The Mystery Of Migration

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Of all the wonders associated with birds, the ability to migrate to far off places with precision of navigation remains the "mystery of the ages." It is not my purpose to review the volumes of literature covering this topic, but only to indicate possible solutions are as likely hidden in the past as the present.

The homing pigeon has traditionally been used to study orientation because the variables of study are more easily controlled in domestic pigeons than in wild bird populations. James L. Gould (*Nature,* Vol. 296, 18 March 1982) states clearly, "Homing pigeons can be taken from their lofts and transported hundred of kilometers in covered cages to unfamiliar sites and yet, when released, be able to choose fairly accurate homeward bearings within a minute and fly home. From direct tracking we know that a homing pigeon typically circles near the release site once or twice, edging in the general direction of home, and then straightens out and flies off at nearly the correct bearing."[1]

The racing pigeon possibly holds the solution to this matter of fact, taken for granted, bird migration mystery. Yearly, 100 million birds leave our shores each fall and fly the Atlantic Ocean to islands and lands as distant as the tip of South America. Imagine, if you will, the tiny Kirtland and Blackpole warblers, "not even a child's handful of feathers," attempting such a journey without food or friendly terrain for thousands of miles. It is an observed and measured fact of life that these little energy units fly non-stop for 86 hours in the cold, oxygen deficient air at 21,000 feet in altitude, to follow their evolutionary paths of migration. (Allen C. Fisher, Jr.: Bird Migration, *National Geographic,* August, 1979, p. 156-164).

It was truly a sad day for pigeon science when Gustav Kramer fell to his death while gathering pigeon eggs from cliff nests in 1959. He had just demonstrated, "unbelievable as it seemed, birds could determine compass direction by the sun and could compensate for solar movement. In short, they had a sun compass and a biological clock of amazing precision. Ornithology would never be the same after these discoveries" (Fisher, 1979, p. 185).

In order to establish the point: "the new is really not so. . .," we must quickly skip over the important research on pigeon homing by Hans Wallraff, Klaus Schmidt-Koenig, G.V.T. Mathews, Charles Walcott and William T. Keeton to reach the present challenge of theories. At Cornell University, Ithica, New York, Dr. Charles Walcott has been directing attempts to validate the "olfactory hypothesis" (orientation by sense of smell) advanced by Papi, Fiasch, and Benvenuti at the University of Pisa, Pisa, Italy. This theory of an "olfactory map" for bird orientation and migration is the newest explanation in the continual chain of research into this migration mystery. The Italian theory has gained wide acceptance in Europe.

When I spoke to Benvenuti in 1985, he was having considerable difficulties duplicating Italian studies using Cornell University pigeons. At this point, we must leave the contest. Actually, we must leave this century, to report the olfactory (sense of smell) theory of migration is, first, not new. Second, hidden in the past are some data and questions related to "scent" which might help our modern scientists in their quest for a solution.

Without comment, I will quote passages from a little known work by Captain Gabriel Reynaud, director of the Homing Pigeon Service of the French Army in 1896. The translation to English by Clara Coxe was published in *Bird-Lore,* Volume II, Number 4, August, 1900.

"The question of the orientation of animals has given rise to many controversies, and the ideas expressed on this subject may be summed up in two theories. Some, with Spaulding, Russell, Wallace, and Croom Robertson, think that the faculty of orientation should be attributed to a particular acuteness of the five senses inherent in animals, they having ideas which only reach us through the medium of instruments of precision. Others consider that orientation brings into play a sixth sense, independent of the first five. Flaurens, Romanes, Henry Lordes, Goltz, Pflüger, Mach, Crum Brown, and Brand admit that this sense exists and has its seat in the semi-circular tubes of the ear.

These two opposed theories are each supported by unquestionable facts, apparently giving reason for the two schools. Now, there cannot be contradiction regarding facts.

If one unique law governs all the acts of orientation, these acts must all occur in the same way. If, when placed in different conditions, the animal has recourse to different methods of orientation, it indicates that the law which it obeys is no law.

We have bent all our attention to the observation of the facts. We have verified that our predecessors are not in harmony with each other, because the observations which had served them as a point of departure was incomplete."

"We had at our disposal a grand field for observation. M. le Ministre de la Guerre gave us the task of constructing a movable Pigeon cote, which represents the practical illustration of our theory. Finally, La Compagnie Transatlantique requested us to organize a Carrier Pigeon post to be utilized for the service of their steamships. To the numerous experiences on land and sea we have added very interesting observations, of which the results have been communicated to us by credible witnesses.

To sum up, we bring a great number of facts, many of which, controlled by the official reports of the commissioners representing the Minister of War, have the character of veritable discoveries.

We have grouped the acts of orientation in two categories: *near orientation,* attributed to the exercise of the five senses, showing observation at work and, in a certain sense, reasoning and intelligence; and *distant orientation,* an act purely mechanical, accomplished by means of a subjective sense to which we give the name of the Sense of Direction.

In each of these two cases the mechanism of orientation obeys distinct laws.

"Let us attend in thought a *release* of pigeons. Many hundreds of birds coming from the Pigeon cotes of the same region are set at liberty at the same time. They set out together, divide for traveling in two or three groups, then, as soon as they reach the known horizon, scatter themselves, and each of them flies directly to his own home.

"A certain number of carriers do not answer to the call, others come home the following days. The 'pigeon-flyer' limits himself to registering the loss of some and verifying the tardy homecomers, without trying to penetrate the reason of the fault of instinct. How could we ask of the bird his secret that a sudden rapid flight conceals from us? Instinct is at fault, the bird must wander at random, counting on chance alone to find his way back again.

"We cannot share such an opinion for the following reasons: The bird astray through fault of instinct is not for that reason in revolt against the general law of preservation which regulates all his actions. On the contrary, he feels very keenly the call of instinct which incites him to search for his own Pigeon cote.

"He sees very clearly the end in view, but the means of reaching it are momentarily at fault. He then displays all the activity of which he is capable, and tries many aërial tracks, one after another. The 'law of reverse scent' will permit us to follow him on his wayward course, and to re-establish his itinerary. When we surprise the lost Pigeon's

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secret, we will verify that *chance* does not play any part in the movements of the bird.

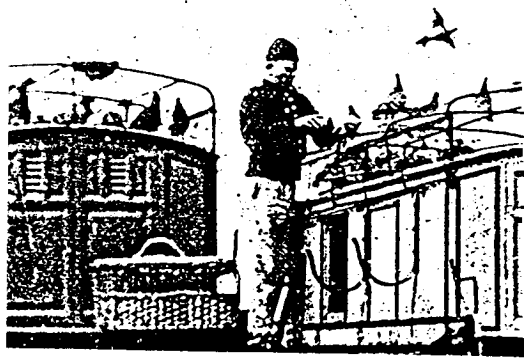
"In 1896 we attended a *'lacher'* of Pigeons that came from the Pigeon cotes of Mons and Charleroi.

"The two flocks of Pigeons having been set at liberty by chance at the same time, from two different points of the freight station, reunited in the air and formed at the time of their departure one flock. The weather was extremely unfavorable, mist rain, and a contrary wind contributing to retard the homecoming of our winged travelers. A first fault of instinct, easy to explain, was noticed on their arrival; two Pigeons from Mons are captured at Charleroi, and three Pigeons from Charleroi are taken at Mons. In short, about forty Pigeons did not return to their homes the same evening they were set at liberty.

"The departure from Orleans had taken place with a perfect gathering of the whole number of Pigeons; the birds taking their direction first showed the way to follow to their companions, and some of these followed their guides blindly, to the extent of entering with them their unfamiliar Pigeon cotes.

However, at Orleans, an observer verified, between three o'clock in the afternoon and seven o'clock in the morning, the arrival of about thirty Pigeons, which perched themselves on the roof of the station. Night came and we succeeded in capturing nine: five from Charleroi, and four from Mons. We set them at liberty again. This verification permits us to suppose that the thirty-two Pigeons which came back to Orleans had all lost their way when they were released in the morning. The morning of the next day, from five to seven o'clock, they all disappeared, one after the other, in the direction of the North. About thirty of the belated ones returned the same day to Charleroi and Mons.

"These comings and goings explain themselves quite naturally by the 'law of the reverse scent.' Our winged voyagers forming one flock at their departure from Orleans, were not long about dividing themselves into many groups. We have pointed out that to come back they had to struggle against the bad

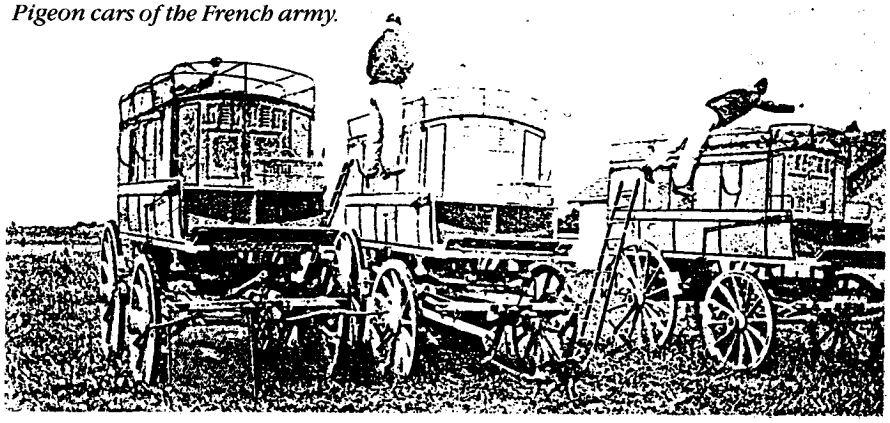


weather. Now, in this regard, the Carrier Pigeons are not all armed with the same ability to fight the elements. The small Pigeon, called the 'Liegeoise,' flies with great velocity during normal weather.

"A Pigeon from Mons, finding himself in the midst of a band of companions flying toward Charleroi, followed them as far as their destination. Then seeing each one of them disperse, in order to regain his own home, he remained alone, lost on the roofs of an unknown city. Now, Mons is not far from Charleroi, and it would be sufficient for our traveler to raise himself in the air to see, perhaps, his natal roof. He does not do so; having in the course of his preceding journeys contracted the habit of using only the sixth sense for distant orientation, he does not dream for an instant of utilizing his sight. Resuming in an inverse sense the road followed to come to Charleroi, he arrives at Orleans at the point where he had been liberated that very morning. Tired with the long trip accomplished during the day, he rests there one night. The next day he takes his bearings and finds again the 'reverse scent' of the road practiced two days before in the railway train, and reaches Mons. The thirty-two Pigeons which reappeared at Orleans the evening of the release, only to disappear the next day, very likely followed the same rule of conduct.

"The example we have just cited is assuredly interesting. We have based our statements on real occurrences, then when facts failed on simple conjecture, to explain the comings and goings of

Pigeon cars of the French army.



the Pigeons. We have consequently in our deductions, if not certainty, at least a great probability, which, however, does not quite satisfy us. We think, therefore, we ought to present a few cases more conclusive than the first.

A Pigeon belonging to a colombophile of Grand-Couronne alighted in the garden belonging to M. le Général M—, at Evreux. We were to go that same day to Roueń. We carry away the lost Pigeon and set him at liberty in the station of Grand-Couronne near his Pigeon cote. The Pigeon takes his bearings and returns to Evreux, at M. le Général M—. Caught again, he is this time expressed in a postal package to his owner. Allowed to go free in the cote, he no longer thinks of returning to Evreux.

"The Pigeon stopping to eat and rest at M. le Général M—'s did not consider for one instant that unknown house as a new home: it represented to him a point of journey followed before and, consequently, must be a point of departure for future investigation. After a few hours of rest he will set out again from there to resume the 'reverse scent' of the aërial path that led him to Evreux. He only thinks of finding again his lost home.

"We take him in a railway car to Grand-Couronne, and we free him at *a few steps from his cote.* But the sense of distant orientation, the sixth sense, is alone in working order, to the exclusion of the first five. The bird takes up again his reverse scent, passes in sight of his dwelling as if hypnotized, *without seeing it,* and reaches Evreux once more at the point through which passed that itinerary which he is trying to re-establish.

"His calculation is baffled; brought back to his owner's home and given his freedom, he, this time, is brought to himself. The five senses, awakened by stronger sensations, resume the upper hand and the sixth sense, becoming useless, ceases to work.

"There is at Orleans an enclosed Pigeon cote having no external issue for the little prisoners. The Pigeons that are shut up in it, and that come from the military Pigeon cotes at Paris and from the North, live there in semi-obscurity and in absolute ignorance of what passes outside. When, after a month or two of captivity, they are to be set at liberty, every precaution is taken to carry them away for the release many kilometers from their transient cote, to which, besides, they are not attached by any agreeable remembrance. Now, we have stated elsewhere that very often Pigeons know how to find that house

without even knowing its outside appearance. They perch themselves on the roof, then, after a short stop, they take their bearings and disappear in order to go back to the cote where they were born.

"The *law of reverse scent* allows us to explain the conduct of the Pigeon. He is carried away, set at liberty, let us say, at the station of Aubraës, takes up the *reverse scent* and hovers about the *cote of exclusion,* which represents to him the end of the itinerary by which he has been brought to Orleans. It is then from there that he will set out to take up in an inverse sense the road, the remembrance of which has remained deeply engraved on his memory.

"We could multiply examples of the same kind to show that the Pigeon astray always comes back to the point of his release. We may be convinced of this truth by glancing at the roofs of railway stations of Paris, Orleans, Blois, Tours, Poitiers, Bordeaux, etc., where, every Sunday during the fine weather, people set at liberty hundreds, and sometimes thousands, of Pigeons! On Monday we would notice the return of numerous Pigeons lost the day before, that, not having succeeded in their first trial in finding their natal roof, are going to make a second attempt, and sometimes a third, in order to find the right road.

"When set at liberty the day before the Pigeon took his flight, he fled swiftly from that point of departure to which, apparently, no interest attached him. With one powerful sweep of his wings he has crossed four or five hundred kilometers, perhaps more, in the wrong direction. Perceiving his error, he knows how, thanks to a mysterious instinct, to take up again his reverse scent and find the point of departure, of which he has hardly caught a glimpse in the morning. The combined action of the five senses cannot explain such a return. The lost dog acts absolutely in the same manner. When taken away in the railway train to a hunting ground entirely unknown to him, if he happens to go astray, he comes back to the point where he saw his master for the last time, and stations himself there until someone comes to find him, or else, resuming his reverse scent, he reconstitutes in an inverse sense his itinerary through which he has been brought, and finds again his home.

"We have demonstrated that the combined working of the five senses is limited, and is not sufficient to explain the act of distant orientation. The latter is governed by a particular organ that we have called the *sense of direction.*

"The animal entering upon unknown ground takes on his return the reverse scent of the road, *more or less sinuous,* followed in going; arriving in known ground he directs himself to reach his end in a straight line.

"The Carrier Pigeon freed at 500 kilometers from his cote, on his return skirts along the railway which brought him to his place of liberation; he is there guided by the sixth sense. Having in this way reached the known horizon, at 80 kilometers from his dwelling, for example, he ceases having recourse to the sixth sense and travels by sight straight to his own roof. Other times the Pigeon does not think of making use of the five senses on arriving on unknown ground. In this case he follows his reverse scent as far as the Pigeon cote. He passes it sometimes. We have seen him, on coming back from a long journey, pass at 40 or 50 meters from the Pigeon cote, repass it, and enter at the end of an hour or two, having perhaps crossed the wrong direction in this way from 30 to 60 kilometers.

"We made, with regard to this, a very curious observation. When we transport in a railway car a basket of Pigeons having already the knowledge of travel, we see them show the greatest agitation when we arrive at a station where they have once been released, whilst they remain indifferent to other stopping places. Now, we will admit without much trouble, that a Pigeon shut up in a basket which, in turn, is enclosed in a dark car, cannot from the uproar tell one station from another. His sight and other senses are no help to him, since he is as completely as possible isolated from what is happening outside. However, he knows in a very exact way where he is by connectintg it with his point of departure. We are then right in saying that an animal brought from a distance possesses an idea about his location quite subjective, independent of the medium that he crosses at the time.

"We have explained that the animal lives cantoned in a domain where he meets with everything that the instinct of preservation of the individual and of the species calls for. This domain, more or less extended for the wild beast, is reduced for the Pigeon, for example, to the four walls of the Pigeon cote. Does he not indeed find there, as the fabulist happily expresses it, 'good supper, good lodging, and the rest of it?' On the other hand, if it is true that local knowledge is not strictly indispensable to assure the return to the lodging, and that the sense of distant orientation is strictly sufficient to guide the animal, we will admit

without question that it is possible to make a movable Pigeon cote and accustom its inmates to a nomadic life.

"Let us suppose that we have transplanted, with all its belongings, a Pigeon cote in the midst of new surroundings, without the least disturbance being brought to the existence of its inhabitants. The latter set at liberty from the time of its arrival will go far away, perhaps, but the Law of Reverse Scent will assure their return.

"We remarked before that the straying Pigeon knows how to find again the point of release hardly caught sight of in the morning, and to which no agreeable remembrance, no interest, attaches him. With still more reason the inmate of a movable Pigeon cote must try to reconstitute his itinerary. If we carry him away a distance for the release he will come back to find his home at the precise point that it occupied when he left it. The movable cote, arriving in a new lodging place, would be in a condition to render almost immediate service in that locality. This new way of employing messenger Pigeons, unattainable, according to the ideas we have held up to this time, in matter of orientation, is only the strict application of our theory.

"Some interesting experiments have proved in a conclusive manner that the fidelity to the natal Pigeon cote could be reconciled with a nomadic existence. A certain number of Pigeons are born and brought up in a wagon arranged as a Pigeon cote. They have no other lodging than their rolling habitation. It matters little to the Pigeon whether the wagon stops today in the heart of a valley, looks for shelter tomorrow in a forest, or settles itself for some time in the maze of houses which form a great city. If we should carry him away some distance from the cote for the release, he will not be guided on his return by his local knowledge, necessarily very slight, that he may have of the surroundings of his wagon, but by his sense of direction which gives him a subjective idea of his position relating to the cote.

"A carriage Pigeon cote is stationed for twenty-four hours at Epernay. Its inmates are not set at liberty, whilst the Pigeons in the neighboring carriages are set free for two hours, then carried farther away for the release. The next day our carriages have all moved near Châlons, with the exception of the one whose Pigeons had not been freed at Epernay. These birds are divided among the other carriages, which are modeled exactly like the first they occupied. At

Châlons the cotes are opened and Pigeons are set at liberty. Some of these, which had made the journey from Epernay to Châlons in a strange carriage, set out for Epernay and found their rolling habitation. How did they succeed in reconstituting their itinerary in the inverse sense from Epernay to Châlons and find again their carriage in a situation of which they could not know the surroundings?

"The law of inverse scent alone permits this fact to be explained. We have repeated this curious experiment many times.

"During the stationing of the cote at the chateau de Morchiès two Pigeons strayed away. We found them again at Bapaume, a preceding lodging place of the Pigeon cote. One was retaken; the other escaped. People sent word to us of his passage in all the localities where his wagon had been stationed. He arrived, in this way, at Houdain. From there he set out for Evreux, resuming the reverse scent of the journey made a few days before in a railway car. At Evreux, where the Pigeon cote had been stationed for many months, we succeeded in capturing him. This itinerary verified, one may say, step by step, is it not the best proof that we can appeal to to support our theory? Thanks to the Law of Reverse Scent, we can almost always determine the precise point where to find a lost Pigeon. We succeed in this way in limiting our losses, which would be without it numerous and difficult to repair.

"The return of a Pigeon to a lodging which is displaced is not an exceptional fact. We could cite many examples of the same kind taken from the history of birds.

"We made at sea some experiments which confirm our theory. The absence of guiding points and the suppression of all local memory rendered the releases made at great distances from the coast very interesting.

"On the other hand, observation was easier than on land. It was always possible to note the initial direction taken by the Pigeons leaving the ship.

"We left for New York with a number of Pigeons taken from the colombophiles of Normandy. The 25th of March, the day of sailing, we set at liberty ten Pigeons, successively, at distances varying from 100 to 250 kilometers from Havre.

"All the Pigeons acted in the same manner; none of them raised their wings to fly high and see afar. They descended almost to the level of the water, turning two or three times about the ship, and took without hesitating the reverse scent of the route we followed. They all reached the Pigeon cote.

"The next day, the 26th of March, our steamer stopped to save the crew of a shipwrecked vessel, the Bothnia. We sent off, through a howling tempest, seven Pigeons carrying dispatches announcing the event.

"Our messengers made useless attempts to take the route from the East, the reverse scent of the ship. Carried away by a violent storm, they fell on some vessels or even took refuge on the coast of Spain. One of them carried his dispatch in the Gulf of Gascogne to the 'Chatterton,' and our message reached its address.

"The 31st of August, on the banks of Newfoundland, we sent out a Pigeon which, after much hesitation, flew toward the East. He reappeared at the end of two hours to rest, and then set out again, outstripping the vessel in its course. He arrived at Noroton, in Connecticut, one day before our entrance in the harbor of New York.

"This fact shows that the bird, obedient to the sense of distant orientation, has a very precise idea of a direction followed before. After having taken a good initial direction, our bird alters his mind and commits a fault of instinct, but even in this last case he does not wander to the right or the left of the followed route. Thus, it seems, he can only move himself on the axis of the same route, and there is for him only two solutions, the right and the wrong.

"In coming back to France we sent out some American Pigeons, which all took their bearings without hesitation over the wake of the vessel and took up the reverse scent of the route followed.

"On nearing Europe we sent out at 900, 600, and 400 kilometers some French Pigeons which had been shut up on board the vessel and kept to be released on the return trip. We noticed that all having the same idea of following the route took their initial direction over the wake of the vessel, flying toward New York. The greater number changed their minds and came back, afterward outstripping the steamer in its homeward voyage. But the losses were greater than in going, reaching the proportion of 20 percent. These are evidently the Pigeons which, skirting closely the reverse scent of the route followed, went astray in the open sea.

"We assert once more that the land does not appear to exercise any attraction for our messengers. Sent out from

the Scilly Islands, from the island d'Aurigny, or the peninsulas of Cotentin, they all follow the same direction — east, west — some going in advance of the vessel, others following the reverse scent of its route. The Pigeons rise a little higher than at the time of leaving France; the weather is clearer, but they do not seem to have recourse to the sense of seeing in order to take their bearings. None of them bent his flight over the land in sight.

"We have vainly sought for a theory in the works of naturalists which explains in any satisfactory way the acts of orientation accomplished by the animal. Many very interesting statements have been made concerning their habits, and their manner of living; but when it is a question of tracing back effect to cause the observer has generally taken a false direction. Wrongfully taking himself as a term of comparison, he asks what he would do in order to accomplish a certain instinctive act occurring among beasts.

"It is just in this way that some colombophiles attribute the return of the Pigeon to a wonderful local memory. In his daily recreation the animal flying above, the Pigeon cote would note the salient inequalities of the soil, would study their situation, and would use them for guiding points to his dwelling, tracing in this way a veritable triangulation on the country he inhabits. According to others, the animal would base himself on the meteorological record, or else would acquire, in time, a thorough knowledge of the local magnetic currents. Such a hypothesis explains one mysterious fact by other facts still more mysterious. Some have even asserted that the Pigeon takes his direction according to the course of the stars. We think that this theory is fantastic, and must be rejected.

"The animal could not be a mathematician, geometrician, electrician, or astronomer. The explanation we advance is more simple.

"We have stated that the facts of orientation group themselves under two categories: (1) near orientation and (2) distant orientation. Near orientation is based on observation, employing the five senses — objective organs. It puts in play the memory, the reason, the free will of the animal. It chooses one solution and takes the shortest road for its return.

"Distant orientation is based on the functional activity of a *subjective organ* which is situated in the semicircular canals of the ear, and which registers mechanically the road passed over; this sense of direction given to the animal the idea of its position for returning to the points of its departure. The return is governed thus by the Law of Reverse Scent. The animal does not now choose its route; there is but one solution at its disposal — to return by the road which it came.

"Orientation over familiar ground, based on observation, memory, reason and, in a certain measure, free will, is an intellectual act; Orientation over unknown and distant land, based on the functional activity of an organ, is an impulsive and irrational act.

"The most gifted animals in regard to distant orientation are not, in effect, the most intelligent, but are those which possess the most powerful means of locomotion. Thus it is that birds, infinitely less intelligent than certain quadrupeds, have over the latter an incontestable superiority for distant orientation."

I have submitted for publication these extracts of Captain Reynand's work simply to exercise his prior claim to one of the prominent modern theories to explain the orientation of birds, and to further establish some practical tests for the evidence suggested in his work.

Literally, thousands of pigeon races are conducted world-wide each year. Is it practical to provide a mobile loft at the release point for major races to trap valuable pigeons returning to that point after following an erroneous course initially in the race? Are there, really, scalpers that follow this procedure to improperly gain control over valuable racing pigeons?

As a searcher, I don't really know, yet, I must suggest the "mystery of migration and homing" is the type of scientific challenge which proves "nothing is new under the sun!" As we search forward, backward glances have some merit. Job, in the Old Testament (39:26) asked, "Doth the hawk fly by Thy wisdom, and stretch her wings toward the south?" God did not answer. At least He hasn't answered yet. Jeremiah knew though (8:7), "Yea, the stork in the heaven knoweth her appointed times, and the turtle (dove), the crane and the swallow observe the time of their coming . . ."

The wondrous racing pigeon will eventually provide the solution to the mystery of bird migration. But, in the meantime, Gabriel Reynand was a careful observer of the bird that fascinates us all.

"May the dove home-on, may it not!" It is never really lost if it can find the place it began its journey. ●