
from **CRITICAL ASSEMBLY**
John Canaday

ALBERT EINSTEIN

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Life is finite

and improbable.

The wooden tiller smooth as living skin
trembles under my fingers' calcite grip.

What was the chance of my appearing here
and now? And yet my sail has only filled
as nature wills, and as its laws decree

my prow points out across Peconic Bay.
The water, white-capped, wrestles with the wind.
I wrestle both, though each of us obeys

and manifests the selfsame laws.
The instruments are mortal, what we measure
infinite. Mankind's proper posture

must be awe: our bodies' currents carry us,
like Newton (grant we travel half so far),
toward revelation of the limits God

has set on nature. Are we fit to know
such secrets? We cannot resist the sweet
temptation of the possible: we eat

the apple, build machineries of war,
reshape the world in our short-sighted image;
yet no physicist could have a soul so poor

he would not do as much to see God's face.
Nostra culpa! The more we know, the less
we feel. Man cools more quickly than the earth.

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OTTO FRISCH

Physicist

Rare earth sparks the clouds
between two wars.
Fermi, Hahn and Strassman,
Joliot-Curie—
all chemists, physicists,
track protons now.
But Hitler's blinders point
to Austria:
the occupation interrupts
Aunt Lise's
parting of nature's mists.

When she departs
for Sweden, isotopes
of radium
(she thinks) sit on her desk,
unanalyzed.
Lonely, she summons me
north to Kungälv
for our Christmas ritual.
Her colleague's letter
intercepts festivities.
The body's tagged,
identified by Hahn.
It's barium.
I strap on skis; she demurs,
makes good her claim
to move as fast without.
The woods that wall
the Göta älv become
our conference room;
a fallen spruce's trunk
our sticky seat,
my pockets stocked with scraps
of hotel paper.
We know uranium
can't crack in two
against the grain of Gamow's
alpha theory.
Yet it does. We turn
to Schrödinger
for insight: particles
are waves. Then Bohr:
a nucleus is liquid,
like a drop. Our thought:
that heavy nuclei
must undulate
like water molecules,
collectively.
In larger elements
charge balances
the surface tension. Struck
even lightly,
in neutron capture,
the pseudo drop
will wobble, waist, and split.
Sometimes physics
lacks words for what we think.
Its abstract paths—
quantum tunnel effects,
packing fractions,
and disintegration—
lead to thickets
where neutrons multiply
like rabbits, wildly.
The winter woods are gone.
The mind's meadows
bloom as I calculate
the energy
released: two hundred million
electron volts.
Now atoms break and breed
like living cells.
I name their splitting "fission"
and publish it
where even Nazi stooges
can read the news.

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LEO SZILARD
Physicist

In 1913, H.G. Wells produced *The World Set Free*, a novel that describes a global war fought with atomic bombs. Moonshine, Ernest Rutherford would say, with all the Cavendish to echo him. An expert is a man who knows what can't be done. Wells is a dilettante, no doubt—his books chock full of wild imaginings—and yet he does his homework, foreseeing consequences of another man's discoveries more clearly than the man himself. We met once at a dinner party. He was fierce in his pursuit of truth. He cared more for ideas than men—and so he dedicates *The World Set Free* to Frederick Soddy's book on radium and not its author. Individuals will come and go, but what we think and write lives on to bless or haunt the future. Lately, Wells's work haunts me more. I thought at first, like Rutherford, I knew reality from make-believe. But Wells foresaw the birth of man-made radioactivity in '33—he named the very year! And when this fiction proved a fact, the rest seemed . . . plausible. And so I sipped Wells's moonshine. Lounging in my hotel bath past noon, I bribed my body with hot water, let my mind float free—what better place to think than in a tub?—until the maid descended. Then I dressed and strolled through London, wondering. One day I wandered down Southampton Row. A red light broke my chain of thought. I balanced on the curb, and when the light turned green I felt the swift, sweet surge of inspiration hit and knew the missing piece must be an element that would absorb a single neutron when it split and then emit two more. I knew this element, assembled in sufficient mass, might well sustain a chain reaction. Only slowly did the joy of insight give way to a more foreboding thought. I couldn't publish this. Instead, I patented the concept and assigned it to the Admiralty and prayed that no one in the Reich read H.G. Wells. But if all knowledge comes through individuals, it comes to answer questions asked by history. I knew that one day soon I'd have to make a choice, or sit back in my bath and have it made for me.

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LEO SZILARD
Physicist

Not everyone can be as fortunate as Christ. To sacrifice yourself and do some good takes luck. I've had some luck and given one-fifth of my heart to help the world. But always four-fifths I retained. Perhaps it's right that I became a Calvinist: there's something of the proselytizer in my soul, and even Einstein heeds my call. And Wigner. And his car. We set out from the King's Crown on the 12th to find the summer cottage of a Dr. Moore where Einstein lives and sails and thinks his hermit's thoughts. But Wigwam got us lost. Cutchogue and Scuttlehole, Yaphank and Shirley Mastic proved enough to make this pair of former Jews from Hungary despair.

The heat was deadly. No one knew the doctor or his cottage. I had reached the end of my one-fifth. But Wigwam parroted my words: "We have a duty." No more, perhaps, than I deserved, and maybe less. I asked a sunburned boy of seven if he knew where Einstein lived. He pointed with his fishing rod, "Of course I do." And so he did, for good or ill. We sat with Herr Professor on a screened-in porch and sipped iced tea. We spoke of my experiments, the lattice of uranium and graphite, how the neutrons multiplied, and he was quick to see the danger: "Daran habe ich gar nicht gedacht." I can't believe he hadn't thought of it before, despite his self-sought exile for the past ten years. Perhaps he wanted to believe it was not yet a necessary fact. I shared that wish, of course, though in my heart I knew the figures hadn't lied. I feared we'd need Christ's luck before our work was done.

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ALBERT EINSTEIN
Faculty, Institute for Advanced Study

The Czechoslovak state is occupied,
the Nazis stockpile its uranium,
and Leo claims they plan to make a bomb.

He's had some crazier ideas. And if
I listened when he pitched induction flow
refrigerators, why not now? Perhaps

God has designed the world as I have thought,
and firing neutrons at the nuclei
of heavy atoms is like shooting birds

at night. But if I'm wrong, my data old?
It's not improbable that novel sources
of enormous energy exist. And if

we follow, then . . . O grant us no such then!
If Leo's right, then all bombardments all
together since the first men used firearms

would be child's play to what we will unleash,
and we will build ourselves a future age
to make our coal-black present shine like gold.

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EDITH WARNER
Ran a tea room by the Rio Grande

I had been raised a city girl, and loved it—so I thought.
Who needed mountains when a new museum massif loomed
in Fairmount Park? What use the desert's blank rock silences
when Lloyd and Chaplin played the Palace? I had never dreamed
of any other world. But in the middle of my life
a sudden illness blighted my internal neighborhood.
My doctor couldn't name it, knew no medicine but rest.
A year of it. In Philadelphia? One couldn't find

a city minute's stillness there. But every other place
was just geography. My parents' friends clipped articles
that touted German sanatoriums. Mine spun the globe
and urged gay fantasies, though these daydreams always ended, "But
you can't go! I would miss you!" Only Charlotte spoke first hand:
a guest ranch in Frijoles Canyon outside Santa Fe.
"Beans Canyon?" Skepticism was among the luxuries
I'd have to learn to do without in heaven's stony hills.
That didn't worry me. What did was that I didn't doubt.
Or grieve. Friends. Family. Home. I left them all almost with joy.
I watched my mother bustle stubbornly—she fought her fear
with endless energy and counseled seven kinds of sense.
My father frowned and looked for God a foot above my head,
while Oma tried to hide her Deutschlich tears with pious jokes.
I laughed politely, feigned regret, said solemn words, and packed.

What devil took me—or what god? Call it New Mexico,
as I did, knowing nothing but the tremors in my heart,
a many chambered conduit, I learned, for more than blood.

The landscape's nudity surprised me—everywhere bare rock
clothed only in a shift of shadows, sand pooled deep in dry
streambeds, wide gravel washes, deadwood caked with dust, cracked mud,
silt ankle deep in drifts beside the rusted rails. Even
the air seemed naked, stripped of all humidity, crisp, chill,
and intimate. The ranch's battered Packard stuttered north
along a washboard road, turned west, and spun its wheels in clouds
of alkali. The Rio Grande slid like a sleepy snake
so low between its banks the worm-etched wooden trestle bridge
at Buckman siding sang and shrugged its shoulders under us
before I saw a drop of water.

Land of absences,
transparent, vast, a bleached skull's hollow eye, a gulf, a gasp,
a window on the void. My flesh drew tight around my bones.
Was this the heaven I abandoned home for? No. I'd dreamed
a sham. This place was where God rested on the seventh day.

The Packard staggered up a switchback gouged in soft, white tuff
across a mesa's outer face, and as we rose, the world
unfolded like a Mariposa lily's golden heart
when clear rain follows years of drought. We reached the mesa's crest
and straddled a deeply rutted track back toward the Jemez range,
through juniper and piñon, stands of arching western pines
that shed sweet-scented needles like a cloak to tamp the dust.
The road stopped at a canyon's edge. A packhorse grazed thick tufts
of grama grass that bowed bright tasseled heads like sieves of light
beside a steep trail down the canyon's wheat and coral walls.
They formed a crescent mirroring a little river lined
with sun-drenched alders and a stone ranch house. That night I slept
in silence I could feel against my skin. I woke to climb
the canyon trail each morning, walk all day among the groves
of scrub oak and majestic ponderosa. Indian
paintbrush and prickly pear, the spiny cholla's fuchsia blooms
led past the cultivated bounds that had defined my life.
The dust itself seemed full of life—not ashes, but dry clay
only wanting rain and artful hands to free its echoes
of eternal forms. I walked home under a descending sun
that brushed fresh fire on the mountains called the Blood of Christ,
as liquid turquoise filled the valley like a rough clay bowl
the way an old man's eyes will brim a last time as he dies.
Our blood is slaked with earth, each vein that feeds our dusty hearts
a trumpet vine entangled in an old salt cedar's arms,
calling the newly faithful to a kind of reckoning.

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ROBERT SERBER
Physicist

Robert and his brother spent their summers
in the Pecos Mountains north of Santa Fe.
They had a ranch they called Perro Caliente—
Katie Page's Spanish double take
on Robert's first words when he saw the place.
In '35 he summoned us to make
the pilgrimage, and though our city blood
felt like the sap of potted plants, I'd learned
to pity men who disappointed Oppie.
So we headed down Route 66,
with Charlotte riding shotgun, primed to find
high mountain meadows, a canopy of stars.
We crossed into New Mexico, and bang!
the highway turned to dirt. We wondered if
we'd underestimated how much zeal
we'd need. We wondered for two hundred miles.
But once we'd passed the cabin and the small
corral half-hidden in the aspen, twice,
before we grasped it must be Oppie's "ranch,"
we thought we knew the worst. What did we know?
The place was "picturesque." Two rooms. In one
a battered couch, a Navajo throw rug
beside the huge stone hearth, and that was it.
The kitchen housed a wood stove and a pot
of chili left to ripen all week long.
No sink. No plumbing, period. No place
to sit. They all slept on the bare board floor.
It daunted us at first, until we learned
our worry was unfounded, since a few
"old friends" had happened by that afternoon
(the way Scott must have happened by the Pole)
and commandeered our spots on Oppie's floor.
Instead, our kind host loaned us horses. "Ride
straight north, toward Jicoria Pass," he said.
"Blue and Cumbres know the way." We tried
to smile. "In three days you'll reach Taos, where
they always have a room for friends of mine."
Well, I'd seen photographs of horses, once,
so who was I to look these in the mouth?
We mounted gingerly and said goodbye
to Oppie. Almost as an afterthought,
he handed us a fifth of scotch, a box
of crackers, and two bags of oats. "The oats
are for the horses," he admonished us.
We gave the beasts their heads and off we went
into the Pecos wilderness, two rubes
trusting in God as they had never done before.
By afternoon our fears had eased, replaced
by pain: the stirrups bruised our city feet,
the saddles rubbed our thighs and buttocks raw.
We camped that night beneath the canopy
of stars, but hardly noticed them as sore
legs stiffened, backs cramped, tender blisters swelled.
The first two days remain a nightmare blur.
Then on the third day Charlotte lost her grip
and fell. I ran to help, but she got up,
said she was fine, and seemed to be, except
for what appeared to be a bloody straw
stuck in her cheek. I tried to pluck it out
and found it was a fountain of her blood.
A pine needle had pierced her cheek and hit
an artery. I tore strips from my shirt
and bound her jaw. The bleeding wouldn't stop.

What could we do? We mounted our horses
and urged them on toward Taos. Two hours
later, a cluster of adobe houses
appeared on the horizon. Charlotte broke
into a gallop. When she reached the town
she reined her horse in by a wide-eyed group
of local men and fell off at their feet.
They called a doctor, and he sewed her up.
So ended our adventure: a small taste
of life in Oppie's world, which might, you'd think,
have left me soured on my boss. But no:
we'd reached past every possibility
we had imagined for ourselves, inspired
by Oppie's expectations and his blunt
refusal to allow that we might fail.
He drove us past all inhibition. So
when Oppie called six thousand scientists
together in the Jemez range, among
the cottonwoods above the Rio Grande,
to do his secret weapons work, we came,
trusting what he would make of it, and us.

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EDITH WARNER

Ran a tea room by the Rio Grande

Luck finds me when I least expect it. Sometimes I have failed
to make it welcome. Poor, the desert of the here and now
lay all around me, bleak, stark, broken only by wild spice
bush, juniper, and prickly pear. I glimpsed the fingerprints
of god, and tried to turn away, wanting to roll like a colt
in the lush grass of memory's high mountain meadows. Bless
bad luck.

In Posahcongay, "where the water makes a noise,"
the pueblo men made camp, down from the mountains hauling logs
for railroad ties. They laid the Chili Line from Santa Fe
to Antonito, and where it curves to cross the Rio Grande,
splitting a scraggly stand of cottonwoods, they built themselves
a small frame house—a drab, tan, temporary thing—its floors
and walls of knothole-pocked, unfinished boards rough-patched with tin,
a bleached tarpaper roof, skewed windows, and an unplumbed door.

Some men are moved by beauty; some prefer an easy glut.
The logging done, a Portuguese railman stayed on to guard
the broken boxcar depot run aground beside the tracks
that served as freight drop for the Ranch School at Los Alamos.
He hit up Connell for a watchman's wage and called himself
the station agent, but his living was a bootleg still.
He bought a gas pump and a Coca Cola sign and sold
drinks, soft and hard, canned food, and cigarettes. He stayed six years,
then disappeared midwinter—just when my own poverty
was ripe enough to answer Connell's need.

We like to count
blessings, thank lucky stars; but who can number all the names
of god? The first of May, and spring limped like a patchwork tramp.
I was alone—even my trunks less heavy than my heart.
But work distracts, and heals. I swept, hauled water, scrubbed the floors.
A cold wind whistled through the wallboard gaps. I lit the stove
and set a pot of ivy on a windowsill. My clock
ticked on a box of books. A soft Chimayo blanket turned
a folding iron bed into a couch. Slowly the house
foreswore its dubious allegiances and welcomed me.

In the long hour before the twilight, I sat on the steps
and listened to the river. Two great mesas to the south
loomed upward as if drawn out of the earth by ancient spells
the sun had whispered as it swung above their massive heads.
My nearest neighbors lived a mile away across the river.
I thought about the Colt revolver Connell lightly left
propped on a barrel of my mother's plates. "You'll not need this
but might sleep easier if it's to hand." Men place faith strangely.
I'd moved past being saved by men—or any works of theirs.
Madness or desperation brought me here, or so it seemed.
Yet I first heard the river's song that night; and now I dance
the steps for which the gods have shaped my feet. The future sleeps
in secret hollows in our bodies, rising suddenly
as wild geese cross a mesa's rim in long grey lines at dusk.
A flood tide in their hearts sweeps northward.
Death could be like this.

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ROBERT SERBER
Physicist

When Oppie's first recruits arrived in March,
few knew what we were working on. Rumors
stitched bits and pieces of the facts to pure
conjecture: radium-laced poison gas,
electric rockets, windshield wiper blades
for submarines. So Oppie had me write
some talks to bring our colleagues up to speed.
We used the lab's unfinished library.
While carpenters stomped in and out, and cursed
and hammered, hanging drywall, doors, and shelves,
I raised my voice above their senseless noise:

"The object of our work is to produce
a bomb—"

But Oppie stopped me cold. He said
I'd better pitch that word. I tried again:

"A gadget of the kind we hope to make
is likely to result in several kinds
of damage, which I'll outline briefly here.
With fifteen kilograms of 25
we can expect that this device will yield
a range of pathological effects
within a thousand meter radius.
The radioactivity will be
a million curies ten days afterwards,
tending to render the locality
unfit for habitation for some time.
The gadget also will initiate
acoustic waves, and their velocity
will superpose on the velocity
with which the vaporized material
will be convected from the blast in jets,
and so the wave will overtake itself
and build a well-defined destructive front.
Thus, if destructive action is regarded
as a function of the pressure amplitude,
it follows that the likely radius
of noteworthy mechanical destruction
will be about a mile. As you can see,

these are not insignificant results.
But they involve considerable cost.
Since the materials this work requires
are precious, they constrain us to maintain
as high efficiency as possible.
Our aim is, simply put, the maximum
release of energy per nucleus.”

Who would have thought mere words—so technical
and flat the workmen never blinked—could sketch
the pattern of a star to singe the earth?
But first, of course, we had to step aside
and let the work crew build our library.

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EUGENE WIGNER
Physicist

We are all guests
here in this world.
As for the next?
Better, perhaps,
that we not wear
our earthly welcome out.
I learned to love
America in Madison.
Exiled from Budapest
because I wished
to be a physicist,
and from Berlin
by Hitler, then
from Princeton by the men
who coveted my job,
I settled in the midst
of wheat fields in
Wisconsin, fields
like those of Belcza-Pusztá
where I learned to talk
when I was three,
laughing at my uncle's
homespun jokes.
In Madison, I learned
another language
from Amelia. She
took me by surprise
not with her beauty but
my love. What curious
animals we humans are
to need romantic love.
But then I've never been
the quickest to intuit
nature's laws. That was
the first of many things
I learned from her.
A few months saw us
married. Then her heart,
which was, I thought,
the stronger, suddenly
went wrong. No one
could tell us why
or how. Nine months
I lived in her
sweet light. I learned

to read by it
my own heart's flickerings.
Then darkness fell,
and I went back to work.

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EDITH WARNER
Ran a tea room by the Rio Grande

Venus hangs low above the mountains. After a long night's sleep
I feel less like a toy in constant need of being wound.
My headache's gone. My cracked lens bothers eyework, but I read
a little Lattimore. Tilano combs and braids his hair
after his Sunday riverbath. The chicken water pans
need cleaning. I will pickle winter pears, tomatoes, squash,
and then lay out tobaccy Dukey, lemons, and sardines
against the herders' ritual return, driving their sheep
down from the pastures of the Valle Grande.

Much I thought safe
is lost already. War drives innovation, justifies
a hasty, thoughtless excess. Dump trucks rut the riverbank:
the Army steals its gravel for construction on the Hill
and forces farmers from their beanfields on the high plateau.
Power can be so many things. The rivers, sky, trees, fields,
and even mountains take into themselves what we give off—
and give it out again. Niels Bohr would understand. Last night
his eyes drew fire from the pine knots burning on my hearth—
a golden brilliance that the Israelites thought heaven had—
a light that is the legacy of long forgotten trees,
the essence of the elements they gathered and release,
a living circle closed. "What lingers in your heart to say?"
I longed to ask, thinking he had a magic word for me.
But now I know there is no magic word—or need for one.
Only endurance, trust. He cannot tell me what they do.

As if he needed to, when Bethes, Fermis, Allison's,
and Tellers dine each night in my tea room; I recognize
the conversation of atomic specialists; I know
the sound of German and Italian natives, what it means
when such men staff a secret Allied military base.

They think I disapprove. They're right. But not of them.
Last summer Army drillers set up an infernal rig
to test what footing my yard's earth would offer for a bridge.
Fear moved in as a boarder, as it hadn't in past years
when peach trees failed to bloom or hoppers ate the pueblo crops.
But in the end they oiled the Española road instead.
The gods send fat and lean times. Always rain will follow drought.
But men are slow to learn. They trust their ingenuity;
they think their needs are paramount. And so our pueblo boys
ship out for England, Africa, and Guam. Hilario
was burned when his destroyer took a shell; Slim saw two friends
draw sniper fire; and 5 Cents lost a leg. Pity the soul
who doesn't know enough to disapprove.

This afternoon
we'll spend our rationed gas to gather wood on the plateau,
where sky and aspens vie in beauty. Soon hoarfrost will crisp
the smallest weedstalks, quieting the cries of canyon wrens.
Tonight I'll write a note to Brownie in the Philippines
on Peter's diabolical contraption. What the hunt
system will do to thought's another thing. I promised him.
Tomorrow Kitty comes for vegetables. Pronto will hunt
white turkey feathers with Tilano while our women's talk

brightens my kitchen. Later, Compton, Tuck, and Segre grace
my table. Levity and wisdom, laughter, somber words.
And I will serve them lamb ragout with cloves, posolé, sweet
tomato relish in an earthen bowl, and chocolate cake.
My “contribution to the war,” they call it. “To the peace,”
I’d say, but don’t. I’m grateful for the honor they intend.
I’ve listened to their talk and learned that what I thought beyond
man’s compass can be so strong in some it radiates from them.

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ROBERT SERBER

Physicist

Most days it was easy to forget
that we were building bombs. In fact, we weren’t.
My group in T-Division spent its time
comparing tamper scattering results
from Manley’s Cockcroft-Walton measurements
with half-baked estimates we’d jury-rigged
out of gut feelings, guesswork, and little more.
Our conversations ranged through new, exciting
territory: spark gap switches, spalling,
mean free paths, backscattering, and neutron
populations. Who had time to talk
of bombs? Technically, the job was sweet
enough, as Oppie said, to put your heart
and soul in—and we did. We took to sleeping
in the lab. Charlotte said she knew the loss
a widow feels. Even brushing your teeth
became a luxury. So when Bob Wilson
put aside his work one winter night
to host a meeting he sententiously
referred to as “The Impact of the Gadget
on Civilization,” not many people
took the bait. I wasn’t pinched by any
moral qualms, but out of friendship left
a stack of calculations on my desk,
wrapped up in my mackinaw, and went.
Besides, Priscilla told me Oppie planned
to go, and that, as everybody knew,
would make it an occasion. I can’t say
in any detail what was said. Incidentals
dominate my memory: the cold snap
early in the week that set the sea of mud
churned by autumn rains and army boots
as if in stone, the waning gibbous moon,
and Pegasus high overhead. Inside, the air
was fogged with warm breath as we talked
in the shadow of the idle cyclotron.
As I recall, we talked awhile about
the imminent defeat of Germany.
Someone alluded to Dumbarton Oaks
and said the new United Nations should
be founded on full knowledge of our work.
But who could tell our story? We were bound
to silence by our army oaths, the slaves
of military secrecy. Then Oppie said,
so softly, so intensely, no one thought
to disagree: “A demonstration. Let
the bomb speak for us.” It seemed obvious.
And left us even less time to discuss
the moral ins and outs of weapons work.
We followed Oppie from the lab like moths

drawn by the flame of his sweet eloquence.
Behind us, Wilson slowly powered up
the cyclotron. Its giant magnets hummed
their siren's song. Please God,
we weren't monsters. But we loved our work.

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EDITH WARNER
Ran a tea room by the Rio Grande

Over the years I learned their rituals. Tilano joined
the dancers for each new year's festival. On the fourth day
before the dawn the dancers disappeared into the hills.
Slowly women gathered in the plaza. I pressed close
against the wall of an adobe house. They stood in silence,
waiting for the sun to rise above the broad, dark shoulders
of the mountains. That first light seemed to free them, and they formed
a chorus, chanting to the living sun. Its power spilled
into the plaza, filling them. And then the men appeared,
their bodies painted black and white, with mottled turtle shells
tied at their knees and red yarn on their legs, embroidered kirtles
and the skins of foxes, great collars of fir, and feathers bound
into black hair. They moved in unison as animals,
as deer and mountain sheep and buffalo. Their moccasins
beat on the ground with lifted steps that took strength from the earth.
My body seemed to whirl and turn with them, until I thought,
were I an Indian, I'd be a man and dance with men.
But as I watched, I saw their dance revolved around the women,
who softly, slowly, with feet scarcely lifted from the ground,
held men and children, lightly, in the dance. And as they passed,
the women touched the dancing forms and mingled powers
of the earth and sun.

But then a distant sound of blasting
echoed from the canyons near Los Alamos. The tombe throbbed
and the chorus raised its voice. I watched a long plumed serpent
of grey smoke rise from the hills and spread above the pueblo.

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LOUIS SLOTIN
Physicist

My work required grace. It daunted some.
Feynman himself dubbed my experiments
"Tickling the Dragon's Tail." The theorists knew
in theory how these active elements
behave—or misbehave—as they explode.
But someone had to test their bright ideas:
how quickly slower neutrons multiply,
which tampers we should use, even the mass
a bomb required—it all involved guesswork.
At first when every microgram of twenty-
five had fifty people clamoring
for precedence, I used uranium
polystyrene pseudospheres. Later
I worked with nickel-plated hemispheres
of Hanford's gamma-phase plutonium
set in a half-shell of beryllium.
The trick was lowering an upper shell
until it nearly touched its mate below.

Too much space and no chain reaction—but
too little and I'd rather hold a bomb.
"Some delicate adjustments were involved,"
as Oppie said. No wonder I declined
the gross mechanical contrivances
my colleagues recommended—winches, clamps,
thumb screws, and whatnot—favoring my hands."
Grasping the upper shell in my right hand,
I'd rest its rim against the lower shell,
and hold it, hinged like an open oyster,
the pearl between its lips, plutonium.
Slowly I'd let the metal mollusk close.
The Geiger counter stuttered, cleared its throat,
and started chattering. To calm it down,
I'd keep an old slot-headed driver wedged
between the shells. A single metal blade
divided life and death—one slip would send
the whole assembly supercritical—
a sudden spray of neutrons in the gut
and then the long, slow, agonizing wait
as one by one my organs turned to mush.
Yet in those moments, I felt life and death
so fully, so intensely, I was past
all fear. I held a rough beast in my hands
and heard its infant chatter, half amazed
how mild it was and, till it recognized
its own essential terror, beautiful.

.....

KITTY OPPENHEIMER
Biologist

When Robert planted Peter in my gut
at first I felt a flag unfurling. "Claimed,"
my heart said. "Yes," my mouth. A month alone
in Reno earned our marriage, my divorce.
But when fulfillment? What euphoria?
I waddled like a penguin, body gone
all belly, certain I could never love
the slow explosion of these clotted cells,
convinced I would have more luck mustering
maternal feelings for a stone I'd swallowed.
But earth's own mineral accretions smacked,
at least, of duty I could stomach—some.
Then Pronto stalled: still as a granite chunk
he granted my desire, stubborn, sunk
deep as a faultline in my body's dust.
The doctors heard my pleading in the end,
cleft muscle, parted layered fat, and dug
down, lifting free at last the little boy
who waited, smeared and dripping, at my core.
And when I woke, drugged, sluggish, savoring
the sudden emptiness, I swore no man,
no god, not even Robert would seduce
the She in me again.

Now this. Tyke proves
I am the slave of what is possible.
No one can silence nature. She inscribes
her secrets in our flesh: new tissue blooms
with meanings we can't read, but sense. Genes spell
dependence that our lives sound out—small signs
of larger purposes—prolific and
devouring.

What we make consumes us. Tyke,
conceived in disbelief, resists confinement,
scratches the greasy membranes binding us,
fights, furious and futile, kicks and twists,
ties knots in my intestines, spends her waste
into my veins. I long to help her, calm
choked motions, still her strangled gestures.
But both of us are trapped like rats inside
the blood-filled bag my body has become.
Each night, I listen to our heartbeats fight
like bitter lovers, waiting for her rage
to build until she finds the strength to tear
her way out, split me open, spill us both
into a harsh and unfamiliar light.

.....

ROSE BETHE
Head of Los Alamos Housing Office

We beat the Nazis on a Tuesday
and the lab boys threw a party that same night
as only they knew how.
The theorists were good company, of course,
but lived too much inside their heads
to organize a party on the scale the day deserved.
And yet I didn't want a drink that night.
Not that I wasn't glad
the Nazis had been crushed—
their souls belong in hell—
and not that I was sad
to see my birthplace brought to ruin,
though I was.
My mood was hardly personal.
I felt—how can I say it?—
not outside myself exactly,
but outside us all.
The Nazis forced us here, Gentiles and Jews,
Americans and Russians, Germans, Dutch.
They made us all commit ourselves
to evil. Grant this once there is a God,
so God may grant we chose the lesser evil.
After the party, we went back to work.

.....

JOSEPH ROTBLAT
Physicist

Spay nature. Speed
the spray of neutrons—
prompt, delayed.
Halt fission. Feed
it salt of boron—
scattered, stalled.

Vain wish. Chiggers,
sharks reign. Men. Life sows
selves, greed, pain.
Looms lust. Prefers
ripe wombs to calm—blows,
grapple, bloom.

Silence science.
Defy fact. Ignore
ears, hands, eyes.
Scrap evidence.
Unmap Einstein, Bohr.
Knowledge traps.

Worse: when Brits thought
Hitler's tanks were fake,
missed Panzers.
Furor, flaws, faults,
seizures, gaffes, mistakes—
science cures.

Leave the lab. Seek
naïve work and save
the heart. Grieve.
Bless lost years. Speak
low, less. Count light waves'
darker crests.

Humble Doctors
succumbed. Proud, they placed
faith in sums.
Fascists. Better
self-shush than bomb blast,
hush of ash.

.....

LOUIS SLOTIN
Physicist

The core assembly was as riveting
as watching someone bake a birthday cake
at first. I did the whole thing sitting down.
And yet the smallest details somehow still
are luminous. The table top was masked
with long, brown sheets of butcher's paper strewn
with the gadget's gold and nickel-plated guts.
It felt as though I moved in thickened light,
each gesture so precise it almost hurt,
shifting the metal parts as others watched.
My focus narrowed to a small sphere
of beryllium. I cupped it like an egg
between two hemispheres of hollowed-out
plutonium, womb-shaped, as warm as flesh
from random fissions. Then the tamper's curved
plum-colored calyx closed to form a bud.
I felt a world take shape between my hands.
The Geiger counter clicked. My palms grew slick.
My fingers tingled, slowly growing numb,
gripping the heavy chunks, more dense than gold.
I shifted my grip abruptly. Everybody
jumped. My back ached. Were my fingers freezing
or on fire? I tried to blink away the sparks
from my exhausted retinas. I leaned
close to the sphere, only to see it shrink
to a speck far out of reach. Or had it swelled
to planet size? Great jagged mountains stabbed
my hands—yet smaller than a single pin
between my fingertips. And I began

to fall. I closed my eyes. My stomach lurched.
The taste of rotten lemons stained my tongue.
The core gone critical. Air glowing blue
as radiation ionized my eyes.
Now I would die.

Then Serber spoke. "Louis,
are you all right?" He touched my arm. My eyes
were wet. I opened them. In my clenched hands
was the completed core. It seemed that I
was not among the ones about to die.

.....

NORRIS BRADBURY

Physicist; Lieutenant Commander, US Navy

I choose my luck. We start
at midnight, Friday the 13th.
Lt. Shaffer signed off
on the V-site charge assembly.
Dual replacement castings
for the dummy trap door plug
are boxed, all booster holes
Scotch sealed, the unit wrapped
in Butvar water-proof.
Shaffer's lashed the gadget
to its padded truck bed—minus
core, X-unit, and HE.
Two G-2 escort cars
wait, idling, fore and aft.
Luck's physics. Nothing more.
Except a million hours
sweating details, second-
guessing snags and foul-ups,
anticipating every
accident and glitch.
The final hot run starts:
we'll haul the tarp off, hoist
the gadget from its cradle,
rig a canvas tent
to ward off dust and rain,
remove the polar cap,
insert the active core.
G-engineers will chain tongs
to the tentpeak, latch the trunnion,
lift and turn the sphere.
The HE people keep
on hand a shim stock shoe horn
and hypodermic grease gun
to aid the HE fit.
Jercinovic will bring
a small dishpan and footstool.
Lift to the tower top.
The detonator group
cables the X-unit's
switches and informers.
Where they get the springs
and fittings is their business.
Once the gadget's live,
we'll spend all Sunday rubbing
rabbit's feet and finding
four-leaved clovers. Perhaps
I'll bring the Chaplain down.
Then, come Monday: Bang!

.....

FRANK OPPENHEIMER
Physicist

In the lulls between cloudbursts
I set off smoke bombs on the cliffs
to watch the winds. I geared up
for disaster, planning routes
across the desert to escape
the fallout. All night long,
frogs squalled nearby,
copulating in the sudden mud.

.....

DAVID MCDONALD
Rancher

Well, one morning, around the middle of July,
when we were at my brother's in Adobe,
I woke up before the sun was out, thinking
there was a truck backfired, or something like.
I went out on the porch to take a look,
because we still weren't used to strangers then,
despite the goings-on the war had brought
and so forth. Well, I nearly busted a gut,
for there the sun was, rising in the west.
You know, entirely the wrong direction.

.....

VICTOR WEISSKOPF
Physicist

I looked at zero through dark glass.
The night was cloudy. Nothing showed.

I'd climbed a little ridge 100 yards
from camp to find a view, and solitude.

The base camp water tower's shadow aped
a blunt, hunched steeple with each lightning stroke.

A group of SEDs appeared, noisy,
fervent. They fidgeted like kids in church.

Eager to estimate the fireball's
diameter, they measured, argued, mapped.

They struck sticks upright in the ground, each half
foot staking out 1000 feet at zero.

Perhaps I wondered where they found the sticks
when—suddenly—a sun's acetylene.

Despite my welder's glass, the indirect
light blinded me long seconds, stupid, stunned.

But when the brightness died a bit, I saw
a yellow-orange fireball ascend.

An aureole of bluish radiation
bruised the air, haloed the bomb with ions.

Against all reason, it reminded me
of Grünewald's altarpiece at Colmar:

Jesus folded in a bright ascending sphere
of yellow, head framed by a turquoise glow.

Here in the desert of New Mexico
that abstract image clothed itself in flesh.

The resurrection of our Lord in wrath.
1000 billion curies scalding earth.

That awful vision haunts me still,
a forced faith burned into my retina.

.....

EDITH WARNER
Ran a tea room by the Rio Grande

As season follows season, I sense a change,
though subtle, in the earth. Like the thin veil of green
that mantles the desert after rain, a change
has come upon the land. Or else, I hope, the difference is in me.
Now when I smell the Russian olive's bloom each May,
when the woods along the river fill with its rosy scent,
another odor teases my palate, faint, vague, but inescapable—
like the hint of bitterness in milk that will soon sour.
Now when I hear the wind in the salt cedar's feathery leaves,
another sound frets gently in my ear, almost inaudible,
like the whispered passing of a rattlesnake across dry sand.
And now when I see children in the pueblo spreading sheets
beneath the piñon trees to gather nuts, high on the edge of sight
a brief metallic glint catches my eye, then vanishes,
and I stop, and the veil falls, and I listen for the bee drone
fading in and out on the drifting wind. And if
I have not heard it yet, I know, I can't forget, I might.

BIOGRAPHICAL NOTES

ROSE BETHE, daughter of German physicist Paul Ewald and wife of Nobel physicist Hans Bethe who led the Theoretical Division at Los Alamos. At Robert Oppenheimer's request, Bethe preceded her husband to Los Alamos, where she headed the Housing Office.

NORRIS BRADBURY, a physicist and Lt. Commander in the Navy, oversaw assembly of the high explosive charges that would detonate the plutonium bomb in the Trinity test. When Robert Oppenheimer resigned after the war, Bradbury took over as the scientific director of Los Alamos.

ALBERT EINSTEIN signed a letter in August, 1939, alerting Franklin Roosevelt to the possibility that nuclear fission might be used to make "extremely powerful bombs of a new type" and that Nazi Germany was probably already working on them. At the time, Einstein was living on Long Island, where he spent the summers sailing and working on his "hobbyhorse," the Unified Field Theory. Tinef, Yiddish for "junk," was the 15 foot sailboat in which he navigated the waters of Peconic Bay.

OTTO FRISCH, along with his aunt, Lise Meitner, interpreted, in December 1938, the experimental results produced by Otto Hahn and Fritz Strassman in their work on radium and, in the process, "discovered" (and named) nuclear fission. He later joined the British bomb project and was part of the contingent that moved to Los Alamos to support the Manhattan Project.

DAVID McDONALD owned a ranch in southern New Mexico. It was commandeered by the Air Force for use as a bombing range and was ultimately chosen as the site for the Trinity test in July, 1945.

FRANK OPPENHEIMER, brother of Robert, was an experimental physicist who came to Los Alamos late in the war to assist with preparations for the Trinity test.

KITTY OPPENHEIMER was Robert's first wife; he her fourth husband. She first married a jazz musician while a student at the Sorbonne, but his drug addiction led to an annulment. She then married a communist organizer from Ohio; he was killed in the Spanish Civil War. While studying for a degree in biology at the University of Pennsylvania, she married a British doctor and they moved to Pasadena where she met Robert. In May of 1941, Kitty gave birth to her first child, Peter, nicknamed Pronto because he arrived six months after she married Robert. Although she didn't care for motherhood, like many of the wives at Los Alamos she found herself pregnant again in the spring of 1944. She gave birth to their second child, a daughter named Katherine (nicknamed Tyke and, later, Toni) on the third anniversary of the Japanese attack on Pearl Harbor.

JOSEPH ROTBLAT, a Polish physicist, was a member of the British mission to Los Alamos. After the defeat of Germany, he was the only senior scientist to leave the project. He was awarded the Nobel Peace Prize in 1995.

ROBERT SERBER studied under Robert Oppenheimer at Berkeley before joining the Manhattan Project as a theoretical physicist. In March of 1943, he delivered a series of lectures, later mimeographed and nicknamed the "Los Alamos Primer," to incoming scientists to "bring them up to speed" on the bomb project. He led a theoretical group at Los Alamos and later worked at the Air Force base on Tinian, preparing for the bombings of Hiroshima and Nagasaki. Immediately after the war, he visited Japan as part of a scientific team gathering data on effects of nuclear weapons.

LOUIS SLOTIN, a Canadian physicist, had little luck finding an academic job after receiving his PhD. He worked for a couple of years as a lab assistant before transferring to Los Alamos, where he ran critical mass experiments nicknamed "Tickling the Dragon's Tail." He was killed by radiation in a lab accident shortly after the war ended.

LEO SZILARD, a Hungarian physicist, recognized the possibility of a nuclear chain reaction and patented the idea in 1936. He drafted, and convinced Einstein to sign, the letter that initiated the US government's effort to build nuclear weapons.

EDITH WARNER moved from Philadelphia to New Mexico before the war, seeking a place to recover from tuberculosis. She established a tea house by the Rio Grande river, near Los Alamos, where she lived with an older Native American man named Tilano. During the war, she served scientists from the mesa exclusively, providing a secure location in which they could relax and escape for a few hours from the pressures of their work.

VICTOR WEISSKOPF, an Austrian physicist, served as a group leader in the Theoretical Division at Los Alamos.

EUGENE WIGNER (nicknamed Wigwam) worked as a physicist for the Manhattan Project in its Princeton, Oak Ridge, and Chicago divisions. He drove his friend, and fellow Hungarian, Leo Szilard to Long Island during the summer of 1939 to meet with Einstein and discuss how best to alert world leaders to the threat of a Nazi nuclear weapon. He won a Nobel Prize in 1963.

ACKNOWLEDGEMENTS

Some of these poems appeared previously in journals, sometimes in slightly different forms, as follows: "Otto Frisch" in *Slate*, "Leo Szilard" (In 1913, H.G. Wells) in *Raritan*, "Robert Serber" (When Oppie's first recruits arrived) in *The Southwest Review* and in *Poetry Daily*, "Rose Bethe" in *Prairie Schooner*, "Louis Slotin" (The core assembly was as riveting) in *The Cincinnati Review* and in *Poetry Daily*, "David McDonald" is a "found poem" recast in rough blank verse from an interview with McDonald in Jon Else's film "The Day After Trinity."

ABOUT THE AUTHOR

John Canaday won a Walt Whitman Award from the Academy of American Poets for *The Invisible World*, a book of poems set in the Hashemite Kingdom of Jordan. He is also the author of a critical study, *The Nuclear Muse: Literature, Physics, and the First Atomic Bombs*. The poems published here are from the first volume of *Critical Assembly*, a series in the voices of the scientists, spouses, laborers, locals, and military personnel involved in the Manhattan Project and covering the years leading up to the Manhattan Project, the design and construction of the first nuclear weapons, and the Trinity test. The second volume will include preparations at the Tinian airbase in the Pacific, the bombings of Hiroshima and Nagasaki, and the aftermath.
