mulls over how to destroy the axis of evil, gets bored and practises his golf shots.

Meanwhile, in another room, Marie Curie kneels on pitchblende pebbles, surrounded by cabinets of laboratory glassware, and talks to her dead husband. "What have I obtained, what have I lost?" she cries over and over again. Butterflies seem to fly out from the pattern of the wallpaper to follow her in a dim beam of light, in a scene reminiscent of Gabriel García Márquez's *A Hundred Years of Solitude*, vanishing as she enters Robert Oppenheimer's grey cave. Here Oppenheimer watches, in anguished silence, the first nuclear explosion, projected in a continuous reel on to a fine-meshed screen, as if on smoke. He clutches to his chest a framed picture of a deformed baby.

Next door, Albert Einstein writes, smokes a pipe and chats with other performers in a study cluttered with books and papers, blackboards and equations. His letter of August 1939 to Franklin D. Roosevelt, in which he urges the president to build an atomic bomb before the Nazis do, is projected on the floor.

In a prison cell, Nikita Khrushchev reenacts his speech at the United Nations during the Cuban missile crisis, while the speech is shown on a television set. Mikhail Gorbachev mourns his wife, Raisa, next to her coffin. Her dresses hang listless from the ceiling, from which water starts to leak.

"Political decisions should not be left to scientists," sing the tenor and the soprano. Were they ever? But, the opera seems to tell us, perhaps they should also not be left to the bored

US president, nor to Khrushchev, drunk on vodka and the power of his nuclear weapons, nor yet to Gorbachev, a loser, broken by the death of his wife and the fall of the Soviet Union. "We are all the children of uranium," the singers continue. How we use it is for us, the people, to decide.

The live performance comes to an end, but recordings have been intelligently incorporated into the installation. Its large scale and small details challenge and perplex. Greenaway's relationship with physics remains ambiguous, but his creation is visually stunning. ■ Sylvie Coyaud is a science journalist based in Milan, Italy.



Albert Einstein makes the case for the bomb in *The Children of Uranium*.