A Biochemical Property Relating to Power Seeking in Humans

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The disposition to seek power in a social arena is tied in this research to a biochemical marker, whole blood serotonin. This finding constitutes the first systematic evidence of any biochemical property in humans which differentiates power seekers from others. The disposition itself is given empirical content with the use of measures of three components of the Type A behavior pattern—aggressiveness, competitiveness, and drive—and of distrust and self-confidence. The statistical fit with serotonin is very good. This discovery echoes similar findings in a species of subhuman primates.

Power seekers are different. Surely few students of politics would assume otherwise. But different how? It will not do to answer that the difference lies in a special attraction to or need for power. That is true by definition. It is by the strength of their desire to dominate and control others that we recognize power seekers. So we must ask what else differentiates them from other people? The answer seems to be that we don't know. Dahl, after scrutinizing the relevant literatures, offers what appears to me an uncontroversial conclusion: "Whatever the reasons may be, some people do seek power more intently than others [but] scientific knowledge about the personalities and motives of power seekers is still scanty" (Dahl, 1976, p. 116).

This ignorance plainly represents a fundamental void in behavioral political science. After all, we are here dealing with—as Lasswell (1948, p. 19) put it—"political man, homo politicus, a basic political type." Understanding the inner drive of those who devote themselves to the capture and use of power roles was for Lasswell central to the understanding of politics. Perhaps most students of politics would agree. But, as noted above, progress in understanding that drive, and in understanding the contextual circumstances that influence it, has been slight.

This research report speaks to that void. Evidence is presented below which suggests that power seeking, or possibly successful power seeking, has a biochemical marker, namely whole blood serotonin. Serotonin is a neuroregulatory agent already known to be intimately involved in dominance relations in certain subhuman primates. It is shown here to be strongly tied to a syndrome of human behaviors and orientations characteristic of a drive for power.

This discovery, mysterious in many ways, gives Lasswell's "political type" the beginning of a neurochemical profile. It offers political scientists an important new tool in the behavioral study of influence and the influential, and relatedly, it provides a research bridge from behavioral political science to the neurosciences, perhaps the first such bridge built on a foundation of systematic empirical results instead of untested hypothetical argument.

The report is organized in four sections. In the first, previous research is discussed, with special attention given to the biochemical studies of dominance in the aforementioned primates. In the second, the methods used in the present project are described. The third section presents findings. Finally, there is a discussion of those findings and of possibilities for future studies.
Studying Power Seeking

Although political science is interested in power seekers because of their presumed impact on the nature and conduct of government, it is important that behavioral research on power seekers not be recast as research on the incumbents of potentially powerful government roles. There are three reasons for this. First, all social organizations, not just the general or public governments of broad political communities, have within them a value allocation process (even if not deemed fully authoritative). Hence, all social organizations have power roles—that is, roles that permit their incumbents to exercise disproportionate influence over the allocation process. This is obvious in private corporations and in armies, but it is also true of social cliques and street gangs. Indeed, for most people almost all struggles for influence will take place in nongovernmental arenas, for example, in school, in the workplace, and in social arenas more generally. It might seem easy to dismiss this, to view as trivial the influence that can come from these everyday routes and contrast it with the influence that can come to those at the pinnacle of government. Yet in terms of either attitude or behavior, there is no reason at this point to assume important differences with respect to those seemingly lesser struggles.

Second, if it is true that not all power seekers are public governors, it is equally true that not all public governors are power seekers. Those who fill political roles for which no struggle was required, for example, hereditary monarchs or legislators from uncontested electoral districts, may well lack a power-seeking disposition.

Finally, understanding power seeking will require that we understand its limits. How does the power seeker set boundaries for his ambition? When will the big frog venture from his small pond in search of greater gain? We know that movement across games will require examination of power seeking at all levels.

In thinking about behavior it is often useful to employ the three-part scheme made famous by the classic whodunits. Behavior, it is argued, results from the interaction of motive, resources, and opportunity. Such a scheme can serve here to organize a sketch of the work relevant to power-seeking behavior. Consider opportunity. We know in a general sense that opportunity is important to political success. In pursuing dominant status, only the right power seeker for the context will succeed. But there has been very limited empirical specification of how context works its effects. Of course, all circulation-of-elites theorists argue the importance of changing contexts for the emergence and decline of different types of leadership. Max Weber, for example, found in severe social and economic distress the societal conditions that set the stage for the rise of the charismatic political leader (e.g., Weber, 1968). However, although there is evidence supporting this general argument, there still are no specific predictions about how the opportunity presented by the context influences the behavior of power seekers, successful or otherwise.

Similar problems exist with the small group research literature in social psychology (although that literature is far more developed on this point than the political science literature). There is evidence, for example, that highly competitive or otherwise stressful situations set the stage for autocratic leadership (see Blake & Mouton, 1961; Hamblin, 1958; Sherif et al., 1960). But again there is no specification of the kinds individuals who will gain or lose power in such settings. Fiedler’s work (1965) is an exception in that it deals both with context and with effective leadership style. However, the operational definition of context is most relevant to static formal structures, and there is no concern in this work with power seeking.

With respect to opportunity, then, there is some evidence on how room at the top is shaped by context, and one can intuitively appreciate the importance of environmental contingencies for political success. But there is little understanding of how the context influences power-seeking behavior.

The second and third factors, resources and motivation, both shift attention to the individual actor, although, as noted above, their effects depend on context. Separation of the two factors in particular cases is sometimes difficult. For example, although skills would surely be considered a resource, would a disposition like Machiavellianism (Christie & Geis, 1970) or a physical characteristic like energy level be a skill or a feature of motivation?

In discussing the role of resources, Dahl (1975) is representative of many analysts when he writes, “In allocating income, wealth, status, knowledge, occupation, organizational position, popularity, and a variety of other values, every society also allocates resources with which an actor can influence the behavior of other actors in at least some circumstances” (pp. 145-146). But no evidence about which resources come into play for power seekers in particular contexts is available. The political participation studies (e.g., Verba & Nie, 1972) describe certain social and psychological resources of several strata of political activists, but one cannot substitute measures of electoral or community activism for measures of power seeking. As already noted, power seeking occurs in
many arenas, and those defined by local or national elections may not be very important to most people. Beyond that, many activists in elections may themselves have no desire to dominate or control others. Their satisfactions may have little to do with actual power (see Eldersveld, 1964; Marvick, 1967).

Motivation is the least understood aspect of human behavior. Moreover, it has ambiguous status as a construct in studies of behavior because its presence so often can only be inferred from the behavior it is supposed to have influenced. Thus, one finds in some work the rather unenlightening argument that power seeking is a result of a "power drive" (Hutchcnecker, 1974). Ultimately, of course, motivation must be defined in terms amenable to causal analysis, and those terms are very likely to be biological. At present, except in the areas of eating and drinking, such definition is missing (Teitelbaum, 1967). Still, we are not entirely without guidance on the motivational underpinnings of power-seeking behavior.

A most interesting contribution comes from Christie and his collaborators (Christie & Geis, 1970), who have derived from Machiavelli's Prince, Kautilya's Arthasastra, and examples of Chinese legalist philosophy, a set of orientations which these writings hold to be characteristic of the successful power seeker. Among them are a great desire to win, little concern with conventional morality, manipulativeness, low ideological commitment, and suspicion of others—but none of these in pathological degree. A psychological scale was built from these characteristics, and the behavioral distinctions between high and low Machs were these: highs lied more plausibly and effectively, were more inclined to engage in and to enjoy the manipulation of others, were likely to initiate and control bargaining situations and to be very successful in such situations, were much stronger and more forceful in social relations, persuading others more often and being persuaded by others less often, and, finally, saw more manipulativeness in those around them.

This striking picture is quite close to the popular conception of power seekers. Not surprisingly, Christie and his colleagues found Machiavellianism to be correlated positively with scales measuring need for achievement (.29) and internal control (.43). One could speculate that self-confidence would also be tied in, an argument that has been made by others for political leaders in general (see Gibb, 1969; Stogdill, 1974).

Weaving together the three strains in the whodunit analysis has proven to be an impossible task for students of power seeking. It is clear that characteristics of the individual can be more or less suited to a particular context or vice versa, but no research on human social systems has given empirical specification to this intuitively obvious point.

The UCLA Studies

By and large, political scientists—even those of the behavioral persuasion—seem not much impressed with animal models of social processes. We surely would not quibble with the contention that animal models have served medicine and psychology well, but the empirically oriented investigators in political science seem to assume that the leap from animal models to human politics is simply too great to be seriously considered. Whatever the accuracy of this assumption in general, there is in this particular case a body of research using animal models which is of exceptional value.

A team of scientists at UCLA has for some years studied the social structure and political behavior of vervet monkeys. McGuire (1982) offers some basic information on this species:

These animals have distinct male and female dominance hierarchies which generally operate independently... Considerably more is known about male-male relationships and they appear to be less complex than their female counterparts... Male vervets generally have a binary type dominance system: one adult male is dominant. Kin relationships (genetic kin) appear to be minimally important in adult male relationships, and agonistically based coalitions—two or more animals joining together to fight one or more other animals—are seldom observed... When animals engage in aggressive encounters, dominant animals most often win... As sub-adult males reach maturity, they inevitably challenge the dominant male through display... Depending on the intensity and frequency of such behaviors, aggressive encounters with the dominant male will follow. In most instances, say 80% of the time, the sub-adult male does not become the dominant male. Rather, he continues his challenging behavior for several months and then assumes a non-dominant position in hierarchy. If he fully assumes a non-dominant status, the probability that he will become the dominant male is considerably reduced.

In their experimental studies, the UCLA investigators most often have worked with vervet

2That is not to say that there is no published speculation about the relevance of animal studies for political science. Indeed, the unfortunately named subfield, biopolitics, is awash with such argument. But among the many empiricist students of political behavior, Wahlke (1979) is one of the very few calling for greater attention to relevant work on animal models.

The species name is Cercopithecus aethiops sabaen.4
subjects which, although reared in the wild, had been in captivity for several months before the research commenced. Groups typically included three male and three female adult members housed in outdoor cages. Note that these arrangements provide very important simplifications for the study of behavior. First, the context is relatively constant; hence, ascension to power is less likely to be dependent on environmental factors. Constancy is also found in the kinds of resources that permit success. It is the skills involved in a direct challenge which are important, rather than the presence or absence of allies, for example. Motivation is still a mysterious factor, but recall that all subadult males apparently will sooner or later mount a challenge; this clearly provides more constancy than in the human case.

The UCLA researchers initially focused on the effects of social factors on vervet behavior. Of much greater interest here, however, is their work that connects status differences with distinct biochemical profiles. A key finding was that among captive male vervets there is a clear biochemical marker for dominance, namely the level of serotonin in the blood (McGuire, Raleigh, & Johnson, 1983; Raleigh & McGuire, 1980; Raleigh et al., in press). For nondominants the level of whole blood serotonin was on average 650 nanograms/milliliter (ng/ml), and for dominants, it was 937 ng/ml. The difference is significant at \( p < 0.001 \). Serotonin level also correlates with a repertoire of behaviors closely tied to dominance, such as approaching others, not avoiding others who come near, and initiating aggression (Raleigh et al., 1981), and most interesting, serotonin levels track changes in status: dominant males who become nondominant exhibit a decline in whole blood serotonin from the 900 ng/ml range to the 650 ng/ml range, whereas nondominant animals who become dominant show the reverse (McGuire, Raleigh, & Brammer, 1982; Raleigh et al., in press). In other words, biochemical change follows status change, which suggests that for vervets the success or failure of power seeking, and not power seeking itself, is crucial to serotonin levels. I will return to this point later.

The connections between peripheral serotonin and central nervous system function have been partially worked out (Raleigh, Brammer, & McGuire, 1983; Raleigh et al., 1983). However, for immediate purposes the details of this relationship are not important. The interesting question is whether or not the whole blood serotonin findings with respect to dominance can be replicated in man.

**Methods**

The present research was launched with the major purpose of examining the relationship between psychological stress levels and distributions of influence in small social units that are processing problems of collective importance. The concern with testing for serotonin correlates came later.

The design was experimental and involved 12 groups of six men, half of the groups in the high-stress condition and the other half in the low. Subjects were male undergraduates who were recruited through an advertisement in the student newspaper. Volunteers were excluded if they had a chronic illness, high blood pressure or severe allergies, were using medications or other drugs on a daily basis, or smoked a pack or more of cigarettes a day.

All sessions were held in a university hospital. Subjects were fully informed of the nature of the study and of the procedures involved. All physiological procedures were carried out by medical staff.

Tension was high as the experimental sessions began. Each group was directed to devise group solutions to 10 very difficult logic puzzles, presented seriatim. For each puzzle only 10 minutes were allowed. For a puzzle solution to be registered by a group, at least five of the six members had to vote in favor of that solution. Thereafter, one of the group had to report the group’s solution and why it was the only correct one. (There was a financial incentive for members to resist being stampeded to a solution.)

Three types of observations were recorded. First, the session for each group was videotaped for subsequent coding of each subject’s behavior. Second, questionnaires collected behavioral, judgmental, and attitudinal data. (The questionnaire items are given in the Appendix.) The basic questionnaire was administered three times: when volunteers assembled in a large room in response to the advertisement, about a month later when each set of six volunteers for a particular session

*An example of the kind of puzzle used is this: Three boxes are labeled apples, oranges, and apples & oranges. Each label is incorrect. You may select only one fruit from one box. How can you label each box correctly?
had come to the hospital, and when a session was finished. The third type of observation required that a sample of blood be taken from each subject every 20 minutes throughout the session. Later, these samples would be assayed for a number of biochemical properties.

Each group was processed on a separate day but at the same time of day. A session began with the subjects' arrival at the hospital at 4 P.M., at which point vital signs and baseline blood samples were taken. At 5:30 all subjects were given a standard meal. At 6:00 the questionnaire was administered. From 6:30 until roughly 8:30 the group dealt with 10 logic problems, each of which required an agreed-upon solution (or the expiration of the allotted time) before the next puzzle could be addressed. Subjects were sent home at about 9:00 P.M.

In the blood sampling for the serotonin analysis, about 7 ml of venous blood was drawn, frozen, and maintained at −70°C. When all samples had been collected, they were packed in dry ice and sent by overnight express to UCLA where serotonin levels were determined. The UCLA investigators were blind to other information collected in this study.

The basic questionnaires had three major foci, two attitudinal and one more behavioral. The first attitudinal focus was the perceived locus of control (internal vs. external) over events in one's life. Items from the Rotter (1966) scale were used in that assessment, but they (as well as the other items in the questionnaire) were converted to a magnitude scaling format. The second attitudinal focus was perceived normal anxiety levels, for which modified items from Spielberger, Gorsuch, & Lushene (1970) were used.

The behavioral items in the questionnaire dealt with the Type A pattern. Because this typology has been little noted by political scientists, it will be useful to consider it in some detail. The Type A (vs. Type B) behavior pattern was originally observed by Friedman and Rosenman (1974) through structured interviews with cardiac patients. (See also Rosenman, 1978.) The behavior pattern has four key elements: extremes of aggressiveness, easily aroused hostility, a sense of time urgency, and competitive achievement striving (Matthews, 1982). The burgeoning research attention to Type A behavior derives from its connection with coronary disease, but obviously that connection is not in point here. Rather, it is hard-charging competitiveness itself which is of interest.

To permit larger epidemiological studies of Type A effects, Jenkins and others (Jenkins, 1978; Jenkins, Rosenman, & Friedman, 1967, 1968) developed the Jenkins Activity Study (JAS), a self-administered questionnaire of approximately 50 questions about the kinds of personal behaviors assessed in the structured interview. The JAS items were validated and weighted in a discriminant function analysis of a criterion population (i.e., a population of individuals already classified as Type A or Type B on the basis of structured interviews). Test-retest reliability checks of the Jenkins survey have produced correlations of approximately .65 over a year or more (Jenkins, 1978). The JAS has seen widespread application, but there remains a need for better measurement of the components of the Type A pattern. One effort along these lines, a factor analysis of the JAS items (with, for unexplained reasons, a varimax solution) did not produce dimensions having predictive power with respect to coronary disease (Zyzanski & Jenkins, 1970). Magnitude scaling was introduced in this study in response to these measurement problems.

The specific Type A items used in this study, in number, come from Glass (1977), who created a student version of the Jenkins survey. This version involves minor rewordings to make questions suitable for an undergraduate population. Glass confirmed the comparability of this student version with the original JAS through the examination of factor structures.

In conceptual terms, the Type A pattern has clear overlap with Machiavellianism. Both include aspects of dominance, and, in fact, Glass (1977) shows a strong empirical relationship between the student JAS and a measure of dominance. Both emphasize competitiveness. Both emphasize (and correlate with) achievement striving and sense of personal control over the events of life (Glass, 1977). There is, however, an important difference in the ways the two have been measured: Machiavellianism is assessed primarily in terms of at-
titude, whereas the Type A pattern has always been tied more closely to (reported) behavior.

**Findings**

The analysis of serotonin levels (introduced after the above basic design was completed, remember) was exploratory. The only expectation was that some feature of power seeking or dominance would be tied to whole blood serotonin (WBS), but how the particular descriptions of self elicited by the questionnaire would relate to WBS was unknown.10 This, then, could be no more than a loose test in humans of the UCLA group’s fascinating finding for male vervets.

The distribution of WBS in this set of subjects was normal, with a mean of 146 ng/ml and standard deviation of 49. The highest value was 295 ng/ml, and the lowest 40 ng/ml. The responses to the questionnaire items were also approximately normal.

Preliminary analysis of the questionnaire measures involved testing their interrelationships. The items (given in the Appendix) representing each of the three scales—internal control, anxiety, and the Type A behavior pattern—should reflect a common domain, and they do. The mean correlation within the set of four items measuring internal control was 0.38, and that for the eight measures of anxiety, 0.42. For the 19 measures of Type A, it was only 0.19; however, this is not appreciably different from the mean interrelationship in other analyses of JAS items. Moreover, the orthogonal factor structure of these Type A data included the H (hard-driving) and S (impatience) dimensions found by Zyzański and Jenkins (1970) in their factor analysis of the full set of JAS items, and with much higher communalities for the defining measures. Glass (1977) also has found these two dimensions, using the same factoring techniques. Hence, it seems that the magnitude scaling version of the A-B measures was valid.

Correlational analysis showed significant covariation between WBS and a number of the questionnaire items. However, further inspection of these relationships showed that in most instances they were not linear but instead depended heavily on the more extreme values at one end of the distributions. For example, the simple correlation between the response to the statement, “I find competition stimulating,” and WBS was +0.13. But when that measure is rescaled with the lower two-thirds of the distribution scored zero and the upper third scored one, its correlation with WBS increases to +0.25. This was not a matter of dividing the distribution at the agree-disagree point; it was well into the agree response that the flat relationship continued. Put differently, it was not those who agreed that competition was stimulating who were more likely to have elevated WBS values; rather, it was those who strongly agreed. This, of course, further illustrates the value of magnitude scaling; had category scaling been used, this relationship might well have been lost.

The questionnaire items having a significant zero-order relationship (p < 0.05) with WBS are presented in Table 1. The form of each item—dichotomous or continuous—is indicated. All Type A items are also indicated.

What is immediately apparent in Table 1 is that Type A items show up in striking proportion. Ten of the 13 significant items are drawn from the JAS. This is more than half of the A-B items in the pool. What does not show up here are the items tapping anxiety and sense of internal control. Other than A-B items, the significant correlates of WBS are self-confidence, dislike of being in a leaderless group, and distrust of others.

These simple findings are most intriguing. The aggressively competitive type defined as Type A does in fact seem to have elevated WBS. In addition, the discovery of the WBS correlation with distrust of others, when put in the context of a Type A behavior pattern, suggests plainly the orientation Christie labelled Machiavellian.

An obvious next step was to test multiple-item scales. The findings were straightforward: first, the composite measures of internal control and anxiety, whether items are weighted or unweighted, do not show significant relationships with serotonin. In the case of the Type A measures, neither a summed index, a first principal component, nor the orthogonal dimensions described earlier show a relationship with WBS as great as the correlations for most of the individual items given in Table 1. With the summed index, it was once again noted that the relationship was curvilinear: the takeoff in WBS values came at the upper end of the index. Hence, the A-B items were factored, this time with the “optimal” form for each item. Because there seemed no reason to continue following Zyzański and Jenkins (1970) in seeking orthogonal structure, the defining items of the three resulting factors (given in the Appendix) were simply added together after being standardized. This produced three indexes: drive, aggressiveness, and competitiveness. Their correlations with WBS were +0.41, +0.44, and +0.33. When given simultaneous tests in a regression analysis, com-

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10The questionnaire data in this analysis were collected immediately before the beginning of the experimental session.
petitiveness dropped out of significance, both substantively and statistically. Both of the others proved to have about equal impact (betas = .30; t-ratios = 2.5). The resulting multiple correlation, adjusted for degrees of freedom, was 0.487. That petitiveness dropped out is a reflection of the correlation this index has with the other two. It should not be taken as evidence that competitiveness per se, or even of this particular index of competitiveness, has no role in the statistical explanation of WBS levels. What is suggested here is that its effect is indirect, flowing through the other two factors.

Another technique for exploring these data is provided by stepwise regression analysis with backward elimination of statistically insignificant variables. (The procedure stops when all coefficients are significant at \( p < 0.05 \).) This is a brute force method which plainly lacks theoretical grounding. Moreover, criticisms of the caprice that can operate in such an exercise are well-founded (Lewis-Beck, 1978). There is every reason, then, not to pay much attention to the individual coefficients that result from such an exploration. Nonetheless, here the technique can serve a very useful purpose: namely, to give a rough picture of the stamina of the WBS correlates in what is now a multivariate setting. Starting with the full set of questionnaire items (again, with optimal forms), the stepwise procedure continued until a final model incorporating 14 variables was reached. (The variables are identified in the Appendix.) Of these 14 variables, nine were from the Type A set. Distrust also remained. In a purely empirical sense this model constitutes a very good statistical explanation of WBS levels; after adjusting for degrees of freedom, 50% of the variance in WBS was statistically explained.

Perhaps more important, however, is the evidence given here of the resilience of the Type A items in a multivariate analysis.

**Discussion**

What is to be made of these findings? First, there is good evidence here of a connection between a peripheral biochemical measure, WBS, and a number of reported behaviors and attitudes. Note that this is not at all an obvious connection, as would be the case, for example, in the correlation between an attitudinal measure of fright and adrenaline. Moreover, with respect to the Type A measures, it is a connection with an extensively analyzed syndrome of behaviors and orientations, a syndrome important in its implications for other (i.e., coronary) features of human physiology. Finally, it is a connection that has in its biochemical component a quite stable biological property (Yuwiler et al., 1981). Changes do not occur quickly and reflect only ephemeral, and therefore for the political scientist uninteresting, human states. Of course this stability complements the demonstrated stability of the Type A pattern and the assumed stability of the attitude measures.

Second, and more important for students of political behavior, there is in the WBS-related amalgam of behaviors and attitudes a striking portrait of the kind of person one would intuitively take to be power oriented. Hard-charging, competitive, impatient, aggressive, distrustful, confident—all in all a remarkable mix, and one readily tied to Machiavellianism, lacking only evidence of the ruthless and manipulative aspects to make the match very close. The strong relationship WBS has with this amalgam makes it a bio-
chemical marker of fundamental importance to political science. For the first time, evidence is at hand which suggests that Lasswell's political type may be at least partially characterizable in terms of biological properties.

This finding has immediate and obvious methodological implications for the study of influence and the influence in human social units. However, its substantive implications, potentially enormous, can for now only be a matter of speculation. There is no theory about how power seeking might drive WBS; we do not yet know what consequences elevated WBS levels might have. With respect to the latter, it might be tempting to argue some sort of changed brain function, because serotonin is a neuroregulator, but such an argument would be premature. Recall that the connections between WBS and brain serotonin have not been fully worked out, and within the brain itself, the role of serotonin is still highly uncertain. However, even in the absence of that kind of knowledge, one can see in this discovery clear linkage between behavioral political science and the neurosciences, which reminds us that many of the most enduring research problems in political science have investigatable biological foundations.

Third, there is in these findings a clear, although not closely specifiable, connection with the UCLA group's results with male vervets. One important implication of this connection is that animal models can indeed prove useful in biobehavioral studies of politics. Of course such models cannot substitute for direct investigation of human behavior, but they can serve as invaluable heuristic guides in the specification of hypotheses about the biological substrata of that behavior.

Of greater immediate importance, however, is the fact that the connection established here with the previous work on vervets confers additional validity upon the interpretation of the present findings. A power orientation related to dominance seems clearly involved in human subjects with high WBS levels, and this view gains still more support in pilot work by the UCLA group which has found that leaders of campus social organizations have significantly higher WBS levels than do initiates (McGuire, personal communication).

However, note that there is a disparity between the vervet findings and the view that high WBS levels in humans mark power seeking. In the vervets, recall WBS levels followed status, rising with ascent and falling with descent. With the humans there was no dynamic analysis; only cross-sectional correlations are available. Because WBS is a stable biological property over many days at a time, we know that success or failure in the experimental context could not produce the recorded WBS values. What we do not know is the subject's power or dominance status in the social settings of greatest relevance to him. Thus, the available data do not permit us to rule out the possibility that for humans, a high WBS level is a marker of successful power seeking, as it was for vervets. I have opted for the less restrictive interpretation (i.e., that WBS marks power seekers, successful or not) because of the general characterization of self found in the questionnaire data and because I have no evidence that my volunteers were dominant in any social arena. Obviously, sorting this out is a high priority in future work.

A note on the measurement of power seeking in this study: It goes without saying that questionnaire data here are only second best and that direct and detailed observations of actual social behavior would have been preferable. These findings obviously must be judged within the limits imposed by questionnaire data (a caveat that could appear in almost all political behavior research reports; see Wahlke, 1979). Bear in mind, however, that the questions treating the Type A pattern have been developed and refined on the basis of careful and frequent assessments of their ties to actual behavior (and to the coronary disease that is thought to be associated with that behavior).

What are the next research steps that might be taken by political scientists (necessarily in collaboration with medical and biological consultants or co-investigators)? The first need, of course, is a study that attempts to reproduce the findings presented above. The design for such a study should provide for much greater attention to the social environments from which volunteers are drawn, taking as a special concern the power status of each volunteer within his natural environment. It should also involve greater specification of the elements of the Type A pattern and of Machiavellianism which are related to WBS level. A second possibility would be replications in different subject populations, for example, in women or in various age groups. A third would be to work backward from blood samples, perhaps available from other projects, to the individuals in their social contexts. One could select a sample of males with high and low WBS levels, for example, and then collect ethological or questionnaire data on them and on their natural environments. A fourth possibility is close to being the reverse of the preceding one: to go to structured social environments and take blood samples from high and low dominance individuals. Finally, one might try to create a natural social environment in the fashion of Sherif et al. (1960) and to monitor both power status and WBS levels over the course of a number of weeks.
In summary, then, there is in these research results good evidence of a tie between whole blood serotonin and a power or dominance orientation in humans. That discovery echoes similar findings in a species of subhuman primates and constitutes the first systematic evidence of any biochemical property in humans that differentiates power seekers from others. This finding represents for political science a major new direction in the behavioral study of power.

Appendix. Questionnaire Items

Type A Behavior Pattern

Aggressiveness
I lose patience with speakers who don't get to the point.
I get a bit angry with people who can't understand simple ideas.*
It makes me angry when people are late for appointments.

Drive
I probably eat faster than I should.*
After eating, I want to get busy instead of sitting around.*

Competitiveness
I am more responsible than most college students.*
I often set deadlines for myself.
I need to slow down, to be less active.
I plan to find a career that is difficult and challenging.
I am more precise than most people.
I find competition stimulating.*

Other
Everyday life is filled with challenges to be met.
I stay up late at night to relax and unwind.
I am relaxed and easy going.*
When I do a job, I do it well.*
My friends see me as competitive and hard-driving.
Frequently I think of other things when someone is talking to me.
I like to get up and get going in the morning.*

I give more effort to my work than do most college students.
I am more serious than most people.*

Internal-External Control
I do not believe that luck plays an important part in my life.
When I make plans, I am almost certain I can make them work.
Most people's lives are controlled by chance circumstances.
I have more will power than most people seem to have.*

Anxiety
Normally I feel secure.*
Sometimes I feel useless.
Much of the time, I feel under stress.*
Normally I feel calm.
Normally I feel a little bit anxious.
Normally I feel self-confident.
Often I feel worried.

General
I would dislike being a member of a leaderless group.
Strong leaders are what made this country great.
People can be trusted.*
Once I make up my mind I seldom change it.
I have less energy than most people my age.*

*These items were left in the final regression model.

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