

PETER GENA (b.1947)

BEETHOVEN IN SOHO AND OTHER WORKS

1. **Chopin's Catarrh cf2—canon mensurabilis**
(**Cystic Fibrosis CFTR 508delF mutation**) * (2023) 8:14
two computer-driven pianos
2. **John Henry** (1986) 12:28
Anthony de Mare, piano
3. **Dihydrotestosterone** * (2000) 7:55
digitally synthesized DNA sequence
4. **Beethoven in SoHo** (1980) 9:52
Joseph Kubera, piano 1; Anthony de Mare, piano 2;
Gregory Chudzik, bass guitar
5. **For Morton Feldman** (1988) 10:37
Joseph Kubera, piano
6. **Red Blood Cells** * (1995) 10:08
digitally synthesized DNA sequences
7. **Vaccinum: Covid-19 spike protein**
(**SARS-coronavirus 2 Vaccine**) * (2021) 6:42
V. In memory of those lost
Joseph Kubera, piano 1; Anthony de Mare, piano 2

* DNA Consultation: Charles M. Strom PhD, MD



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PETER GENA
Beethoven in Soho
and other Works

Peter Gena: Sonifying DNA and Other Data

Peter Gena likes to point out that throughout history music has often relied on groups of data points expressible as series of numbers. The twelfth-century composer Perotin would take a Gregorian chant as a series of notes to provide drone points for larger structures. Motets of the fourteenth century were often rhythmically structured via a series of durations known as the *talea*; similarly, classical Indian music uses numerical rhythmic patterns known as *tala*, a word that seems evidently cognate. Renaissance polyphony, as well as the chorale preludes of Bach, took as its basis the *cantus firmus*, an underlying melodic line of a fixed shape. Twelve-tone music, invented by Schoenberg in 1921, came to rely on twelve-note patterns, of which there were 479,001,600 possible choices. John Cage used the 64 numbers derived from the ancient Chinese divination technique, the *I Ching*, as determinants for rhythm, pitch, dynamics, and so on. Starting in 1955, composers have patterned music on algorithms, often computer-generated, designed to produce general, not always specific, results. In many ways, throughout many periods, music has been driven by data sequences.

Most of the current disc, though not all of it, is an expression of this historic trend: the *sonification* of data, the transformation of some previously found pattern into pitch and rhythm. Gena (born April 27, 1947, in Buffalo, NY) received his education at the State University of New York at Buffalo in the 1960s and '70s, in the heady atmosphere of the Creative Associates. From 1964 to 1980, composers Morton Feldman (1926–1987), Lukas Foss (1922–2009), and Lejaren Hiller (1924–1994) oversaw a program for intrepid young composers and musicians involved in the creation and promotion of some of the most avant-garde music around. John Cage and Iannis Xenakis frequently appeared as guiding spirits. Performers included, among

others, pianists Joseph Kubera (whom Gena had known since their first days of college) and Anthony de Mare, flutists Petr Kotik and Eberhard Blum, percussionist Jan Williams, trombonist James Fulkerson, composers Maryanne Amacher and Victor Grauer, as well as composer/singer/pianist Julius Eastman, the African-American gay activist who has become a posthumous *cause célèbre* since the first disc of his music appeared on this label in 2003. Similarly, Gena and his fellow graduate student Judith Sherman, the producer of this disc, spent numerous sessions in the electronic music studio ruminating over the new Moog synthesizer and Vocoder.

Feldman, with his trenchant and powerfully counter-intuitive personality, was a phenomenally influential teacher. Virtually all of his students came away from him with an appreciation for sonority and a nonlinear sense of musical continuity, or at least one freed from the conventional logic of classical music. This is true of Gena, though an equally strong influence on him was the less well-known Lejaren Hiller. Hiller had gotten his Ph.D. in chemistry, though in the 1950s his work in the then-nascent science of computer languages drew him into using them for music as well. In 1955–56 he and fellow composer/chemist Leonard Isaacson used computer algorithms to produce the first work for conventional instruments composed via computer, the *Iliac Suite* for string quartet, which occasioned some controversy at the time. Hiller was also the computer expert on whom Cage relied in 1969 to produce their mammoth multimedia spectacle *HPSCHD*. Having joined the SUNY Buffalo composition faculty in 1968, Hiller introduced Gena to computer programming and algorithmic composition.

It could be said, then, that Gena's music has been a combination of three primary influences: Feldman, with his emphasis on sonority and non-linear continuity; algorithmic computer composition; and later, the minimalism of Steve Reich, Philip Glass, Terry Riley, and others (Julius Eastman included), which swept through

Chopin's Catarrh cf2: canon mensurabilis

Cystic Fibrosis CFTR 508delF mutation

Peter Gena

DNA consultation: Charles M. Strom Ph.D. MD

♩ = 112

Piano 1

Piano 2

A

B

10

B

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the new-music world in the 1970s. Meanwhile, Gena taught at the California State University in Fresno, where he directed the Electronic Music Studio from 1974–76; then at Northwestern University from 1976 to 1983. After that, he taught at the School of the Art Institute of Chicago from 1983 to 2017.

The present disc documents all three of these influences, the dominant one being the algorithmic sonification of data. That is, some outside source is translated numerically into musical notes. This thread has run throughout Gena’s career, his earliest work in this vein being *Egerya* (1972), which translated the columns and rows of weaving patterns of a Scandinavian rug into successive sonorities. Having previously employed other types of data, in the 1990s Gena started working with DNA as a result of his friendship with geneticist/pediatrician Dr. Charles Strom. Four of the works here—*Chopin’s Catarrh*, *Dihydrotestosterone*, *Red Blood Cells*, and *Vaccinum*—are based on DNA chains, fed into formulas (through the object-code language MAX/MSP) which convert the genetic material into long melodies.

To explain: Strings of DNA are made up of the nucleotides guanine, adenine, thymine, and cytosine, fairly well known as the G A T C patterns in which DNA can be represented. Four elements alone would be little to work with, but the nucleotides combine in groups of three—GAG, ATC, TTT, and so on—to form different classes of amino acids. There are 64 possible combinations of the three letters, a nice coincidence with John Cage’s use of the 64 hexagrams of the Chinese oracle, the *I Ching*. The data from DNA chains is fed into “physio-musical” formulas that correlate each three-letter unit (known as a *codon*) with a certain pitch, dynamic, and duration. Gena’s DNA pieces tend to be highly polyphonic, with the same chains being heard moving at different rates, because cells replicate similar chains constantly at varying speeds. As Gena notes, “You’ve got a lot of polyphony going on in your body.”

Chopin's Catarrh (Nocturnes) was the first of Gena's DNA-derived compositions to use acoustic instruments—Disklaviers, or computer-driven pianos. Dr. Strom informed Gena that Frédéric Chopin's symptoms and physical characteristics suggest that he more likely suffered from cystic fibrosis rather than (or in addition to) the consumption that was long considered his fatal malady. Gena, immediately inspired by the Chopin connection to write for piano(s), transformed the DNA sequence for cystic fibrosis into musical notation, and then searched through Chopin's nocturnes for note patterns that matched the DNA *cantus firmus*. These passages were then woven into the work. The first version, for one piano, was written in 2005. The present version, titled *Chopin's Catarrh cf2—canon mensurabilis*, was finalized in 2023. (“cf2” stands for “cystic fibrosis cantus firmus.”) As the title indicates, it is a canon, one piano playing the other piano's notes at different speeds. Within the texture one can hear one piano's notes echoing the other's at increasing distance.

The next most common, quite different musical thread is postminimalism, because throughout the 1980s Gena got caught up in the vogue for the style's diatonic (major-scale) harmony and use of repetition to create form. Part of the impetus behind this was political, for Gena also fell into the orbit of the political composers around Cornelius Cardew, such as Frederic Rzewski, Christian Wolff, and Gena's Chicago friend, Frank Abbinanti. The minimalist idiom appealed to composers who felt it incumbent on them that their music reach a wider audience than the usual elite circles interested in contemporary music, and several of Gena's works of this period had political themes, including *McKinley* (1983), *Mother Jones* (1985), *John Henry* (1986), and *Joe Hill Fantasy* (1992–3). *John Henry* is based on the oft-recorded eponymous folk song about the mythical figure who died after successfully competing with a steam-powered rock drilling machine in building a tunnel. The piece opens by additively building up the theme of the folk song and then going into a motoric continu-

um of repeated notes (reminiscent of a machine) based on the notes of the tune. Then the process starts again, leading to thunderous repeated chords that run through the blues harmony in slow motion (Perotin again comes to mind). As Gena mentions, his method in the political works is not so different from that of the DNA works: Both start out with a string of data, whether the notes of a folk tune or the pattern of codons in a DNA sequence.

Dihydrotestosterone (2000) is another DNA piece. The title refers to a hormone that results from enzyme conversion of testosterone, which serves to stimulate the development of male sexual characteristics. This is one of five male hormones featured in Gena's sound installation *Him, Himself and He*, which was commissioned for “From Steel to Flesh,” an exhibit held in 2001 during the first Miss USA Pageant, under the auspices of the Trump Casino in Gary, Indiana. The masculinity-themed show was located adjacent to the facilities used by the beauty contestants on the campus of Indiana University Northwest. There is no score to the work; Gena designed an algorithm that would translate the codons to MIDI values that would directly drive a Yamaha TX802 synthesizer with eight different timbres, each representing one of the eight classes of amino acids.

Political in perhaps a different sense than *John Henry, Beethoven in Soho* (1980) resulted from a conflict between two opposing ideas in music of the 1970s: information theory and minimalism. There was much excitement at the time about what information theory could help theorists understand about musical style. As leading writer on the topic Leonard B. Meyer put it, “music may be meaningful in the sense that within the context of a particular musical style one tone or group of tones indicates—leads the practiced listener to expect—that another tone or group of tones will be forthcoming at some more or less specified point in the musical continuum.”¹ At the same time, minimalist music was flouting the sequential conventions

Beethoven in SoHo

Peter Gena

Allegretto (At the da capo, piano 1 waits 1m, for piano 2 to finish VIII before starting)
 (A) at the da capo, piano 2 begins here (A), but plays from (B). -----

I I played canonically; piano 2 begins when piano 1 reaches m. 7.
 repeat 3 - 5x

II III IV
 3x after piano 2 arrives non pedale
 piano 1 waits here first; repeat several times
 repeat several times
 piano 1 2 pianos in sync; each bar multiple times - 9x max.
 (don't repeat bass)
 piano 2 non pedale
 9x max
 long F# (chose octave) at random, on 4 beats

V VI VII VIII (See instructions: (A) repeat 3x, Piano 2: canon @ m. 3, then (B) 4x, Piano 2: canon @ m. 2.)
 simile
 simile
 simile
 Pianos 1 & 2 (m1)
 (m2)
 (simile) long Bbs (chose octave) at random on q-note beats (tacet) f (A) repeat 3x, (B) 4x

IX canon as in Section I (piano 2 waits 2 mm. to start IX after piano 1 begins IX)
 at end of the 3rd repeat of (A), piano 1 waits 2 mm. before starting (B)
 piano 1 waits 1m for piano 2 to finish VIII before starting
 piano 2 cues bass for IX
 piano 2 cues IX

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of musical meaning by creating gradually changing music which short-circuited the listener's expectations through stasis and illogical change. In a class, Gena was given an exercise to go through Beethoven's Op. 31/3 Piano Sonata and edit out repeated (i.e., redundant) phrases and sequences to see what was left. Several years later, he decided to make a similar attempt with the second (final) movement of Beethoven's Op. 54 Sonata and turn it into a quasi-minimalist piece by delaying expectations through repetition. The title *Beethoven in Soho* came from Gena's idea that, were the revolutionary Beethoven alive at the time, he would have been working in Soho, i.e., Manhattan's "downtown" scene, rather than writing twelve-tone or neoromantic music in academia or in the neoromantic orchestral circles. *Beethoven in Soho*, then, is entirely made up of phrases from Beethoven's sonata movement, their progression greatly slowed down through textural repetition and thus resistant to the expectations associated with the style.²

For Morton Feldman (1988) is a memorial to Gena's teacher, who had died at only 61 of pancreatic cancer the previous year. The floating chords and slowly changing sonorities make a clear reference to Feldman's musical style with one crucial exception: Feldman's pitch language was almost always dissonantly chromatic, while Gena's draws a more restful atmosphere in E-flat major, with (at first) only the pitches E-flat, F, G, B-flat, C, and D. Other pitches (first F-sharp, A, C-sharp) begin to appear, but the piece settles into middle register with only the main six pitches before crescendoing into a sudden series of loud A-flat octaves. For Feldman aficionados, this loud interruption will be reminiscent of works in which Feldman broke the quiet stillness with a single loud noise, such as *For Frank O'Hara*—a work Gena conducted

¹ "Meaning in Music and Information Theory," Leonard B. Meyer, *The Journal of Aesthetics and Art Criticism*, Vol. 15, No. 4 (June 1957), p. 413.

² Gena and the author of these notes played the pianos in the first two performances.

many times, and whose startling snare drum stroke he interprets as a reference to O'Hara's untimely death in a car crash. From this point, the remainder of the piece draws more obliquely on the ending of Mahler's *Das Lied von der Erde*, in which the soprano sings the word "ewig" over and over on a sighing motive of E–D, as an orchestral motive rises E–G–A–B—in Gena's piece transposed up a third to G–F and G–B-flat–C–D. Toward the end, the A-flat octaves reappear as well with Feldmanesque half-step dyads on top, Gena saying good-bye to a beloved teacher and one of the most amazing figures in recent music.

Red Blood Cells (1995) belongs to a handful of Gena's very first forays into DNA sonification. It is based on a mix of five genes that are present in human blood: alpha and beta globin, heme synthetase, transaldolase, and glucose 6 phosphate. These are run into a DNA mixer that realizes them simultaneously, just as they are produced in the body. Like *Dihydrotestosterone*, *Red Blood Cells* was fed directly into an FM synthesizer.

Vaccinum: Covid-19 spike protein (2021) was a timely response to the associated pandemic which was raging at the time. Gena declined to represent the virus itself, however, and based the work on the vaccine that did so much to stem it. Because the DNA sequence is so lengthy, he divided the sequence into five "regions," of which the present work represents the last. The Covid vaccine uses the RNA sequence of the spike protein to cause the body to synthesize it, thereby inducing antibodies, which in turn bind to the actual spike protein on the virus, preventing attachment. For this work, Gena returned to live pianos, and had the DNA Mixer translate the sequence into musical notation. (There is also a version of this region for string orchestra.) This final region serves as a memorial for those lost to the disease.

As Gena admits, there is some inescapable inherent subjectivity in correlating DNA data to pitch, duration, and dynamics. "Music and metaphor," Gena has

written, "are inseparable... Implicit in data is interpretation. Data are widely interpreted in all disciplines of inquiry. Realization requires interpretation."³ Since the sequences represent the processes of life itself on some microscopic level, he is reluctant to tamper with the score as derived, but he does sometimes move notes by octaves to make the result more musically understandable and playable. Whereas in Cage's chance works we hear the abstract result of a chance process in which we did not participate, in Gena's DNA pieces we are listening to the process of life (cellular growth) itself, amplified into the realm of audibility and a time scale in which we can savor them. We are also listening to canons in which a melody is being heard in several different speeds at the same time, a more inherently musical process, and yet one that matches the biological process from which it is drawn. In the other pieces, we hear similar strings of melody—the tune "John Henry," Beethoven's Op. 54 Sonata, the final progression from *Das Lied von der Erde*—stretched out to varying time scales. As Gena has said, the concept that runs through his music is that of the *cantus firmus*, the fixed melody that generates the musical continuity around it.

—Kyle Gann

Kyle Gann is a composer and the author of seven books: six of them on American music, including monographs on Cage's 4'33", Charles Ives's Concord Sonata, and the musics of Conlon Nancarrow and Robert Ashley, plus The Arithmetic of Listening: Tuning Theory and History for the Impractical Musician. Since 1997 he has taught at Bard College, where he is the Taylor Hawver and Frances Bortle Hawver Professor of Music, and from 1986 to 2005 he was the new-music critic for The Village Voice.

³ Gena, "Apropos Sonification: A Broad View of Data as Music and Sound," pp. 197–8.

Composer **Peter Gena** (b. 1947) has long presented works for various media, including instrumental, electronic, sociopolitical portraits, sound installations, and bio-music in North and South America, Europe, Asia, and Australia. An author of numerous publications, he has penned articles on new music, composers, sonification, etc., and was co-editor of *A John Cage Reader*. His music appears on the Nonesuch, Lovely Music, and Edition bianchi-neri labels. Visiting-artist residencies and fellowships have brought him to venues in the Americas, Europe, and Asia. Gena's work first employed compositional algorithms in 1969, when an undergraduate at SUNY Buffalo. He learned from Lejaren Hiller to respect computers as decision-makers—rather than as strict data processors. Shortly afterwards, he began sonifying representational data, patterns, and physiological signals. Some twenty-five years later, his close friend, renowned geneticist Dr. Charles M. Strom, suggested that they explore DNA music. Gena immediately began an ongoing physio-musical sonification of various DNA sequences, including human genes and viruses. For more than a decade he served as a principal investigator for VR and sound research in collaboration with colleagues from several French art schools. Gena remains Professor Emeritus at the School of the Art Institute of Chicago and is decorated by the French government at the rank of *Chevalier dans l'Ordre des Palmes Académiques*.

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Leading new-music pianist **Joseph Kubera** has personally worked with such luminaries as Morton Feldman, Julius Eastman, La Monte Young, and Roscoe Mitchell, and many composers have written for him. An expert Cage interpreter, Kubera toured for years with the Cunningham Dance Company at Cage's invitation. He has worked with S.E.M. Ensemble, Steve Reich, and myriad other New York ensembles, and has collaborated with pianists Marilyn Nonken, Adam Tandler, and Sarah Cahill, and

baritone Thomas Buckner. Kubera has been awarded grants through the NEA and the Foundation for Contemporary Arts. He appears on a dozen New World recordings, in addition to Wergo, New Albion, Lovely Music, Tzadik, and many other labels.

Anthony de Mare is one of the world's foremost champions of contemporary music, known for his entrepreneurial performance projects, including the speaking-singing pianist genre that he pioneered over thirty years ago. With a discography of more than twenty-five recordings, the breadth of his programming speaks to his versatility and virtuosity, which has inspired the creation of more than ninety new works by some of today's most distinguished artists. His landmark project, *Liaisons: Re-Imagining Sondheim from the Piano*, celebrating the music of Stephen Sondheim, encompasses fifty works, including composers from across the musical spectrum. Recordings appear on ECM, Avie, Innova, New World, KOCH Entertainment, CRI, and Mode, among others. A Steinway Artist, he also serves on the piano faculty at Manhattan School of Music and summer festivals around the United States and abroad.

Charles (Buck) Strom M.D. PhD. H.C.L.D. is a medical scientist specializing in Clinical Metabolic Genetics, Clinical Molecular Genetics and Laboratory Medicine. He is currently an Attending Physician in the Division of Medical Genetics at Children's Hospital of Los Angeles.

Bassist **Greg Chudzik** has performed premieres by Steve Reich, Steve Coleman, Brian Ferneyhough, Johnny Greenwood, Alex Mincek, Eric Wubbels, Sam Pluta, Ted Hearne, Anthony Cheung, Paula Matthusen, and Anna Clyne, among others. He performs regularly with Ensemble Signal, Talea Ensemble, ICE Ensemble, and Wet Ink Ensemble, as well as the bands Empyrean Atlas, and the Briars of North America. In 2019 he released his second album, *Solo Works Vol. 2*, for double bass on Panoramic Recordings.

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in honor of the centenary of his birth, February 2024.**

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