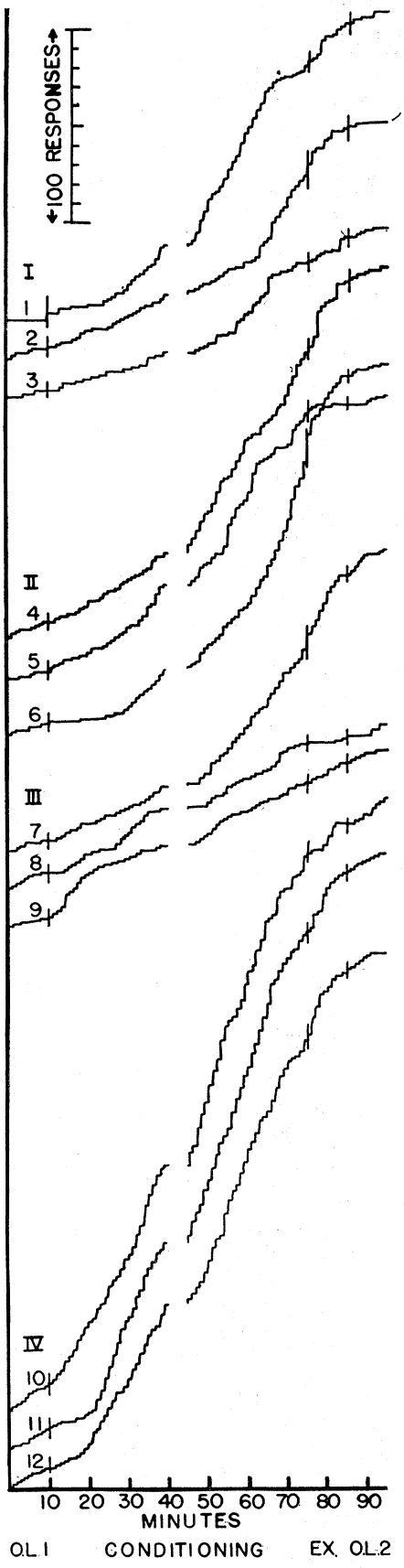

Fig. 1. Cumulative response curves for adult human subjects in a situation where an invisibly small and unnoticed thumb-twitch either terminated or postponed noise stimulation. *OL 1* and *2*, initial and terminal operant level determinations, respectively; *ex.*, extinction.

Whenever the experimenter saw on the meter an instance of the selected response, he pressed a key. This turned off the noise for 15 seconds or, when it was already off, postponed noise resumption for 15 seconds. [This type of avoidance schedule, mentioned in 1950 (*2*), has been extensively employed by Sidman in animal work (*3*).]

After an hour of conditioning, with a 5-minute intermission at the half-hour point, 10 minutes of extinction occurred during which the subject's response was ineffective in terminating continuously present noise. During final 10 minutes of music only, the extent of recovery of the original operant level was recorded.

Figure 1 presents cumulative response curves for each subject. Conditioning is clearly indicated by the positive acceleration in the rate of responding for all subjects except subjects 2 and 3 in group 3. These two kept so busy producing voluntary thumb-twitches that the small, reinforceable type of response had little opportunity to occur.

When interviewed later, all members of group 1 still believed that they had been passive victims with respect to the onset and duration of noise, and all seemed astounded to learn that they themselves had been in control. Subjects 1 and 2 of group 2 reported that they early gave up searching for an effective response and thus, in effect, transferred themselves to group 1. Subject 3 of group 2 professed to have discovered an effective response sequence, which consisted of subtle rowing movements with both hands, infinitesimal wriggles of both ankles, a slight displacement of the jaw to the left, breathing out—and then waiting. Subject 1 of group 3 gave evidence of conditioning perhaps because he misconstrued the instructions. Instead of making the response a quick contraction, he spent his time very gradually increasing pressure on an imaginary switch button. This may have kept deliberate activity at a level low enough for the correct response to break through and be reinforced.

Group 4 subjects, provided with their own meter, obtained many more reinforcements than the others, an effect which continued through the second half-hour of conditioning, with the meter removed. While the meter did not enable them to achieve direct control of the discrete response, it seems to have provided a basis for rapid responding within a range which included the reinforced size. This showed on the meter as rapid oscillation.

The technique employed in this study (*4*) offers possibilities for investigating human behavior, in a sense, at the animal level. Research now in progress is concerned with attempts to clarify the circumstances under which the human subject may come to discriminate verbally—that is, to become conscious of—his small responses.

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4. This investigation was supported by research grant M-2961, National Institutes of Health, U.S. Public Health Service, and by grants from the Higgins Fund and the Columbia University Council for Research in the Social Sciences.

16 July 1959

Elementary-Body Virus Isolated from Clinical Trachoma in California

Abstract. From an adult white resident of California with clinically typical early trachoma a virus was isolated by growth in embryonated eggs. Morphologically and serologically the virus belongs in the psittacosis-lymphogranuloma group. When it is instilled into monkey eyes it produces acute follicular conjunctivitis with typical inclusion bodies.

It is estimated that over 400 million people, mainly in Africa, Asia, and parts of Europe, suffer from trachoma as a serious eye disease. In the United States this disease was widespread in the past, but at present it occurs only at a low endemic level, most frequently in the West and Southwest. In San Jose, Calif., indigenous clinical cases of trachoma occur occasionally.

On morphological grounds the elementary bodies and inclusion bodies found in the conjunctival scrapings from many patients with trachoma have long been accepted as the probable etiological agent. Recently T'ang *et al.* (*1*), Collier and Sowa (*2*), and Murray *et al.* (*3*) have grown from trachomatous eyes in China, Gambia, and Arabia, respectively, strains of elementary-body viruses antigenically related to the psittacosis-lymphogranuloma group. Upon inoculation into the eyes of volunteers, some of these viruses have produced typical acute trachoma (*2*). We report here the isolation of a similar agent from a patient with clinical trachoma in California.

A 36-year-old white machinist, a long-time resident of San Jose, developed a red left eye on 10 Jan. 1959, with moderate yellow discharge and a nontender left preauricular lymph node.

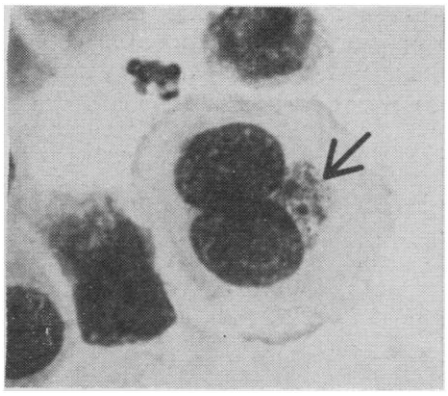

Fig. 1. Inclusion body in epithelial cell of patient's conjunctiva.

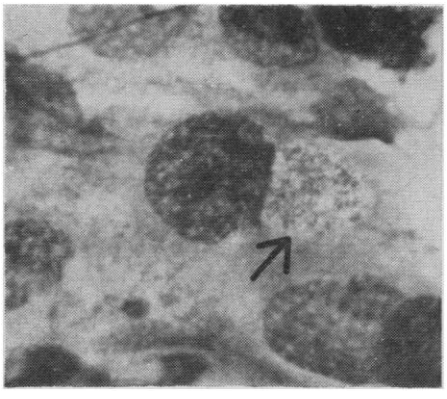

Fig. 2. Inclusion body in conjunctival epithelial cell of *Macacus cynomolgus* inoculated three days earlier with sixth-egg-passage virus (Bour).

His physician prescribed 1-percent chloramphenicol eyedrops, which he instilled for the next 26 days, with some symptomatic improvement. On 12 February a similar conjunctivitis developed in the right eye, with marked photophobia. Neomycin-polymyxin eyedrops were administered for 4 days. On 16 February the inflammation in the left eye suddenly increased markedly, and gross keratitis appeared. Clinical examination on 17 February revealed bilateral papillary hypertrophy, with buried follicles of the upper tarsi, microscopic pannus and corneal infiltrates, and palpable preauricular lymph nodes. Scrapings from the upper tarsal conjunctivas showed many inclusions typical of trachoma (Fig. 1). Bacterial cultures were negative. The patient was treated with topical tetracycline and oral methylsulfapyridazine (500 mg daily) from 19 Feb. to 15 Apr. 1959, with gradual disappearance of all clinical and microscopic signs of trachoma. At present he appears healed.

Conjunctival scrapings were collected on 17 and 19 February in broth-saline containing streptomycin (1000 μg/ml) (*1*, *2*). After 1 hour at 4°C they were injected into the yolk sac of 6- and 8-day-old embryonated eggs. In this first egg passage there was no mortality, and no elementary bodies were seen in smears of the yolk sac stained in accordance with Macchiavello or Giemsa techniques. Elementary bodies were seen in five of six eggs of the second passage sacrificed on days 9 and 10 after inoculation. In the third egg passage all embryos died between the fourth and the eighth day after inoculation, and elementary bodies were seen in profusion. At present this virus strain (Bour) in the seventh egg passage has an egg LD_{50} of $10^{-4.5}$. The elementary bodies conform in size and staining properties with those grown by others from trachoma patients (*1–3*). Four monkeys (*Macaca cynomolgus*) were inoculated in one eye with a 20-percent yolk-sac suspension of sixth-passage virus and in the other eye, with normal yolk sac. Two to six days later they all developed follicular conjunctivitis, and conjunctival scrapings contained many typical inclusion bodies (Fig. 2).

The patient's serum, drawn on 19 February, fixed complement in a 1:64 dilution with psittacosis or Lygranum antigens. Antigens prepared from a yolk-sac pool of virus (Bour) fixed complement with antisera to psittacosis virus (*4*).

This appears to be the first isolation of an elementary-body virus of the psittacosis-lymphogranuloma group ("trachoma virus") from a typical case of trachoma arising in the United States. Many intriguing questions are now under study, including the relationship of this virus (Bour) to inclusion blennorrhea and to the elementary-body viruses isolated from trachoma in other parts of the world, the toxin production and pathogenetic potential of this agent, and its biological and epidemiological characteristics (*5*).

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4. The antisera was provided through the courtesy of B. Eddie.
5. This work was supported by grants from the National Institutes of Health (B-604), the Burroughs Wellcome Fund, and the Research Committee of the University of California.

6 July 1959

Growth Inhibitor in Immature Soybean Seeds and 2,4-D-Sprayed Soybean Seedlings

Abstract. A naturally occurring inhibitor of seed germination has been isolated by ion-exchange chromatography from soybean seeds and seedlings. The inhibitor was present in large amounts in immature seeds and in seedlings sprayed with 2,4-D. The inhibitor acted as an "uncoupler" when applied to soybean root tips or mitochondria.

Our concurrent studies on the inhibition of germination in immature soybean seeds (Galitz) and on the inhibition of growth in soybean seedlings by 2,4-dichlorophenoxyacetic acid (2,4-D) (Key) indicated that a common compound was responsible for the two inhibitions. In the studies of growth inhibitions that resulted from spraying seedings with $5 \times 10^{-4}M$ 2,4-D, soybean hypocotyls were extracted with $0.6M$ cold perchloric acid. The extracts were cleared of perchlorate and chromatographed on Dowex-1-formate for separation of nucleotide components (*1*). One elution peak (designated *C* in this report) increased about twofold in seedlings which had been sprayed with 2,4-D 24 hours before extraction. Compound *C* eluted from the ion-exchange column between adenosine monophosphate and guanosine monophosphate when a gradient of formic acid was the eluent. There was a positive correlation between the concentration of compound *C* and the growth inhibition induced by 2,4-D. Further investigation showed that compound *C* was present in mature soybean seeds and young seedlings but declined rapidly during germination in the absence of 2,4-D treatment.

Galitz (*2*) reported the presence of a water-soluble inhibitor in immature soybean seeds. These seeds could be induced to germinate by leaching with water for 2 to 4 hours. The leachate obtained from these seeds would retard elongation of radicles excised from mature seeds. Immature seeds were therefore investigated for the presence of *C*.

Figure 1 shows the elution chromatogram of perchloric acid extracts of immature soybean seeds collected 25 to 30 days after flowering. The dry weight of such seeds was approximately 25 percent of the dry weight of mature seeds. Compound *C* accounted for over 50 percent of the 260-mμ absorbing material. Compound *D* appeared to be derived from *C* during extraction, for, if the perchloric acid extracts were held overnight at 2° to 4°C, there was a loss of *C* and an increase in *D*. The amount of *C* in immature seeds was 2 to 3 times as great as in mature seeds; on a dry-weight basis the concentration